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Analysis of Weed Management Practices among Small Scale Farmers in Makurdi Local Government Area of Benue State, Nigeria

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Abstract

The study analysed weed management practices among small scale farmers in Makurdi Local Government Area of Benue State, Nigeria. The population of the study consisted of all registered farmers in the State. Primary data were collected using a structured questionnaire administered through interview to 120 small scale farmers (respondents) selected using multistage sampling techniques. Data collected were analyzed using descriptive and inferential statistics. Findings revealed that 63.3% of the respondents were aged between 21 and 40 years, 50% each were male and female, 44.2% were married, 58.3% had a household size of between 6 and 8 persons, 60.8% had farm size of 2 hectares, 73.3% had estimated annual income of ₦50,000.0 ($120.25), 65.8% of the respondents obtained information on weeds management from radio, 94.2% controlled weeds using manual method, $\bar{x}$=2.93 perceived weeds control using agrochemicals as spending more money. The result of binary logistic regression indicated that household size (0.421) and estimated annual income (0.000) had a positive and significant effect on control of weeds at 5% while educational qualification (-1.472) had a negative and significant effect on the control of weeds at 5%. There is no best way of controlling weeds, however, weeds are managed based on the type of farm practice adopted by the farmer and the most effective method of managing weeds is achieved through a combination of different methods. It is recommended that agricultural extension workers should enlighten farmers on weeds control practices, use of agrochemicals for weeds control and government and Non-governmental organizations should make available specialized equipment for application of agrochemicals for weeds control.

Keywords: Analysis, weed management, practices, small-scale, farmers.

Introduction

Agricultural production is very important because it is a practice that produces strategic commodities for income, poverty reduction and economic growth at the national and household level of food security. A high proportion of Nigerian small scale farmers are dependent on agriculture directly or indirectly as crops grown is one of the important agricultural export commodities. The productivity and profitability of crop production are threatened by climate change, socio-economic changes, imbalanced input application of especially overuse of agrochemicals, rising scarcity of resources such as labour and water, the rising cost of inputs and fluctuating farm-gate prices and above all weeds infestation. Weeds are probably the most ever-present class of crop pests and are responsible for marked losses in crop yields. Weeds reduce the crop yield and deteriorate the quality of produce and hence reduce the market value of the turnout. Management of weeds in all agroecosystems is imperative to sustain crop productivity and to ensure food security to the ever-growing population.

Weeds constitute a special class of pest that continuously and seriously limits production of crops on any scale. Weeds compete with crops for all the inputs which are given for crop growth and play an important role in lowering the productivity of crops. Weeds control is the science of manipulating weeds such that they do not interfere with the growth, development and economic yield of crops and animals [1]. There are different weeds management practices aimed at preventing, controlling and containing their propagation and its negative effects on crop production. The formulation and practice of sound weeds management practices may involve individual and group responsibilities as well as government-authorized laws to prevent the introduction and spread of weeds. Knowledge of the economic threshold (the minimum weed density at which weeds control is economically justified) and critical period of weed interference: when weeds must be controlled to obtain the best yield is essential. Sound knowledge of weeds population dynamics and how it is affected by different weed management practices are important in developing an optimum crop management strategy. The agricultural interest of the world is to obtain maximum crop yield and fulfil the food, feed and fibre requirements in a competition of fast increasing population. This interest of the

globe is damaged by weeds. Weeds directly reduce the crop yield and deteriorate its quality.

Traditionally, a weed is defined as any plant growing where it is not wanted. This definition can apply to crops, native plants as well as non-native species. If it is considered to be a nuisance where it is growing, it can be termed a weed. However, weeds are not just unwanted species; they have substantial negative effects wherever they are present. Weeds can efficiently compete with crops, increase labour requirements, can lower yields, and fundamentally increase food costs for the consumer [2, 3]. One of the most common traits of weed species is its tendency to be an annual or biennial rather than a perennial; this allows the species a faster reproduction rate leading to a higher prolificacy. Other characteristics that determine the weediness of a species is the ability to take over crops under high sunlight and low soil moisture conditions.

Weeds represent a special class of pest that dangerously limits the production of crops on any scale. They compete with the crops for all the inputs which are given for crop growth and play an important role in reducing the yield of crops. The ability of crops to compete against weeds could be increased by selecting the right crops and cultivars, considering the weeds present as well as the climate, ensuring rapid and uniform crop emergence through proper seedbed preparation, and by using the right seed and seeding depth, increasing planting density and adapting planting patterns wherever possible to crowd out weeds, adequate and localized resource (water, fertilizer) application, and optimum management of the crop, including insect pest and disease management [4]. Weed control practices are meant to use weedicides, hoeing, tillage operations, hand pulling, mulching, intercropping, cultivation of weed competitive varieties, use of the pure seed, seed rate, use of fertilizers, mixed cropping, crop rotation, sowing time and sowing methods etc. to reduce weeds infestation in crop fields for maximum crop production.

Despite all the problems caused by weeds, they have some beneficial properties, particularly when occurring at low densities. They include helping to conserve soil moisture and prevent erosion, reduce the amount of bare soil exposed helping to conserve nutrients, particularly nitrogen which could otherwise be leached, especially on light soils. Provision of food and shelter for natural enemies of pests and even alternative food sources for crop pests, weeds can be valuable indicators of growing conditions in a field, for instance, water levels, compaction and pH and source of food for wildlife, especially birds.

More than 70 percent of Nigerians live in rural areas where farming is the main occupation. Statistics suggest that an average farmer who uses improved and traditional tools for crop production contends with weed problems annually. Uncontrolled weeds growth has been reported to cause yield reduction of 34-55 percent in maize, 28-100 percent in rice, 40-67 percent in grain legumes, 52 percent in oil and fibre crops (sunflower) and 65-91 percent in root and tuber crops [1]. Timely weeds control aims at minimizing weeds interference with a crop at critical periods to reduce yield losses are very important. Weeds have remained one of the major threats to farmers' quest for food self-sufficiency and environmental management especially in developing countries including Nigeria. As the population increases ahead of food supply, there is every need to boost food production through intensive and extensive cultivation; this can succeed only if weeds and other pests are controlled effectively. The study analysed weed management practices among small scale farmers in Makurdi Local Government Area of Benue State, Nigeria. A lot of researches have been conducted in the area of weeds management/control on specific crops using different practices, however, this study is on general weeds management practices.

Materials and Methods

Makurdi Local Government Area (LGA) is one of the 23 Local Government Areas in Benue State; it is bounded by Guma LGA to the north, Gwer LGA to the south, Gboko LGA to the east and blessed with a river called River Benue. The local Government Area is made up of ten council wards with a total population of 478, 0389 and occupies a landmass of 32,518 square kilometres according to the result of the 2006 population census of the Federal Republic of Nigeria [5]. Makurdi LGA is located between longitude 8° and 9° east, and latitude 7° and 8° north. It is within the southern guinea savannah belt of Nigeria with an annual rainfall of 1000-1500mm, and average humidity of 50-70%.

Agriculture is the mainstay of the economy. The predominant occupation of the people is farming. The Local Government Area and the entire State are endowed with fertile land that encourages the production of arable crops. Data for the study were obtained from a primary source. The primary data were obtained by administering a structured questionnaire. Purposive sampling was used to choose five out of 10 council wards from the Local Government Area based on the intensity of farmers, the council wards were Agan, Bar, Fiidi, Mbalagh and Modern market. Simple random sampling was used in selection of 24 farmers (respondents) from each of the council wards which amounted to a total of 120 respondents.

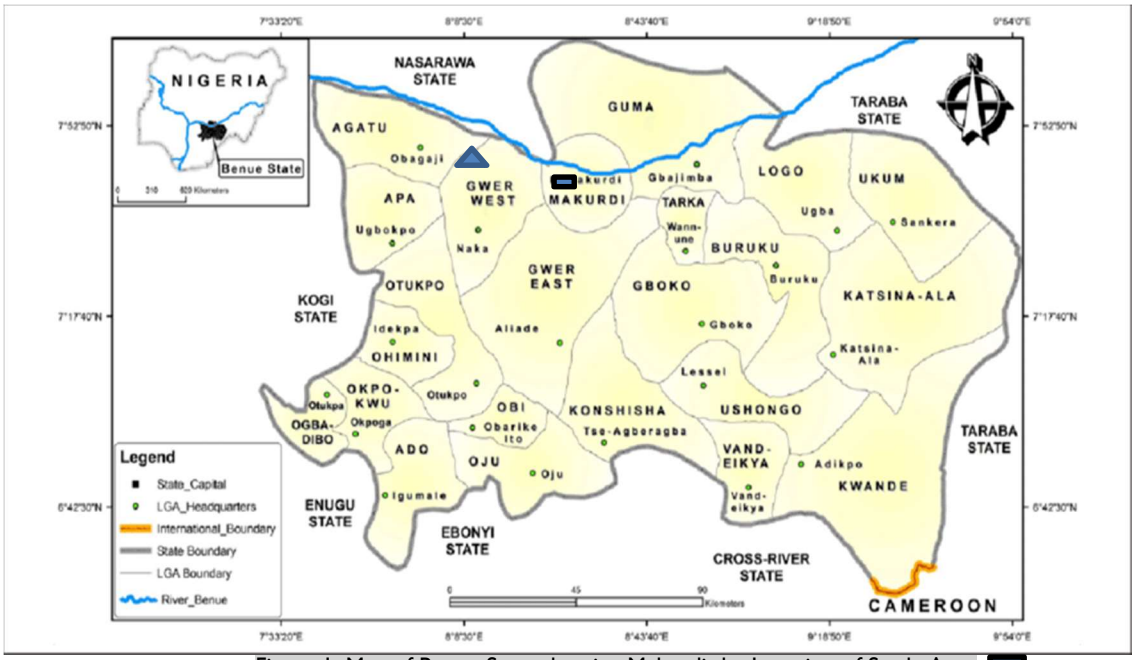

Figure 1: Map of Benue State showing Makurdi the Location of Study Area

Results and Discussion

Results in Table 1 show that the highest (63.3%) proportion of the respondents was within the age of 21-40 years with a mean age of 31.37 years. This reveals that the respondents were young people. Energetic young people are capable of carrying out farming operations especially in Nigeria where most of the farm operations are done manually. Manual labour requires many people to carry out a farm operation that could be done by a machine within a short period to be done in many hours. This confirms the findings of Kolo [6] that most farmers were in their active age which enabled them to perform strenuous farm activities actively and they constitute the majority of the farming population. The findings in Table 1 indicate that 50.0 % of the respondents were female, 50.0 % were males. Gender is a significant factor in agriculture because of its vital role in determining farmers' activities. In most parts of Northern Nigeria, males engage in agricultural activities that are labour intensive such as preparation of heaps and tilling the soil among others while females carry out less labour-intensive activities such as planting, winnowing, weeding etc. Besides, the purdah system (seclusion of women) limits women's active participation in agriculture activities especially in places dominated by Muslims. This finding contradicts that of [7] that women in the northern parts of Nigeria were not actively involved in farming activities of religious belief. The finding similarly contradicts that of [6] that more than 90 percent of Nigerian farmers were male and the weed control method largely practised is a manual method that is labour intensive**.** Finding on the marital status of the respondents, a reasonable (44.2%) proportion of the respondents were married. This is an indication that married people were more involved in farming in the study area. In traditional African culture, people of marriageable age who are not married are not respected in the traditional society. In farming, people marry for many reasons including to be respected as an adult in the traditional society, proclaim, have more hands to assist them on the farm among others.

Results on major occupation depict that 41.7% were engaged in farming. Farming is one of the most prevalent occupations and income-generating enterprises in the study area. Most people in rural areas are engaged in farming. Farming is an occupation that people engage in it with little or no resources depending on the level of a farmer provided they have a piece of land. People of different ages and statuses get involved in farming for various reasons including non-availability of white-collar jobs, generation of income and pleasure just to mention a few. The finding is similar to that of [8] that many people have taken to farming in the recent time either to supplement their income or to serve as their main source of income.

The result in Table 1 on education indicate that a reasonable (44.2%) proportion of the respondents had tertiary education. The acquisition of tertiary education by the respondents is as a result of the availability of tertiary educational institutions in the study area. Acquisition of tertiary level of education by the respondents is very important as education is the hallmark for improvement generally, it also helps in widening the horizon of the respondents to react to things in more mature ways and with high expectations that the respondents could easily understand and adopt improved techniques of weeds control. Farmers who are educated may be efficient in the control of weeds both manually and application of herbicides in the management of weeds in their farm, similarly, educated farmers may have the ability to read and understand instructions written on labels of herbicides for effective control of weeds. The finding is similar to that of [9] that education is an instrument for the social and economic improvement of mankind.

Results on household size show that most (58.3%) of the respondents had a household size of between 6 and 10 persons and the mean household size was 6 persons. This means that the respondents had a reasonable number of persons as members of the household. In most farming communities a large number of people in the household is very common as such people are use as family labour. In weeds management especially where manual weeding is practised, families with large household sizes make use of members of the household in controlling weeds. Some farmers in the rural area do not apply herbicides for the control of weeds because they do not have the resources to buy herbicides, therefore, use family members for control of weeds. Large household size in the traditional agriculture society influences the availability of family labour and facilitates increased total area of land cultivated which in turn increase output. The larger the household size the more available hands and larger the area of land cultivated, the higher the quantity of output which the entire family may benefit more.

Results on estimated annual income show that most (73.30%) of the respondents had estimated annual income of at least ₦50, 000.0 This could be attributed to the fact that the respondents were peasant farmers who use crude farm tools to carry out farming activities, they lack access to formal capital for lack of collateral, lack farm inputs like fertilizers and improved seeds and this has limited their production capacities. This supports the finding of [10] that the annual income of a farmer determines his ability to acquire inputs such as fertilizer, hired labour and use of improved technology which may bring about increase in output. The higher the annual income of a farmer, the larger the scale of agricultural production.

Results of farm size show that the majority (60.8%) had at least 2 hectares (ha); the mean farm size of the respondents was 2.8ha. This shows that the respondents had small farm holdings. This is an indication that the respondents were small scale farmers. Small scale farmers are faced with a lot of limitations for expansion of their farms including small farm size scattered at different locations, inadequate capital, inadequate farm inputs and lack of collateral for the acquisition of capital. The finding is similar to that of [7] that small-scale farmers dominate agricultural production in Nigeria.

Table 1: Socio-economic Characteristic of Respondents (n=120)

Variable	Frequency	Percentage	Mean
Age			
21 – 40	76	63.3	
Less or equal 20	24	20.0	31.37
41 – 60	17	14.2	
61 and above	3	2.5	
Sex			
Male	60	50.0	
Female	60	50.0	
Marital status			
Married	53	44.2	
Single	43	35.8	
Widower/Widowed	11	9.2	
Divorced	7	5.8	
Separated	6	5.0	
Occupation			
Farming	50	41.7	
Civil service	27	22.5	
Artisan	22	18.4	
Fishing	21	17.5	
Level of Education			
Tertiary education	53	44.2	
Secondary education	46	38.3	12.20
Primary education	15	12.5	
Non-formal education	6	5.0	
Household Size			
6 – 10	70	58.3	6.37
Less or equal 5	43	35.8	
11 – 15	7	5.8	
Farm Size			
Less or equal 2.0	73	60.8	
4.1	22	18.3	
2.1-3.0	4	3.3	
3.1 - 4.0	4	3.3	
Annual Income			
At least 50000	88	73.3	
50001 – 150000	22	18.3	63,457
150001 – 250000	1	.8	
250001 and above	9	7.5	

The result in Table 2 shows that the majority (65.8%) of the respondents' accessed information on weeds control using radio. Radio is widely used by farmers for accessing information on agricultural innovations. The use of radio by farmers may be attributed to the fact that radio signals are readily available even in remote areas where other means of disseminating information like television and telecommunication are not available. This has made many farmers especially those in the rural areas to listen to the radio frequently for very important information in all aspects of life. Farmers who listen to the radio frequently are aware of time-specific messages/programmes that are aired and they keep a date with it not missing such important programmes. The characteristics of radio including portability, signal availability and access to the dry battery just to mention a few has made itself attractive to many people for information dissemination and acquisition. The establishment of many private radio stations especially in Benue State has also made access to information through radio very easy. The finding is in tandem with that of [11] that the availability of many radio stations in Benue State has made it possible for farmers in the rural to get informed about agricultural innovations.

Table 2: Sources of Information on Weeds Control (n=120)

Source	Frequency	Percentage
Radio	79	65.8
Television	77	64.2
Neighbours	72	60.0
Other Farmers	62	51.7
Dealers Agro Chemicals	59	49.2
Extension Agents	56	46.7
Members of Cooperatives	55	45.8
Social Media	47	39.2
Traditional Rulers	20	16.7

* Multiple responses *

Results on weeds control in Table 3 reveal that the highest (94.2%) proportion of the respondents used the manual method. The findings reveal that most (94.2%) of the respondents controlled weeds using manual means. The use of manual means to control weeds is prevalent in the study area because most farmers are small-scale. Small scale farmers have limited resources to neither buy agrochemicals nor apply other means in controlling weeds on their farms. The income and the size of the farm of most farmers may have constraint them from applying other means of weeds control. The control of weeds using other means is accompanied by materials that some small scale farmers may find difficult to acquire. For instance, the control of weeds through chemical methods requires the buying of agrochemical and a sprayer which some farmers may not be able to afford. Based on safety matters, those farmers who make use of a manual method of controlling weeds are safe and their farm produce and farmland are not polluted by agrochemicals on one hand. On the other hand, farmers who made use of only manual means to control weeds may not produce on a scale equal to those that made use of other methods. Farmers with large family sizes make effective use of their family members in controlling weeds on their farms.

Table 3: Methods of Controlling Weeds used by Small scale Farmers (n=120)

Method	Frequency	Percentage
Manual weeds control	113	94.2
Chemical control	97	80.8
Cultural control	65	54.2
Preventive method	61	50.8
Biological control	57	47.5
Mechanical control	38	31.7
Integrated weed management	33	27.5
All of the above	12	10.0

*Multiple responses *

The results in Table 4 reveal mean scores of type of herbicides used, most ($\bar{x}$ = 2.16) of the respondents chemical decomposers. Chemical decomposers may be systemic or contact agrochemicals that if applied on herbs upon contact with the substance make it wither up. The application of chemical decomposers dries up the weed and allowed only the crop, space, air and nutrients among others to flourish. Most of the agrochemicals used in the rural areas in Nigeria are chemical decomposers because their actions are immediate, unlike growth inhibitors. Chemical decomposers are good for clearing of grasses especially in the savannah zone/grassland area where grasses grow to a very tall height making it difficult for farmers to clear the field for farming activities. The grasses are also, a problem when crops are grown as they compete for nutrients, space and air among others. This means farmers need agrochemicals especially herbicides for clearing grasses for effective crop and animal production and by extension improve productivity.

Mean scores on farmers' perception of weeds control using herbicides in Table 4 indicate that more money was spent ($\bar{x}$ = 2.93). Farmers' perceived control of weeds using herbicides as

spending a reasonable amount of money. In using herbicides or agrochemicals in controlling weeds a sprayer and agrochemical are involved, however, if the farmer who has both agrochemical and sprayer cannot apply it himself, someone may be hired to do the application all of these require some money. For small scale farmers, the use of money in carrying out several farm operations including buying of agrochemicals, repairing of a sprayer if spoiled and hiring a labourer for spraying of herbicides for control of weeds on the farm is considered as spending of money in controlling weeds.

Small scale farmers especially those who have large household sizes may make use of their family members in controlling weeds in this manner, the acquisition of agrochemicals and other tools for its application at any cost may be viewed as costly by those farmers who make use of members of the family on one hand, on the other hand, farmers who have a small household size with a reasonable number of hectares cultivated may certainly need agrochemicals for controlling of weeds. The buying of agrochemicals and other tools for control of weeds has made small scale farmers incur more costs than if family labour was used for the same purpose. Similarly, reduce the quality of crops ($\bar{x}$=2.78). In the actual sense, the application of agrochemicals negatively affects the ecosystem in several ways including the killing of beneficial insects, direct harmful effects on the person applying the chemical and the crop among others. The application of agrochemicals directly reduces the quality of crop (farm produce) by adding a certain amount of toxic materials contained in the chemical into the crop. The gradual accumulation of these agrochemicals in the human system for a long period may result to an unknown sickness.

Table 4: Farmers' Perception of Weeds Control using Herbicides (n=120)

Perception of farmers	Mean	Std. Deviation
More money spent on weed control	2.93	.976
Reduce quality of crop	2.78	1.022
Cannot absolutely remove weeds	2.63	.935
Stressful farm operation	2.58	.993
Difficult farm operation	2.55	1.076
May take many Months	2.54	1.060
Time-consuming	2.52	1.037
Involvement in other activities	2.46	1.060
Labour intensive	2.42	.949
High cost	2.28	1.004
Reduce crop quantity	2.25	1.015
Require thorough supervision	2.19	.938
Inadequate labour	2.18	1.085
Labourers non-commitment	2.17	1.010
Timeless actives	2.15	1.066
Drudgery associated with control methods	2.11	1.027
Affect crop quality	2.08	1.026
Time Consuming	1.93	1.083

Cut-off mean = 2.50; ≤ 2.50 = High; > 2.00 = Low

Results in Table 5 depict binary logistic regression analysis of the effects of socio-economic characteristics of the respondents on weeds control. The R^2 of the regression was 0.9714, indicating that the independent variable in regression accounted for 97.14% of the variations in the dependent variable at 5%. The overall result was significant at 5% level of probability (prob. > chi^2 = 0.9714) indicating that the socio-economic characteristics of the respondents had a significant effect on weeds control.

The coefficient of educational qualification had a negative (-1.472) and a significant effect at 5 %. This means that increase in the level of education will decrease the use of agrochemicals for the control of weeds. The implication is that the application of agrochemicals for control of weeds has both positive and negative effects and people who are educated might have known the dangers associated with the use of agrochemicals for controlling weeds, hence their reluctance to make use of it. The negative effects of agrochemicals include the killing of useful insects, consumption of accumulation quantities of agrochemicals in the farm produce and there are crops like yam which at a certain age the application of agrochemicals may not be feasible.

The coefficient of household size had a positive (0.421) and significant effect at 5%. This means an increase in household size will increase the application of agrochemicals for the control of weeds. This is not in line with our prior expectation that an increase in household size will lead to a decrease in the use of agrochemicals for the control of weeds. Farming operations are tedious and it is not everybody who has the energy and the time to get involved physically in carrying out weeds control activities, however, for farmers who cultivates reasonable farmland, the control of weeds using agrochemicals is recommended as the use of other ways of controlling weeds may not be known to many local farmers and therefore cannot be applied.

The coefficient of estimated annual income had a positive (0.000) and significant effect at 5%. This is in line with our prior expectation that an increase in the annual income of the farmers is likely to increase the use of agrochemicals for weeds control. One thing with peasant farmers is that improvement in annual income is directly proportional to the portions of farmland cultivated. It implies that increment in annual income comes as a result of the cultivation of many portions and the use of

agrochemicals for control of weeds is proper. High-income earners have the financial capacity to buy agrochemicals and use them for control of weeds. This confirms the finding of [12] that farmers with a high capital base can easily purchase and use improved technology and enjoy the advantage of such improved technology.

The coefficient of farm size had positive (0.323) and significant at 5%. The implication is that increase in farm size can lead to an increase in the use of agrochemicals for weeds control. Farmers with large farm sizes tend to use herbicides for controlling weeds probably because the chemical weed control method is less labour demanding, require few man-days and is not time-consuming like the manual method. Besides, such farmers may have a high capital base. This supports the finding of [13] that large-scale farmers usually have a high capital base and therefore, can easily purchase and use improved farm inputs and practices.

Table 5: Binary Logistic Regression Analysis of Effects of Socio-economic Characteristics of the Respondents on Weeds Control

Variable	Coef.	Std. Err.	Wald	P>|z|	[95% Conf.]
Sex	.506	.749	.456	.500	1.658
Age	.057	.054	1.106	.293	1.058
Marital status	-1.054	.944	1.247	.264	.348
Educational level	-1.472	.746	3.897	.048*	.229
Household size	.421	.187	5.066	.024**	1.524
Estimated ann. Income	.000	.000	5.895	.015**	1.000
Farm size	.323	.272	1.411	.235	1.382
Occupation	-.582	.881	.437	.509	.559
Constant	-.244	1.942	.016	.900	.784
X^2 = 97.14					
R^2 = 0.9714					

**, * = Significant at 1% and 5% level of probability

Conclusion

Weeds are available on planet earth from time immemorial and have negative effects of crops production; weeds can survive in the soil without germination for many decades. Weed control is an important component of crops protection and production. Weeds control is done in such a way that the crop sustains its production potential without being damaged by the weeds. Weed management is carried out in many ways including biological, cultural, mechanical, and agrochemicals. The application of herbicides in recent times has dominated other control practices, however, it has both positive and negative effects. There is no best way of controlling weeds, however, weeds are managed based on the type of farm practice adopted by the farmer and the most effective method of managing weeds is usually achieved through a combination of different methods. It is recommended that agricultural extension workers should enlighten farmers on different methods of control, information on the use of agrochemicals and complexity of weeds control practices and government and Non-governmental organizations should make available specialized equipment for the application of agrochemicals.

Declaration of conflicting interests

The authors declared no potential conflicts of interest.

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