



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION  
ENGINEERING

**INVESTIGATING THE EFFECTS OF USING  
AGROCHEMICALS FOR GREENHOUSE FLOWER  
PRODUCTION ON THE ENVIRONMENT**

**Case study of Wakiso District**

**BY**

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## **ABSTRACT**

The use of agrochemicals in greenhouses for flower production is common in many flower farms in Uganda today. This is because of their copious advantages which tantamount to increase in yields, improvement in quality and thus more revenue. Some of the most common agrochemicals include; pesticides, fungicides, herbicides and fertilizers all of which play a vital in ensuring production of high quality and plentiful of yields. Since flowers are ornamental plants, their prices are mainly determined by the quality of the flower and this thus calls for massive use of agrochemicals. These investments earn Uganda a lot of foreign exchange because over 90% of the flowers are exported to outside countries like Holland, Germany, Switzerland and United States of America (UFEA). However, despite of all the benefits like increase in yields and foreign exchange, some agrochemicals used in these farms are a danger to humans when exposed to them and the aquatic life that live in the surrounding water bodies where wastewater from these farms is discharged. This research project therefore analyzed the effects of using such agrochemicals in greenhouses for flower production on the environment while providing practical solutions to the causes of the identified effects. The research involved the use of questionnaires which were distributed to workers of different flower farms and of different section so as to determine in what ways they are exposed to mainly pesticides and causes of such exposure. Key informant interviews were also carried out by the researcher as a means of looking for what ways those effects could be minimized. The researcher also had walks in those farms while monitoring the movement of wastewater from the farming area to the water source where the wastewater was being discharged. Also soil and wastewater tests from different farms were carried out and results showed that both soil and wastewater were some how contaminated. The research finally provides practical solutions which when implemented can reduce on the impacts of agrochemicals on the environment. The first solution is a wastewater management system layout which separates excess pesticides from excess fertilizers and general wastewater discharge. The excess pesticides are harnessed in a soak pit while the excess fertilizers are recycled and the general wastewater discharge is harnessed in an artificial wetland on its way to the nearby water body. The second and last solution is a website for control of agrochemicals which can be used by the general public, flower farm workers plus owners of the flower farms. All users of this website can check for farm tips for those working in areas exposed to pesticides,

check for pesticide being used: its WHO classification, active ingredients and effects on the environment. One does not need a password to check for such information. Owners of flower farms can check for recommended values of different soil and wastewater parameters, check for recommended suppliers of standard agrochemicals and laboratories to carry out both soil and wastewater tests. This user requires a password to access such information which is provided by a main Administrator who can also edit and add missing information for both users.

**DECLARATION**

I **KIBUULE FRANCO** hereby declare that this final year research project Report is as a result of my own research and effort and to the best of my knowledge has never been presented or submitted to any person or institution of higher learning for an academic award of any kind.

SIGNATURE *Kibuule Franco*

DATE.....10<sup>th</sup> / 06 / 2014.....

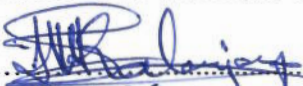


**APPROVAL**

I hereby do present this research project report for approval as supervised for the process for which it's being written.

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## **DEDICATION**

I dedicate this report to **W.PARTHE GRACE**.

Thank you so much for all what you did for me.



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First of all, I thank the almighty God for the gift of life and for the knowledge and courage that has enabled me complete my project well

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## ACRONYMS and ABBREVIATIONS

- ACP-Africa, Caribbean and Pacific
- AMI-Agricultural Mechanization and Irrigation Engineering
- EIA-Environmental Impact Assessment
- EPA<sub>s</sub>-Economic Partnership Agreements
- EU-European Union
- Euro-GAP-European Good Agricultural Practice
- ICC-International Code of Conduct
- ILO-International Labor Organization
- IFC-International Flower Coordination
- ISO-International Standards Organizations
- ITC-International Trade Centre
- FAO-Food and Agriculture Organization
- FLP-Flower Label Program
- ha-hectares
- MAAIF-Ministry of Agriculture, Animal Industry and Fisheries
- MOWE-Ministry of Water and Environment
- MPS-Millieu Program Sierteelt (Market Label)
- MPS-SQ Millieu Program Sierteelt – Socially Qualification
- NEMA-National Environment Management Authority
- NEAP-National Environmental Action Plan
- NGOs-Non Governmental Organizations

php-Php Hypertext Pre-processor

SPSS-Statistical Package for Social Scientists

UFEA-Uganda Flower Exporters Association

UWEA-Uganda Workers' Education Association

WFP-United Nations World Food Program

WHO-World Health Organization

## **CHAPTER ONE: INTRODUCTION**

### **1.0 INTRODUCTION**

This chapter presents the general information relevant to the research as it clearly shows the problem of interest for the intended research. It as well shows how this study helps to reduce the problem through the fulfillment of a number of objectives listed.

### **1.1 BACKGROUND**

Kumar, 2013 defines greenhouse as a building in which plants are grown under controlled conditions. It is a structural building with different types of covering materials, such as glass or plastic roof and frequently glass or plastic walls.

As they may enable certain crops to be grown throughout the year, greenhouses are increasingly important in the food supply of high-latitude countries. Greenhouses are often used for growing flowers, vegetables, fruits, and transplants

According to Smith (2003) floriculture is a branch of horticulture that is concerned with the propagation of ornamental plants, specifically focusing on flowering plants.

Globally, the horticulture industry has been growing very fast, it is developed in Kenya and Picking up in Tanzania, Ethiopia and Uganda.

Commercial floriculture farming in Uganda started around 1992 as one of the non-traditional cash crops. Gabre-Madhin and Hans de Vette (2004), say floriculture was introduced in Uganda after the decline in volume and value of traditional cash crops i.e. coffee, tea and cotton. According to USAID (2006) by mid-2004, Uganda's commercial flower industry was making significant economic contribution to the country.

Uganda's floriculture exports were targeting two segments of the market: cut flowers and cuttings. Flower farming in Uganda is one of the fastest growing businesses in the country. The good climatic conditions and the abundant "cheap" labour have favoured the growth of the industry in Uganda.

## REFERENCES

Belwal, R. and Chala, M. (2008): Catalysts and barriers to cut flower export: A case study of Ethiopian floriculture industry. *International Journal of Emerging Markets* Vol. 3 Issue 2

Bruno Leipold and Francesca Morgante (June 2013): The Impact of the Flower Industry on Kenya's Sustainable Development  
*International Public Policy Review* • Vol.7, No 2

Camilo Lesmes-Fabian and Claudia R. Binder, 2013, *Environmental Research and Public Health*  
ISSN 1660-4601

Crop Protection Handbook 2004

David T. (2002): The Bloom on the Rose, Looking into the Floriculture Industry  
*Environmental Health perspectives* Volume 110, Number 5. Focus

Dolan, C.; M. Opondo, & S. Smith (2002): Gender, Rights and Participation in the Kenya Cut Flower Industry. NRI Report No 2768. SSR Project No R8007 2002-4

Dolan, C. S. and Sorby, K. (2003): Gender and Employment in High-Value Agriculture Industries, *Agriculture and Rural Development Working Paper 7*, World Bank.

Elaine S. (2006): Food Safety Management Systems Certification: Report on the ISO /Sadcstan Seminar on ISO 22000 Food Safety Management Systems Held In Windhoek, Namibia.

Fliess B., Lee H., Dubreuil O. and Agatiello O. (2007): CSR and Trade: Informing Consumers about Social and Environmental Conditions of Globalized Production; *OECD Trade Policy Working Paper No. 47 - Part I*.

FAO, 2004, "FAO warns of the Dangerous Legacy of Obsolete Pesticides" Press Release 99/31

FAO CORPORATE DOCUMENT REPOSITORY, 2004. Wastewater treatment and use in agriculture. Produced by: [Natural Resources Management and Environment Department](#).

Frank B. and Cruz E. (2001): Flower for Justice, Implementing the International Code of Conduct, Friedrich Ebert Stiftung.



Getu, M. (2009): Mizan Law Rev: Ethiopian Floriculture and its Impact on the Environment, Vol.3, No 2.

Great Lakes--Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 2004. Recommended Standards for Wastewater Facilities. Published by: Health Research Inc., Health Education Services Division.

Hamrick, D. (2004): "Can Dutch roses survive", FolraCulture International, Vol. April

Hazard (2002): The WHO Recommended Classification of Pesticides

Illing, H.P.A. (1997). Is working in greenhouses healthy? Evidence concerning the toxic risks that might affect greenhouse workers

International Flower Coordination (IFC) (2004): Guidelines for the socially and Environmentally Responsible Production of Cut Flowers, version 2

International Trade Center (ITC), (May 2001): Product Profile: Cut Flower and Foliage, Business Sector Roundtable Discussion Document, Brussels

Jackline Bonabana-Wabbi and Daniel B. Taylor, (2008), Health and Environmental Benefits of Reduced Pesticide Use in Uganda

Mena, N. and S. Proano (2005): Sexual Harassment in the Workplace: The Cut Flower Industry. Case study Northern Sierra of Ecuador

NSW Agriculture, 2001. Environmental Management Guidelines For Growing Cut Flowers. Sydney: Horticulture section. Available at: [www@agric.nsw.gov.au](http://www@agric.nsw.gov.au).

Pesticide Action Network Updates Service (PANUPS), (June 2002): Floriculture: Pesticides, Worker Health and Code of Conduct

Sepulveda, O.P. (2004): Behind the Flowers. The Workers' Rights Corporation Cactus Bogotá, Estigma publications

Seyed Soheil Saeedi Saravi and Mohammad Shokrzadeh (2011), Role of Pesticides in Human Life in the Modern Age: A Review, Pesticides in the Modern World - Risks and Benefits, Dr. Margarita Stoytcheva (Ed.), ISBN: 978-953-307-458-0

Smith, S., Auret, D., Barrientos, S, Dolan, C, Kleinbooi, K, Njobvu, C, Opondo M and Tallotire, A. (2004): Ethical Trade in African Horticulture: Gender, Rights and Participation. IDS Working Paper 223, Institute of Development Studies, Brighton, Sussex, England

The control of agricultural chemicals act

The National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, S.I. No 5/1999.

Tips/AusAid (2005) "Trade Information Brief: Cut Flowers and Foliage." Trade and Industry Policy Strategies (TIPS) South Africa

Town of Castle Rock Colorado, 2012. Wastewater Collection System Design Criteria Manual

United States Environmental Protection Agency (USEPA) (1996): Cut-Rose: Request for Exception to Worker Protection Standard's Prohibition of Early Entry in to Pesticide Treated Areas to Harvest Roses by Hand Cutting EPA Document Volume 61, Number 211

W. O. Nyakundi, G. Magoma, J. Ochora and A. B. Nyende, A survey of pesticide use and application patterns among farmers