BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION ENGINEERING

FINAL YEAR PROJECT

DESIGN AND SIMULATION OF A BIRD CONTROL SYSTEM FOR RICE GROWERS IN EASTERN UGANDA

BY

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DECLARATION

I SSEKIZIYIVU ATANANSI declare that the contents of this project are my original work and have never been submitted to any institution of learning for any award.

Signature _____

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Date 29/05/2013

APPROVAL

This project has been submitted for examination with approval from the following supervisors:

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DEDICATION

I dedicate this report to my sweet heart Zabaali Samali who has been very supportive to me throughout the entire process.

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Special thanks go to the entire team of AMI department, Faculty of Engineering, Busitema University especially to my supervisors Mr. Kavuma Chris and Mr. Andama Aotubo whose skills, advice, knowledge and suggestions greatly helped me throughout the whole session of the project research.

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ABSTRACT

Rice is an edible starchy cereal, consumed and cultivated worldwide with almost $^{1}/_{3}$(a third) of the population reliant on the cereal. Uganda yields 180,000 metric tons at a local demand of 240,000 metric tons leaving a deficit of 60,000 metric tons with most of this rice being grown from the Eastern. At this deficit Ugandan farmers still encounter a reasonable loss due to post seedling damage of over 10%.

Post seedling damage to rice is mainly by the weeds followed by the rice birds. Birds' damage usually occurs between the milky and early maturity stage with the birds eating more during the morning, evening and rainy hours when the grain is soft.

Bird control in Uganda is mainly by local methods which include physical shouting, chasing and scaring: poisoning: static scare crows: beating sonorous sound and use of tapes that produce a whistling sound.

The birds destroy the rice crop reducing its final productivity yet there is an increasing local and international demand for the crop. This has led to high and crippling crop losses coupled with significant price fluctuations to famers who have got a few options to manage these birds, hence turning bird control into an overwhelming task that has even resulted into children of school going age missing school. Yet the credited methods of bird control like poisoning and throwing stones at birds are also causing diver-stating effects on natural ecosystems and biodiversity due to their cause of reduction in numbers of birds and extinction of some bird species.

Thus the main goal of this project was to design and simulate a bird control system for rice growers in eastern Uganda. From gathered literature, a floating system was deemed as the most efficient and economical. Thus a combination of a tethered balloon and a kite was designed using the law of buoyancy and the aerodynamic wind forces which were acting on the system. The design was then later simulated to visualize the motion and ensure optimal system performance thus accomplishing the second project objective.

From the simulations, the designed system could float at a height due to the presence of helium gas in the balloon that provided a gross lift necessary for its floating and it was at the same time able to exploit the effect of wind on the kite and balloon that results into

generating drift and lift forces capable of hovering the system with in the atmosphere so as the system would exploit on the birds instinctive fears of hawks.

The embedded tether line was to act as the control for the system such that any motions of lift and drift by wind impact on the system should be restricted within a specific locality.

The system was also supplied with an attached set of rattling devices such as beads in a tin that would produce sounds of varying intensities depending on the magnitude of the wind in order to exploit the birds' sense of sound.

To accomplish the third project goal, an economic analysis was conducted and the results showed that the system had a coverage of approximately 1(one) ha giving it a benefit cost ratio of 1.986 upon its implementation.

To ensure optimum system results, it is recommended that the system should be supported with good crop husbandry practices like weeding and timely planting which do help in combatting the intensities of birds attracted to the fields.

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Abbreviations

DSIP	-	Development Strategy and Investment Plan
GoU	–	Government of Uganda
MAAIF	-	Ministry of Agriculture Animal Industry and Fisheries
UNRDS	-	Uganda National Rice Development strategy
PEAP	-	Poverty Eradication Action Plan
NERICA	–	New Rice for Africa
IRRI	–	International Rice Research Institute
GRiSP	–	Global Rice Science Partnership
UNFFE	–	Uganda National Farmers Federation

Definitions

Rattling	A rapid series of short loud sounds - Shake and cause to make a rattling sound
Design consideration	Essential qualitative and quantitative characteristics that set criteria to be satisfied in designing a system (objectives the design strives to achieve)
Design parameters	what the engineer intends the device to do, should be should be known and listed before actual work begins
Lift	a wind generated vertical force perpendicular to wind that provides lift to the system.
Drag	a wind generated horizontal force in the direction of the wind that drags the system rearwards.
Moment	rotational force that will either flip the system over the noise of the kite or over the tail
Tether line	system motion control component
Simulation	a mathematical or visual model showing imitation of the real world system operation
Hovering	Be undecided about something, Move to and fro, Hand in the air; fly or be suspended above, Hang over, as of something threatening, dark, or menacing.

CHAPTER ONE

1.0 INTRODUCTION

This chapter has been prepared to provide background information for this project, the problem statement that describes the context for the study and the purpose statement to provide a specific and accurate synopsis of the overall purpose of the study, and the significance indicating how this project will refine, revise, and extend the existing knowledge on bird control systems for rice. It further incorporates the objectives of this study and climaxes with the scope and limitations of the proposed project.

1.1 BACKGROUND

Rice is an edible starchy cereal that produces a vast number of grains. It has been harvested, consumed and cultivated worldwide for more than 10,000 years (Kenmore, 2003). It has been under intensive cultivation originating in Asia for over 4,000 years and has since spread across the world, where almost a third of the population depends on rice for vital nutrition (Niki, 2012). Rice is the second highest worldwide production after maize (corn) and since maize is mostly grown for purposes other than human consumption, rice is the most important grain for human consumption (Hawaii Rice Fest, 2010). Globally the total area under rice cultivation has been estimated to be 150,000,000 ha with annual production averaging 500 million metric tons (Tsuboi, 2004), and which represents 29 % of the total output of grain crops worldwide (Xu et al., 2003).

Rice has become increasingly popular in Africa with its consumption estimated to 16 metric tons and its production at 14 metric tons which creates a deficit of 2 million metric tons (MAAIF, 2009). Currently, rice is grown in over 75% of the African countries, with a total population close to 800 million people (MAAIF, 2009).

Most of the rice in Uganda is grown in Eastern Uganda followed by Western Uganda due to the presence of lowland with high moisture content throughout the growing season (MAAIF, 2009). And Uganda yields about 180,000 metric tons of rice compared to local demand for the cereal that stands at 240,000 metric tons (UNFFE, 2012). Therefore the Government of Uganda envisioned to increase rice production to cater for the ever increasing demand and identified rice production as a major intervention in its

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