WEEDS PREDOMINANT IN POTATO FIELDS: A CASE OF SOUTHERN DIVISION, KABALE MUNICIPALITY, KABALE DISTRICT, SOUTH WESTERN UGANDA

BY

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A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT OF AGRICUTURAL SCIENCES IN PARTIAL FULLFILLMENT OF THE AWARD OF A BACHELOR'S OF LAND USE PLANNING AND MANAGEMENT OF KABALE UNIVERSITY

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DECLARATION

I declare that this research report titled “Weeds Predominant In Potato Fields; A Case Of Southern Division, Kabale Municipality, Kabale District, South Western Uganda” is my own independent work and that I have not previously submitted this work for a qualification at another university.

SIGNATURE:…… **DATE:**……

AKANKWASA LOWLAND

APPROVAL

The undersigned certify that he has read and hereby recommend for acceptance by Kabale University a research report entitled, **"Weeds Predominant in Potato Fields; A Case of Southern Division, Kabale Municipality, Kabale District, South Western Uganda"** in fulfillment of the requirements for award of the DEGREE in Land Use Planning and Management of Kabale University.

SIGNATURE:…….. **DATE:** …….

SUPERVISOR: DR. JIMMY OBALA (PhD)

DEDICATION

This work is dedicated to my parents Mr. Musinguzi Denis and Mrs. Musimenta Agrippina plus my beloved brothers and sisters.

ACKNOWLEDGEMENT

Firstly, I would like to pay the deepest gratitude to God for granting me the power, wisdom, and passion to complete this study. I would like to express my special gratitude to my parents, brothers and sisters who inspired me to successfully complete this study. I also thank them for the tolerance they incurred during my absence.

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ABSTRACT

The existence of weeds on potato crops could decrease the productivity of the crops, so that weed control efforts were absolutely necessary. The diversity of dominant weed types needed to be known so that weed control could be done correctly. This study aimed to make dominant weed mapping on potato cultivation in Southern Division Kabale Municipality. Two fields of Irish potato scattered at different altitude or topographic conditions were randomly selected in each village. At each field the weed samples were taken diagonally (5 times) for each plot of potato cropping using quadrants of size 0.5 m × 0.5 m. Field data was used to determine weed species, weed density, weed frequency, weed domination, importance value, summed dominance ratio, weed dry weight and species diversity index. The results showed that the dominant weed species in Central, Nyakambu, Mwanjari and Nyakiharo were *Galinsoga parviflora*, *Amaranthus spinosus*, *Drymaria vilosa* and *Cyperus rotundus*, respectively. Weed diversity index ranged from 1.46 to 2.26. This study concluded that broad-leaved weeds are the dominant weed types in potato fields in the Southern Division of Kabale Municipality.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Weed has long been known as a component of agricultural ecosystems and one of the main factors reducing the crop yield (Týr, 2008).

Weed flora that competes with a particular crop species differs from location to location depending upon climatic, edaphic and management practices which are influenced by its geographical location. Identifying the major weeds of a crop enables the researcher to design sound weed management strategies. Southern Division Kabale Municipality represents a unique agro-climatic condition due to its geo-graphical location. The elevation of the district ranges between 1000 to 2500 m above MSL which falls under moist sub-humid group of climatic classification.

In Southern Division Kabale Municipality, the mean annual rainfall received is 1300 mm under two seasons with a little higher share of 50-55% during the month of February and April. The mean maximum temperature ranges between 17.5°C and 22.2°C and the range of mean minimum temperature is between 7.3°C and 12.3°C. The soils of the region are characterized by low pH, high organic carbon and low available phosphorus. All these factors support the wild vegetation to be alive throughout the year, creating competition for the agricultural crops and hindering them to express their full yield potential.

In Southern Division Kabale Municipality, the weeds predominant in potato have not been documented so far, which is very much essential in designing sound measures for controlling them. Assessment of the types of weeds predominant in Irish potato (*solanumtuberosum l.*) fields in southern division of Kabale Municipality, South-western Uganda. Hence, an attempt was made to document the most dominant weeds of potato crop through their importance value and importance value index in relation to other species in the community.

The Irish potato (*Solanumtuberosum L.*) is the fourth most important staple food crop in world after rice, wheat (*Triticum aestivum*) and maize (*Zea mays*) (Knapp 2013). It was ranked first in the world's root and tuber crop production followed by sweet potato (*Ipomoeasbatatas*). In terms of yield, potato is the third crop in the world and first in root and tubercrops followed by sweet potatoes (CIP, 2008).

Potatoes were introduced in Uganda in the early 20th century. The most common varieties grown in Uganda include Victoria, Rwashaki, Rwangume and Kinigi grown in Kabale, Vitoria and Wanale grown in eastern Uganda (Sebatta et al., 2014). Potato is a cool season crop that requires bright and sunny days and cool nights. Potatoes grow best in temperatures ranging from15 to 20 ºC and should not be grown in areas where temperatures above 32 ºC are experienced (Särkinen et al., 2018).

In Uganda, potatoes can be grown 3 times a year for the short season varieties such as BP1. This is very attractive to farmers as potato production is a very lucrative industry. This is however not common due to frost, fluctuating demands in the market and the need for crop rotation cycles to control pests and diseases such as potato tuber moth and blights (Fusire, 2001).

High production costs and the difficulty faced in obtaining loans also add to the constraints of potato production while pests and diseases greatly affect yield (Lutaladio et al., 2009). Lack of diversity in potato varieties reduces the ability to overcome problems of drought, diseases, pests, climate change and decreasing yields in marginal lands (FAO, 2008).

Weed as plant-disturbing organisms included important constraints to be overcome in increasing horticultural crop production in Uganda. Weeds were one of the most dangerous factors in agricultural land because it could decrease crop yield. Depending on the level of competition, weeds could reduce yield productivity from cultivated plants between 10-25%. In potato plants, if weeds were not controlled, the weeds would reduce damage to potato crops around 54.8%.

The diversity of weeds in a cultivation plant was not fixed but varied according to the factors that influenced it, following the general rules of the dynamics of the plant population. Factors affecting the change or diversity of weeds planted in horticulture were different ways of cultivation, control methods and plant stadia that affected the microclimate and season. Horticultural crops were very sensitive to weed disturbance during the critical period of between 1/3 to 1/2 age of the plant, so in that critical period, it needed weed control.

In Southern Division Kabale Municipality, the weeds of potato have not been documented so far, which is very much essential in designing sound Assessment of the types of weeds predominant in Irish potato (*solanumtuberosum l.*) fields in southern division of Kabale Munici-

pality, South-western Uganda. Hence, an attempt was made to document the most dominant weeds of potato crop through their importance value and importance value index in relation to other species in the community.

The appropriate weed control program to obtain satisfactory results needed to be considered first. Knowledge of weed biology, factors affecting weed growth, knowledge of how weeds multiplied, spread and reacted to environmental changes and the way weeds grew in different circumstances was very important to know in determining the direction of the weed control program. Success in weed control should be based on sufficient knowledge of the biological properties of the weed, for example, (a) By identifying, (b) Searching in the literature on the reference to the weeds and (c) Asking the experts.

1.2 Statement of the Problem

Biological and physical factors, such as weed infestation, low soil fertility, poor water management are limiting potato crop yields (Seck et al., 2012). The demographic pressure and emerging land shortages largely prevent the opportunity to increase yields through area expansion, leading instead to the need for increasing the cropping intensity and the yield per unit land area.

The extent of slopes uses is likely to intensify weed growth dynamics, water and nutrients fluxes and thus to differentially impact fertility and crop productivity (Bognonkpe, 2014). Several weed problems have been reported in Kabale municipality particularly in southern division. Weed growth dynamics are likely to vary with the cultivation practices. Farm work mainly uses the family's labour, and the technical operations are mostly manual.

Hence land preparation is mostly done by hand and fields are often inadequately bounded and leveled resulting in uneven flooding and patchy conditions favoring weed growth (Roden burg & Johnson, 2009). Given the time required for preparing the land, planting, and weeding during the growing season, farmers are under the main constraint of fast weed growth.

The introduction of improved varieties with high yield potential is a promising option, though most experts concur that complementary weed management is needed. A quantitative understanding of the predominant potato weed types of Kabale Municipality particularly in the Southern Division and the weed management practices affordable by smallholder farmers in the low-input systems is needed in order to improve the spatial targeting of technical options aiming at better managing of weeds and improving potato production.

1.3 Objectives of the study

1.3.1 Overall objective

To contribute towards development of sustainable weed control for enhanced potato yield in South-western Uganda.

1.3.2 Specific Objective of the study

To identify predominant types of weeds in potato fields in Southern Division, Kabale Municipality, South-Western Uganda.

1.4 Significance of the Study

The results of the present study could help researchers to uncover the characteristics of dominant weeds that could affect the yield of potato crops, and will help in designing appropriate methods for sustainable weed management.

1.5 Scope of the study

The study covered the geographical scope, content scope, and time scope.

1.5.1 Geographical scope

The study was carried out in Southern division, Kabale Municipality covering Kirigime and Mwanjari wards basically covering two villages per ward and two gardens per village.

1.5.2 Content scope

The study focused on assessment of the types of weeds predominant in potato fields in southern division Kabale municipality.

1.5.3 Time scope

The study was carried out in the period between November, 2020 to February, 2021.

CHAPTER TWO

LITRATURE REVIEW

2.1 The potato history and origin

Potato (*Solanumtuberosum* L.) is the only most popular and potential crop for ensuring food and nutritional security to fight hunger and malnutrition. During the last two decades (1994-2014), worldwide production of potato has increased from 271 million tones to 385 million tones (FAO, 2014).Potato with time has crossed the continental boundaries and is now an integral part of the global food system.

Potato is the member of Solanaceae family that also comprises of crop for example tomato, eggplant, tobacco and pepper. The major potato species grown worldwide is *Solanumtuberosum* (tetrapolid) with 48 chromosomes. The ploidy levels vary in potato with different series. On the basis of haploid number for example 12, the ploidy level varies from diploid (24) to hexaploid (72) (Daniel, 2011). Most of the wild potato species are diploid.

Potato tuber is formed underground on a particular plant part, known as stolon (Mitchell et al., 2015). Stolon forms tuber under short day conditions (day light) and cool temperature at night. Uganda during winter season the potatoes are mostly grown in sun-tropical indo-gangetic regions due to the presence of favourable conditions for example. Short day conditions (day light) and cool temperature (at night). On the other hand, in Kigezi hills these conditions are present in summer season and therefore potato is cultivated during summer season.

Potato plant is propagated through tubers. Tubers which mediate propagation are known as seed tubers or seed potatoes. Additionally, botanical seeds (True Potato Seeds, TPS) can also be used for the propagation of potato plant. TPS is a substitute for propagation in the areas where production of seed potato is not economic and feasible.

2.2 Weeds

Weeds are recognized as a major threat to both agricultural and native vegetation systems (Adesina et al. 2012). The naturalized flora of Uganda consists of about 2700 species believed to be non-native. Of this total, 798 are considered a major problem in natural ecosystems. Those posing a problem for agricultural systems number 1266 species, 35% of which

represent a major problem. Sixteen of these species are currently subject to nationally or state-coordinated eradication programs throughout their known range because of their perceived impacts on agricultural ecosystems (Groves et al., 2003).

A common definition of a weed is simply a plant growing where it is not wanted. A species may be labeled a weed because of its geographical origin, because of its impact on a particular land use, or because of more encompassing effects on ecosystem structure and function.

Typical characteristics of weeds that make them unwanted include: contamination of agricultural produce; livestock poisoning; restriction to livestock movement and access to pastures; and because they occupy space and resources that could be utilized by more beneficial species (Grice et al., 2003).

Weeds are an important economic problem in agricultural systems. Weeds have a direct impact by affecting the productivity of crops and pastures, resulting in a reduction in on farm income. The economic impacts of weeds are not confined to an individual farm. There may also be industry-wide impacts if weeds affect the supply and market price of a commodity. Externalities are prevalent where uncontrolled weed populations on an individual farm spread to neighboring farms, imposing additional costs (Jones et al., 2000).

2.3 Competition between weeds and potato

Weeds compete with the potato crop for light, nutrient and water. Yield of tubers can be severely reduced, the size of the reduction being dependent on the density and competitive ability of the particular weed population and the availability of supplies of light, nutrients and water (Ahmadvandet al., 2009).

The earlier the weeds emerge in relation to the crop, the greater their competitive advantage (Amador-Ramirezet. al., 2002) and yields are seriously reduced if weeds are not controlled at an early stage (Ciuberkiset al. 2007). Rao et al. (2000) showed that even small weeds at the time of potato emergence can cause a reduction in potato yield. If potatoes are chitted before planting, they emerge earlier in relation to the weeds and thus compete more effectively against them. Potato plants which are fairly large and growing actively are more capable of competing with weeds than they are at the time of emergence (Seem et al., 2003).

Annual broad-leaved weeds, because of their growth habit, tend to be more competitive than annual grass weeds, and because of their speed of germination and emergence they are more

competitive than perennial weeds, particularly in the earlier stages of crop development. Once the potato canopy has closed, annual weeds are effectively suppressed. Hence weeding or herbicide application is only necessary between planting and closure of the leaf canopy.

The rapidly growing perennial weeds, such as creeping thistle (*Cirsiumarvense* L. (Scof)) and perennial sow-thistle (*Sonchusarvense* L.) can penetrate the canopy once it has closed but rarely provide serious competition. They generally emerge later than annual weeds after the crops have emerged and hence becoming difficult to control with herbicides or cultivations within the growing crop. The perennial broad-leaved weeds and the perennial grasses, e.g. couch grass, often make most of their growth when the potatoes begin to senesce and the canopy becomes more open (Robert et al.,2018).

Subsistence farmers in the tropics spend most of their time and energy on weed control than on any other aspect of crop production and since weed control methods are still largely limited to hand pulling and hoeing, most farmers' time is spent fighting weeds.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

3.1 Description of study area

The study was carried out in Southern Division of Kabale Municipality located in Kabale District of the Kigezi sub-region south western Uganda. It is approximately 420 kilometers (260 miles) by road southwest of Kampala, Uganda's largest capital city. The town is lies between 01°15'00"South and 29°59'24"East on an elevation of 2000 metres (6600ft) above sea level. The average daily temperature ranges from 56°Cto 75°C and is rarely bellow 53°F and above 81°F. The average annual temperature is 17.2 °C/ 62.9°F. According to the 2002 national population census, Kabale Municipality had approximately 41350 inhabitants. The Uganda Bureau of statistics (UBOS) estimated the population of the town at 44200 in 2010. In 2011, UBOS estimated the mid-year population to be around 44600 people. The 2014 national population census conducted in august, put the population of Kabale municipality to be at 49667 people (UBOS, 2014).

3.3 Sampling and sample size

A sample is a small part of something intended as representative of the whole. Sampling is that part of statistical practice concerned with the selection of an unbiased or random subset of individual observations within a population of individuals intended to yield some knowledge about the population of concern, especially for the purposes of making predictions based on the sample frame.

In order to obtain a representative sample for the study, purposive sampling techniques were used to select the respondents for the study. This technique took into consideration the wide range of farmers from four villages in two wards of southern division Kabale municipality and also years of experience in farming practices. The study employed a total of 60 respondents 15farmers from each of the four villages selected for the study.

Two wards were selected from the division. In each ward, two villages and two potato fields per village were selected. The villages were Nyakambu and Central Village in Kirigime ward and Mwanjari and Nyakyiharo in Mwanjari and these were basically selected due to their fer-

tile soils that favour the growth of Irish potatoes (*Solanumtuberosum L.*).The study fields in each village were selected based on being at least 0.5 acres in size.

3.3 Data collection

In each potato (*Solanumtuberosum L.*) field, samples were randomly and systematically taken along diagonal transects using a quadrant. Tools that were used in this study were; squared meters (0.5 × 0.5 m), scissors, hoes, meters, plastic bags, machetes, analytical scales. In each ward two potato (*Solanumtuberosum L.*) Fields were randomly selected. In each sample from each potato field, the analysis of weeds was analyzed diagonally (5 times) for each field of Irish potato (*Solanumtuberosum L.*) and chicory with squared meters; the size of the used quadrant was 0.25×0.25m. Data analysis was performed by quantitative analysis to know the diversity index (H').

3.3.1 Field survey/ questionnaire method.

Questionnaires were directly administered to the respondents chosen from the heads of households, the group of interest to get the information on predominant types of weeds in potato fields in Southern Division Kabale Municipality. Four villages in southern division Kabale municipality the most vulnerable to these weeds were assessed and data collected was scrutinized to eliminate duplications.

3.3.2 Interview

Surveying using interviews was the main source of data. This method has been selected because the research questions pursue understanding of predominant types of weeds in potato fields in Southern Division, Kabale Municipality, land users' actions and human activities and it also helped to gain the interviewee trust. Two types of interview that were used included structured and semi-structured. Interviews were useful in order to clarify a number of issues in the questionnaire and to make the results of this study more reliable.

To collect primary data, interviews were used in different areas. And this ensured the accuracy and the completeness of collected information.

3.3.3 Focus group discussion

Focus groups were organized to gather data on predominant types of weeds in potato fields in Southern Division, Kabale Municipality. These were composed by groups of 10-12 people living in the selected areas.

3.4 Data analysis

Weed vegetation analysis was performed by taking weeds from destructive plot of 0.25 m^2 and group per weed species, dry weight per species and total are measured by weighing the dried weed on the sun light until reaching the constant weight at the temperature of 80EC. Furthermore, the calculation of weeds importance value (IV), Summed Dominance Ratio (SDR), weeds diversity index, dominance index (D), weeds species and the index of weeds species dominance (D) were done with the following formula:

Weeds Importance Value (IV) was the value obtained from the calculation for example;

$$\text{Absolute Relative density value of species} = \frac{\text{Absolute density value of species}}{\sum\text{Absolute density value of classes}} * 100\%$$

$$\text{Relative frequency value of species} = \frac{\text{Absolute frequency value of species}}{\sum\text{Absolute frequency value of classes}} * 100\%$$

$$\text{Relative dominance value of species} = \frac{\text{Absolute dominancevalue of species}}{\sum\text{Absolute dominancevalue of classes}} * 100\%$$

$$\text{Important value} = \text{Relative density} + \text{relative frequency} + \text{relative dominance}$$

$$\text{Summed dominance (SDR)} = \frac{\text{Important value}}{3}$$

Weeds species having the biggest SDR value meant that it was dominant weeds.

Weight dry weeds per species and total dry weight

Observations were made at the time of vegetation analysis by taking from the destructive plot of 0.5 m x 0.5 m and grouped into three groups of weeds, for example, broad leaves weeds, grasses and sedges. Dry weight was measured by weighing the dried weeds in the oven to 80EC.

To know the magnitude of Species Diversity Index (H') in the area/ ward whose purpose is to evaluate the weeds diversity level in the area/ward and this was be done by using the formula below and according to Barbour *et al* data was processed by using Ecological Methodology Program:

H '=-$\sum_{i-1}^{n}(pi)$(In pi)

Wher

e :

Pi =ni/N

Ni =Number of important values of one species

= Number of important values of all species

ln = Natural logarithm

In order to know the meaning of Species Diversity Index (H') Shannon-Weaver could be interpreted, so the criteria were used. According to Barbour *et al*, the H' value usually ranged from 0-7. If H'< 1 the lowest category. If H'> 1-2 low category. If H'> 2-3 medium category. If H'> 3-4 high category and if H'> 4 the highest category.

3.5 Ethical considerations

Respect for anonymity and confidentiality, the researcher ensured and respected anonymity and confidentiality of the respondents.

Respect for privacy, important and private information was respected and kept private in accordance with the will of the respondents.

Informed consent, respondents' consent was sought first before issuing questionnaires and interviewing was conducted.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Weed abundance

The most predominant types of weeds in Southern Division were the broadleaves followed by grasses and lastly, sedges. As shown in Table 1 below; there was a total of 11 weed species in Central, 10 in Nyakambu, 11 in Mwanjari and 14 in Nyakyiharo existing on potato crop fields. The dominant weed species in each of the studied villages were *Galinsoga parviflora* at 29.7% in Central Village, *Amaranthus spinosus*at 34.6% in Nyakambu Village, and *Cyperus rotundus* at 21.26% in Nyakiharo Village.

Table 1. Weed categories in the study area

Village or cell	**Type of the weed**	**Weed Dominance in numbers**
Central		
	Broad leaves	7
	Grass	3
	Sedges	1
Total		**11**
Nyakambu		
	Broad leaves	5
	Grass	4
	Sedges	1
Total		**10**
Mwanjari		
	Broad leaves	8
	Grass	2
	Sedges	1
Total		**11**
Nyakyiharo		
	Broad leaves	11
	Grass	2

	Sedges	1
Total		**14**

Source: Field data, 2020

The most predominant weed species in Southern Division were *Galinsoga parviflora* at 29.7% in Central Village, *Amaranthus spinosus*at 34.6% in Nyakambu Village, and *Cyperus rotundus* in 21.26% in Nyakiharo Village as shown in the table below.

Table 2. Most dominant weed species in the study area

Village	**Predominant weed specie**	**Percentage (%)**
Central	*Galinsoga parviflora*	29.7%
Nyakambu	*Amaranthus spinosus*	34.6%
Nyakiharo	*Cyperus rotundus*	21.26%
Mwanjari	*Drymaria vilosa*	22.72%

Source: Field data, 2020

The least predominant weed species in Southern Division were *Galinsoga parviflora* at 29.7% in Central Village, *Galinsoga parviflora*(14.39%) in Nyakambu Village, *Oxalis latifolia* (11.8%) in Mwanjari and *Drymaria vilosa*(10.34%) in Nyakiharo Village as shown in the table below.

Table 3. Least dominant weed species in study area

Village	**Predominant weed specie**	**Percentage(%)**
Central	*Galinsoga parviflora*	29.7%
Nyakambu	*Amaranthus spinosus*	34.6%
Nyakiharo	*Cyperu srotundus*	21.26%
Mwanjari	*Drymaria vilosa*	(22.72%),

Source: Field data, 2020

Table 4. Summed dominance of weeds on potato crop fields in four villages of Southern Division

Species	**Central**	**Nyakambu**	**Mwanjari**	**Nyakyiharo**
Altenanthera sessilis	5.73	-	-	-
Amaranthu sspinosus	3.71	34.62*	8.32	2.58
Artemisia vulgaris	-	-	13.67	10.86

Biden pilosa	-	-	3.59	6.02
Blumealacera	-	-		5.51
Borreria latifolia	-	-	3.10	1.08
Commelina diffusa Burm. F.	-	-	3.56	2.05
Cynodon dactylon	2.77	4.27	6.10	3.10
Cyperus rotundus	13.54	22.04	4.31	21.26*
Drymariavilosa	-	-	22.72*	10.34
Dygitaria ciliaris	1.58	3.27	-	-
Echinocloa colona	2.66	2.12	-	1.08
Erageronsuma trensis	-	-	-	3.30
Eleusineindica L.	25.60	9.93	1.65	-
Galinsoga parviflora	29.66*	14.39	21.17	6.97
Hieracium aurantiacum	3.01	1.55	-	-
Oxalis latifolia	9.56	-	11.80	19.73
Poa annoa	-	3.61	-	-
Portulacao leracea	2.18	4.19	-	6.13
Total dominance value	**100**	**100**	**100**	**100**
Number of species	**11**	**10**	**11**	**14**

Source: Field data, 2020

4.2 Weight dry weeds per species and total dry weight

The data in Table 2 below showed that weed species with the highest dry weight in the potato area in Central cell/ village with broad leaves weed was *Galinsogaparviflora* and grass was *Eleusineindica*. The weed species that had the highest dry weight in the potato area in Nyakambu cell/ village were broad leaves weed is *Amaranthu sspinosus* and sedges is *Cyperu srotundus*.

Species of weeds that had the highest dry weight inpotato area in Mwanjari cell/ village were broad leaves weeds were *Galinsoga parviflora* and *Amaranthus spinosus* and grass was *Eleusineindica*. While weed species that had the highest dry weight in potato area in Nyakiharo cell were broad leaves weeds were *Galinsoga parviflora* and *Drymaria vilosa*and sedges was *Cyperusrotundus*.

Total weed dried weight in potato area in Central cell/ village was 41.37 g, in Nyakambu cell/ village was 46.89 g, in Mwanjari cell/ village was 130.30 g and in Nyakiharo cell/ village was 100.20 g.

The highest total weed dry weight in sub-district was 130.30 g. According to Pramuha di*et al*.(2004), weed dry weight on cropping tended to increase with increasing soil renewal intensity but tended to decrease with increasing intensity of land piracy. In Mwanjari cell, weeds were dominated by broad leaves weeds, thus having the highest dry weight. Broad leaves weeds had a larger shape, so it was resistant to shade. Broad leaves weeds had dense canopy and the incoming light intensity for photosynthesis could take place optimally compared to sedges and grasses.

According to Gardner *et al*. (1995), the development of weeds was a complex combination of growth processes that led to the accumulation of dry weight of plants. This was because the dry weight was greatly influenced by the vegetative growth of weeds, if the vegetative growth increased, then weed dry weight would also increase.

Table 5. Weight of dry weeds per species and total in potato crops

Species	**Nyakambu**	**Central**	**Mwanjari**	**Nyakyiharo**
Broad leaves weeds				
Galinsoga parviflora	17.94	3.74	45.10	17.30
Hieracium aurantiacum	0.01	0.06		
Alternanthera sessilis	0.78			
Portulacao leracea	0.13	0.83		1.50
Amaranthusspinosus	0.51	17.43	26.30	1.30
Oxalis latifolia	1.40		3.30	6.50
Poaannoa		0.46		
Artemisia vulgaris			11.20	9.90
Drymaria vilosa			20.30	11.20
Commelina diffusa			0.80	2.00
Biden pilosa			1.80	4.80
Borreria latifolia			1.50	0.80
Blumea lacera				3.00

Erageronsuma trensis				3.70
Grasses				
Eleusine indica	13.48	4.25	14.00	
Dygitaria ciliaris	0.19	1.07		
Echinocloa colona	0.57	0.39		0.10
Cynodon dactylon	0.71	2.50	2.60	2.90
Sedges				
Cyperus rotundus	5.65	16.16	3.40	35.20
Total	**41.37**	**46.89**	**130.30**	**100.20**

Source: Field data, 2020

4.3 Index of species diversity

On Table 5, there was an adequately clear difference among the range of existing value in some locations of potato fields' observation. In each of observed villages, it indicated the almost similar value. The significance of index value of species diversity (H') could be interpreted, so the criteria were used. According to Barbour *et al*. (1987), H' value usually ranged from 0-7. If H'<1, it was the lowest category. If H'>1-2, it was low category. If H'>2-3, it was medium category. If H'>3-4, it was high category and if H'>4, it was the highest category.

The index value of potato crop diversity on Table 3 was obtained in Central cell/ village, Nyakambu, Mwanjari cell/ village and Nyakiharo villages. Central cell/village indicated the almost similar value where the value of species diversity index was included in low category due to the weeds which has the species were almost similar so that the diversity was low and the productivity got very low as the indication that there was the heavy pressure and unstable ecosystem, except in Nyakiharo village. Nyakiharo village was included in medium category because the weeds which had the species were composed of some species.

This condition showed that ecosystem was in the state of being sufficient and balanced, sufficient production and moderately ecological pressure. A community was said to have the high diversity if the weeds community was composed by many species with the abundance of similar species. On the contrary, if a community was composed by a little bit of species and only a few dominant species so that the diversity of species was low. The value of species diversity index obtained on the potato cropping area in Southern Division Kabale Municipality was between 1.46 and 2.26 including low to medium category. The figure showed that the level of

species diversity in the research area including low to medium category where a weeds community was composed by some species.

Table 6. Index of species diversity on potato area

	Nyakambu		Central		Mwanjari		Nyakyiharo	
	Field A	field B	Field C	Field D	Field E	Field F	Field G	Field H
Galinsoga parviflora	0.37	0.36	0.29	0.29	0.32	0.34	0.17	0.23
Eleusine indica L.	0.37	0.33	0.23	0.25		0.10		
Hieracium aurantiacum	0.11		0.09					
Alternanthera sessilis	0.22	0.12						
Portulacao leracea	0.14		0.15	0.09			0.24	0.11
Amaranthus spinosus	0.11	0.14	0.36	0.37		0.27		0.14
Oxalis latifolia	0.14	0.27			0.22	0.30	0.34	0.30
Cyperus rotundus		0.32	0.34	0.34	0.18		0.36	0.23
Dygitaria ciliaris		0.08		0.15				
Echinocloa colona		0.12		0.11			0.07	
Cynodon dactylon		0.12	0.19		0.18	0.18	0.12	0.11
Poaannoa			0.16					
Artemisia vulgaris					0.33	0.19	0.28	0.20
Drymaria vilosa					0.33	0.34		0.33
Commelina diffusa					0.13	0.10		0.12
Biden pilosa					0.16			0.25
Borreria latifolia					0.13	0.10		0.07
Blumea lacera							0.22	
Erageronsuma trensis								0.17
Total	**1.46**	**1.86**	**1.81**	**1.60**	**1.99**	**1.91**	**1.80**	**2.26**

Source: Field data, 2020

In addition to above, Kikuyu grass (Pennisetum cland estinum) and crowfoot grass(*Dactyloctenium aegyptium*) can be seen abundantly especially on field bunds and waste

places. Wild radish (*Raphanusra phanistrum*) and Lupine (*angustifolius*) can also be noticed whenever these crops were grown during Lupinus

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The results showed that the dominant weed species found on the potato crop field was *Galinsogaparviflora* (29.66%) in central cell, *Amaranthus spinosus* (34.62%) in Nyakambu, *Drymariavilosa* (22.72%) in Mwanjari and sedges *Cyperusrotundus* (21.26%) in Nyakiharo. The value of diversity index of potato crop acquired in Southern Division Kabale Municipality ranged from 1.46-2.26 including low-moderate, showed that community has moderate species diversity.

5.2 Recommendations

The use of herbicides in these villages should continue to be encouraged with rising scarcity and cost of labor. It is therefore important that farmers in these zones are educated through trainings on the basic principles of herbicides use and other basic weed control measures. The above training should cover safety, calibration, and the appropriate use of herbicides. It is crucial for the effective and efficient weed control and management in potato crop and avoidance of development of resistant weeds owing to inappropriate use of herbicides.

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APPENDICES

Appendix I: QUESTIONNAIRE

ASSESSMENT OF THE TYPES OF WEEDS PREDOMINANT IN POTATO FIELDS IN KABALE MUNICIPALITY, SOUTH-WESTERN UGANDA

Start time:.....

Name of the facilitator:……

Date:……

District:……. Sub-county:……

Parish…… Village……..

Introduction

My name is Lowland Akankwasa and I am an undergraduate student from Kabale University. I am doing research to learn about the types of weeds predominant in potato fields and the control methods used by famers. I would like to invite you to participate in an interview as part of my project. If you take part, we will not use your real name, and what you tell me will be used for academic purposes only. The responses will be treated with utmost confidentiality. This interview will take around 30 minutes. Would you like to take part? Do you have any questions?

End time: …….

Household serial No……

SECTION A: Background Information and Demography of household

Sex

(a) Male	(b) Female

Age ……

Marital status

(a) Single	(b) Married	(c) Separated	(d) Widowed

Highest education standard attained

(a) Primary	(b) Secondary	(c) Tertiary	(d) Never

Total household size: …….

Do you own any land?

(a) Yes	(b) No

If yes, how many acres? .....

How many acres of your land are under cultivation? ……

Are there periods when you leave some parts of land uncultivated?

(a) Yes	(b) No

If your answer is yes, why do you leave this land uncultivated?

…….

Which crops do you grow on your land?

Crops	Crops

Do you grow potato?

(a) Yes	(b) No

What are the most important weed species growing on your potato field, reason for importance and usefulness of these weeds?

Weed Species (Local name/ English)	Botanical name	**Reason for importance (**a) Reestablish easily after weeding, (b) Cause injury to the skin c) Produce many seeds, d) Not sure)e) others specify	**Weed control (**a) Herbicide (b) Burning residues c) Weeding before seed shed, d) ploughing and incorporations of weeds in soil e) others specify	**Usefulness of weeds (**a) vegetable (b) construction c) fodder, d) medicine e) others specify

Do you use herbicides on your potato field to control weed?

(a) Yes	(b) No

If yes, mention them

a) Glyphosate	b) 2,4,D Amine salt	c)others specify

What are the reasons for using the herbicide?

a) Labour saving	b) more efficient than hand weeding	c) others specify

If not, what are some of the reasons for not using herbicides?

a) High cost of herbicides	b) lack of awareness	c) Inability to operate the sprayer	d) lack of capital	d) non-availability of effective herbicide

Are there challenge(s) related to controlling weeds on-farms?

Yes …… (b) No ……

Indicate the affected species and the challenge(s) related to controlling it on-farms

Weed name	Challenges related to controlling the weed

Thank you so much for your time

Appendix II: KEY INFORMANT GUIDE

1. Do you grow Potato?
2. Which areas in Southern Division of Kabale Municipality grow potato?
3. What are the important (dominant) weed species in farmers ‘potato fields?
4. How are these weeds controlled by farmers?
5. What are some of the challenges faced in controlling these weeds?
6. What are some of the uses of these weeds?