



SUGARCANE PRODUCTION AMONG A2 FARMERS IN THE HIPPO VALLEY ESTATES AND THE QUEST FOR SUSTAINABLE DEVELOPMENT, ZIMBABWE

Aaron Dasva¹,

Jemitias Mapira²ⁱ,

Nyashadzashe Ngaza³

¹BSc Honours Student,

Geography & Environmental Science,

Great Zimbabwe University, Zimbabwe

²Professor in Geography & Environmental Science,

Great Zimbabwe University, Zimbabwe

³Lecturer in Chemistry,

Great Zimbabwe University, Zimbabwe

Abstract:

Sugarcane production requires equipment, significant amounts of agro-chemicals including fertilisers, pesticides, herbicides irrigation and heavy machinery that can lead to environmental degradation (Soil Science Society of America, 1997). The expansion of plantation sugarcane farming among A2 farmers in the Hippo Valley estates without proper institutional mechanisms presents a myriad of problems ecologically, socially and economically. Being a semi-arid area, any extensive extractive ventures would exacerbate competition for already scarce land and water resources. Most of the small scale and some of the commercial farmers are not adequately equipped with sustainable ways of sugarcane farming hence, threatening the country's sugar industry's competitiveness in relation to other world class producers and industries. Expansion of sugarcane plantations means that natural resources such as forests, grassland and shrubs, most of which double up as pastureland risk being encroached into. That none of these natural resources is under legal protection increases the risk of them being mismanaged contributing further to environmental degradation through soil erosion, loss of species, exhaustion of nutrients and interfering with other ecosystem services. Researches which have been conducted show that the principle of sustainable agriculture is broadly accepted but the systematic consideration in practical farm management is still very limited in most tropical sugarcane plantations. This study seeks to bring light on the sustainable ways of sugarcane production among A2 farmers in the Hippo Valley estates and to assess the knowledge of farmers on sustainable sugarcane farming and challenges faced by farmers in trying to implement sustainable

ⁱ Correspondence: email jmapira2000@gmail.com

sugarcane production. The study was conducted between January and May, 2018 and it shows the challenges confronting Hippo Valley Estates in its quest for sustainable development.

Keywords: A2 Farmers, Challenges, Sustainable development, Hippo Valley, Zimbabwe

1. Introduction

The government of Zimbabwe decided to launch the fast track land reform programme around the year 2000 (Cook, 2003). Nationalists and war veterans led the programme and the phase seemed to be unorganised. However, the government later on involved the Ministry of Lands in the programme to give the new farmers offer letters. Two main models were introduced that is the A1 and A2 farmer models, with A2 farming being for commercial purposes while A1 was subsistence. This programme affected the main activities in sugar estates of Hippo Valley, Triangle and Mkwesine as well as surrounding conservancies. The new out grower farmers on land reform plots came from a mix of backgrounds, including teachers, extension workers, estate employees, as well as well-connected politicians and security service personnel. Not everyone is doing well, and some recent arrivals have taken time to establish, organizing inputs, hiring and managing labour, dealing with cash flow, and negotiating with the company is always a challenge.

Sugar cane is a subtropical and tropical crop which needs lots of sun provided that its roots are not water-logged (Zimbabwe Sugar Association, 1982). According to a research carried out by Sserunkuma and Kiniera (2006) 127 countries worldwide produce sugar and 30% of it is traded internationally while the rest is consumed locally. In Zimbabwe, it takes 12-14 months to reach maturity although the period varies widely around the world. The Low-veldt has been identified as one of the best places to produce sugar at competitive costs in the world. The climate is ideal for sugar cane.

Sugar cane is a high labour intensive crop especially for weeding and harvesting and it is an important user of agro-chemicals like fertilizers and herbicides. Harvesting is done by chopping down the stems and leaving the roots to re-grow (Base cutting). The crop is essential in providing the nation with sweeteners for all industries, earning the country foreign exchange, generating electricity, making molasses for cattle feed or for distillation and ethanol production. The number of by-products from sugar cane outweighs other commercial crops.

2. Research Methodology

This section discusses on the various methods, which were employed in the collection, analysis, presentation and interpretation of data. The research was based on observable realities of outcomes from natural and man induced activities rather than perceptive or

speculations without evidence. The study examined A2 farmers with reference to sugarcane production done in the Hippo Valley Estates, in order to determine pointer information regarding sustainable sugarcane farming. The aim of the study was to come up with sustainable ways of sugarcane production among A2 farmers in the Hippo Valley Estates. The research design was a cross sectional survey which used observations, structured interviews and open ended questionnaires for the collection of primary data from principal actors in sugarcane production in the Hippo Valley estate. The observations, questionnaire and interviews addressed issues of sugarcane production thus giving insight information which was used to validate the reliability of the study.

A mixed research design was employed, combining quantitative and qualitative research methods. Mixed research design provided a broader view of issues under study compared to single method approaches and removed the bias associated with single methods. Using mixed research design, the study was able to depend on large quantities of data through interviews, observations and questionnaires, and analysed opinions, and attitudes, which are abstract concepts requiring direct inquiry. Since this study examined the knowledge and behaviour (in this case, the activities) of individuals within a sugarcane production locality, imploring quantitative analysis became suitable as it determined numeric measures of observations. Studying the human activities became necessary in establishing facts regarding the sustainability of the strategies used in sugarcane production, knowledge and challenges on sustainable agriculture as a custodian of the natural environment, in relation to other factors such as socio-economic characteristics. It also explored perceptions from which implied extrapolations could be established regarding issues of concern about sugarcane production.

Advantages of a mixed research design were firstly, through interviews and questionnaires; it gave an accurate and detailed picture of current trends in the issues under investigation. Secondly, it enabled the study to capture the opinions and attitudes of individuals or community being interviewed or responding to questionnaires. Thirdly, it linked theoretical facts in literature with reality in the field of study. Also, it enabled the researcher to collect large quantities of data through interviews, observations and questionnaires. The responses gathered through the survey addressed the research questions by providing numeric information on local community's role and perception regarding forest conservation and management for sustainability. Conducted between January and May 2018 its findings were based on 70 respondents.

3. The Quest for Sustainable Development

Sustainability is a concept which claims that that growth and development must take place, and be maintained over time, within the limits set by natural ecosystems. Sustainable agriculture is not a return to pre-industrial methods but a combination of traditional and modern techniques. Sustainability is to leave future generations as

many, if not more, opportunities as we have had ourselves. Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1991). Agricultural systems are regarded to be sustainable if they are economically viable, environmentally safe and socially fair. According to Boiffin (2004), sustainability could involve two approaches. The first approach is the protection of productive resources, for example, maintaining soil fertility, protecting groundwater, developing renewable energies, and finding solutions to adapt farming systems to climate change. The second approach is to consider that agriculture also has to contribute to the sustainability of large territories and social communities. Therefore, because sugarcane production has such significant effects on social development, industry players in South Africa and Zimbabwe and other regional countries have focused on its sustainability.

High input intensive agriculture is perceived as detrimental to the biophysical environment while, concerns are raised about the viability of alternative farming system such as organic farming. In view of this, the present study was focussed on sugarcane farming in Hippo Valley estates. The excessive use of water through flood method of irrigation combined with higher doses of agro- chemicals is observed to be resulting in enhanced rates of degradation of land resources. This is reflected in the decreased sugarcane productivity in recent years in the A2 farms surrounded Hippo Valley estates (Manzungu and Pieter van der Zaag, 2006). A study by the World Bank (2003) has indicated that the demand for water for sugarcane irrigation has led to an increase in the number of wells in the Jalgaon and few other districts of India.

The excessive sucking of water from these wells has led to declining of the water table by more than 4 metres over the past decade in several places in the districts of Jalgaon, Ahmednagar, and Aurangabad. This has significantly enhanced the number of wells going dry over the years. The increased competition to bring more area under irrigation has exerted immense pressure on limited water resources of the state and has jeopardized its sustainability (World Bank, 2003). The present study was conducted to assess the performance of plantation sugar cane farming among A2 farmers with specific focus on farming strategies, knowledge of farmers and challenges faced by farmers towards sustainable agriculture. An attempt has also been made to critically examine the intensive sugarcane production with respect to important sustainability indicators such as conservation of soil, water, power and farmers' economic well-being and livelihood security.

4. The Study Area

Hippo valley estates Section 1 (Subdivision 1-25) Farm 56 (Subdivision 1-35) lies in the south-eastern low veldt of Zimbabwe and is located adjacent to Buffalo range Airport about 10 km south-west of Chiredzi town and 210 km east of Masvingo town. The area receives less than 450 mm per annum rainfall through erratic showers, and is therefore subject to periodic droughts (Vincent and Thomas, 1962). Hence, shortage of water has

always been regarded as the most limiting factor to crop production in this region and the local land-use systems are in accordance with it. It was only after successful experimentation with sugar cane cultivation that the region started to receive attention to exploit this potential. Its geology is good with reddish sodic soils and is rocky (Fig 1).

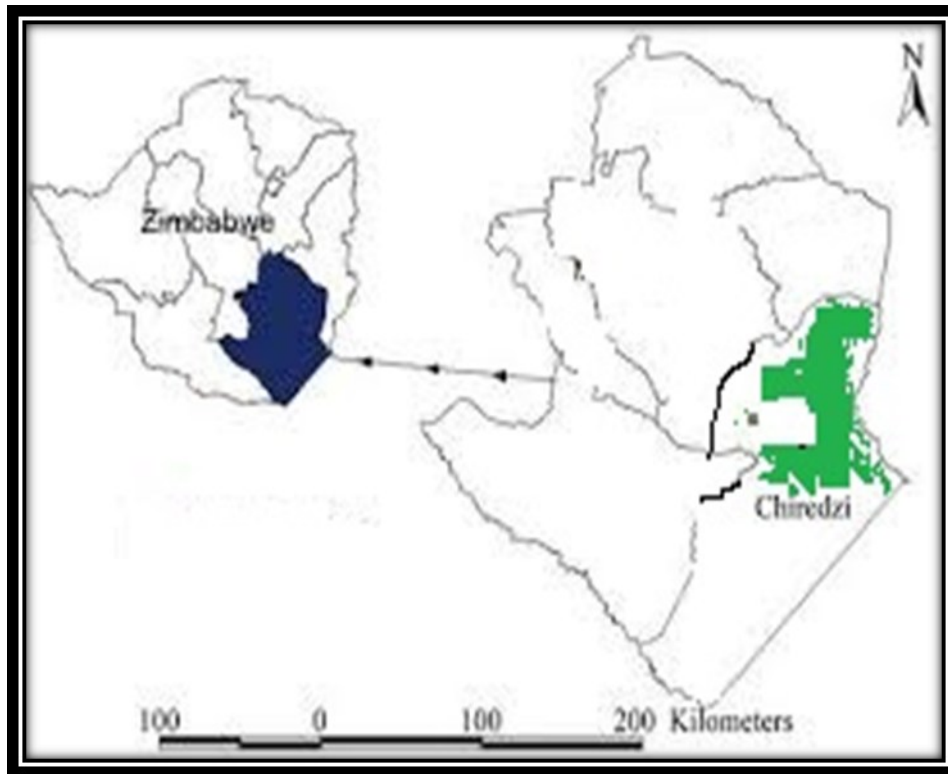


Figure 1: Map of Hippo valley estates

5. Sugarcane Production in Zimbabwe

Sugar cane in Zimbabwe is grown under full irrigation mainly in the low veldt area of Triangle, Hippo valley and Chisumbanje which are located in the South-East Low veldt of the country. About 80% of Zimbabwe's sugar cane crop is produced by two large estates, namely, the Triangle Sugar Estate and Hippo Valley Estate. South African sugar company, Tongaat-Hulett owns 100% of the Triangle Sugar Estate and about 50.3% of the Hippo Valley Estate. Private farmers who comprise large scale farmers and newly resettled farmers together produce about 20% of the country's sugar cane crop. There are only two sugar mills in Zimbabwe, the Hippo Valley Estates Ltd and Triangle Estates Ltd, with a combined sugar production capacity of about 640,000 MT and installed milling capacity of 4.8 million tons of sugar cane per annum. Currently, Zimbabwe has two sugar refineries, namely, the Triangle Sugar Refinery which is a back end refinery and an independent sugar refinery called Star Africa Sugar Refinery Ltd. Water for irrigation is supplied from Mutirikwi, Tokwe-Mukosi, Manjirenji, and Siya dams.

6. The Roles of Stakeholders in Sugarcane Production

71% of the out growers relied on credits given by the Plantation estate and an Anglo-American bank to purchase inputs under the Successful Rural Sugar Cane Farming Community Project (Susco) (AIAS, 2014). Credit arrangements with the mill, operating through a farm-based billing system, also exist. Investment by the company in rehabilitation of the sugar areas through the Sustainable Rural Sugarcane Farming Community (Susco) has encouraged extensive replanting of cane, and provided cheap credit. Eighty-seven per cent of sample farmers have been beneficiaries of the estate-led rehabilitation plan SusCo that is in part supported by the company and the BancABC, and in part by the EU through the Canelands Trust. Due to the 'restrictive measures' that were applied to the government of Zimbabwe by the EU, financing of sugar rehabilitation came through a convoluted route. European finance was not allowed to focus on so-called 'contested areas' (all 'fast-track' land reform areas), and was notionally at least targeted elsewhere such as Chipiwa and Pezulu or infrastructural development such as the Mkwesine railway line, dam rehabilitation, or training and environmental conservation.

Tongaat Hullet Zimbabwe is more concerned with overall production, and has invested in the SusCo plan that offers preferential credit and technical support to all out growers, including the A2 farmers, with the aim of increases of land. Around US\$40 million of preferential credit has been offered through the BancABC to around 670 of 872 out growers. In addition, there are plans to increase land under sugar so that the mills run at full capacity, and 100,000 hectares of expansion is targeted, to including out-growers. The Cane lands trust organizational arrangement involves all farmers unions including representatives from out growers and the state participated to come up with better strategies towards sugarcane production in the low veldt part of Zimbabwe. The company also helps the out growers with chains, tractors and trains to ferry sugarcane during harvesting.

7. The Search for Sustainable Sugarcane Production

The negative consequences of higher use of chemical fertilisers and pesticides are reduction in crop productivity and deterioration in the quality of natural resources. Pretty and Ball (2001) have pointed out that the environment will be effected by the carbon emission of the agricultural system through: direct use of fossil fuel in farm operations, indirect use of embodied energy for producing agricultural inputs and loss of soil organic matter during cultivation of soils. Out growers also must pay for irrigation water, transport and other support. Sugar production faced challenges and a decline by 20% of the 1990s level in 2006, followed by a further 50% in the 2007/8 season was witnessed. Out growers fought with estate owners over transport and input costs as well as milling charges. (Moyo and Chambati, 2013). The period involved in conversion from conventional farming to organic farming is the most difficult one. This

is mainly because of lack of knowledge about the principles of organic farming. Again the shift to organic farming brings in several significant changes in agricultural practices, normally it takes at least three years to complete the conversion successfully (World Bank, 2003).

Conversion of conventional to organic farming decrease sugarcane yield with the beginning of the conversion period lead to the reduction in farmer's income during the conversion period. The same applies to the non-cooperation from neighbouring farmers who practice conventional agriculture under command agriculture for example in Zimbabwe (Sharma, 2005). Zimbabwe's economic crisis in the 2000s, which resulted in drops in yield due to lack of fertilizer application, and other agro-chemicals failure to replant. In addition, A2 farmers have little or no expertise to service the irrigation equipment, including center pivots, pumps and storage tanks which may eventually affect irrigation scheduling and water resource allocation in the low veldt Sugar industry (Moyo and Chambati, 2013). The organic farming is an important emerging area in an agricultural sector of Maharashtra. However, it may be pointed out that the state level data on various aspects of organic farming is very inadequate. Therefore, it would be useful to develop standard data base on organic farming for its assessment and for setting priorities and policy interventions aimed at advancing organic farming in general and OS farming in particular in Maharashtra (Kumar, 1990).

The growing of crops by following organic practices in conformity with certain standards is a process beginning from land preparation to finally reaching the produce in the hands of consumers. Therefore, it is essential to impart scientific training not only to farmers but also to other stakeholders to make them knowledgeable, skilled and efficient in production, processing and marketing of organic products (Singh, 2000). The organic farming does have social benefits in terms of resources and benefits to human health and environment. Therefore, it is suggested that the social benefits of OS farming maybe properly measured and quantified to get an idea about the extent of subsidy that could be justified for promotion of OS farming in the state. In this context, the state Government may form a high level committee comprising of representative of all the stakeholders to help identify the high potential regions, as well as, the high potential crops and to formulate and prioritise the policies and strategies in order to promote the organic farming to reap the benefits of a rapidly growing national and international market for organic products (World Bank, 2003).

8. The Concept of Sustainable Agriculture

Sugarcane production has the characteristics that are associated with significant economic, environmental and social outcomes such the crop's water requirement especially in Sub Saharan Africa. Large scale direct and indirect land use changes which impact the water, energy and nutrient cycles have been associated with commercial sugarcane production Sugarcane cultivation can also be criticised for impacting the environment through deforestation and pollution for example air pollution caused by

burning prior to harvesting of sugarcane fields (Manzungu, 2006). Sustainable agriculture is the concept that growth and development must take place and be maintained over time within limits set by natural ecosystems. Sustainability rest on the principle that we must meet the needs of the present without compromising the ability of the future generations to meet their own needs (World Bank, 2004).

Agricultural system are regarded to be sustainable if they are economically viable, environmental safe and socially safe. According to Boiffin (2004), such could involve two approaches .The first approach being the protection of the productive resource for example maintaining soil fertility, protecting ground water developing renewable energies and finding solutions to adapt farming systems to climate change. The second approach is to consider that agriculture has also to contribute to the sustainability of large territories and social community. Therefore, because sugarcane production has such significant effects on the social developments all industry players in the globe have focused on its sustainability.

8.1 Farming methods practised by A2 Sugarcane farmers in Hippo Valley estates

Based on the respondents farming strategies of the 70 respondents surveyed, 74, 2% agreed that, they are practising intensive sugarcane farming and 25, 8% are operating transitional between sustainable organic sugarcane farming an intensive sugarcane farming. The highest proportion of the sampled population depends on agrochemicals such as inorganic fertilisers and biocides to produce sugarcane. The remaining proportion of the total sampled population are using both traditional farming methods such as weeding, rouging, biological pest and diseases control as well as chemical fertilisers to produce high yields. Based on the argument given by farmers that, the cropping system exist in the farm unit requires large amounts of agrochemicals such as chemical fertilisers and biocides for best yields.

The farming system they operate on cannot allow them to totally shift to sustainable sugarcane production due to limited land resource. The organic farming system best suit to farmers who operate on a number of enterprises which are often spatially separated. For example, there is often more scope for sustainable soil management in home gardens or in plots close to homestead than on the distant where sugarcane is grown. Farmers highlighted that, chemical fertilisers provide concentrated nutrients for the plant even though they are effective so a short period of time. Chemical fertilisers are readily available in shops at affordable prices and know quantities of nutrients as compared to manure which is bulk and expensive to transport.

9. Management Practices Done by A2 Sugarcane Farmers

The results from sampled data show that, 74, 2% of A2 farmers were using biocides and artificial fertilisers to produce sugarcane. The farmers rely much on agrochemicals and sophisticated intensive farming techniques to manage crop growth. The respondents

high-lighted that, organic pest, diseases and weeds control were ineffective and therefore not viable alternatives to biocides. They indicated that, organic sugarcane production is specifically suitable depending on a number of factors which include agro climatic factors, labour availability of inputs and land size and ownership. The respondents further explained that, they were occupied the land under lease condition so they have no choice of using manure because avoid to invest for somebody's benefit.

However ,25,8% of the total sample use mixture of sustainable farming and intensive farming techniques but they have generally not used chemicals to the extent of directly causing harm and the medium and long term effects of using agrochemicals have not been explained to them. The farmers indicated that, they use sustainable methods to control pests, diseases and weeds from sugarcane. They practised base cutting, weeding, variety selection, rouging and break cropping to manage pests, weeds and diseases for best yields. Some of the respondents agreed that, they are using organic manure for soil nutrients management but unavailability of organic farming inputs is a prime constrain which hinder total adoption of the organic farming technique (Fig 2).

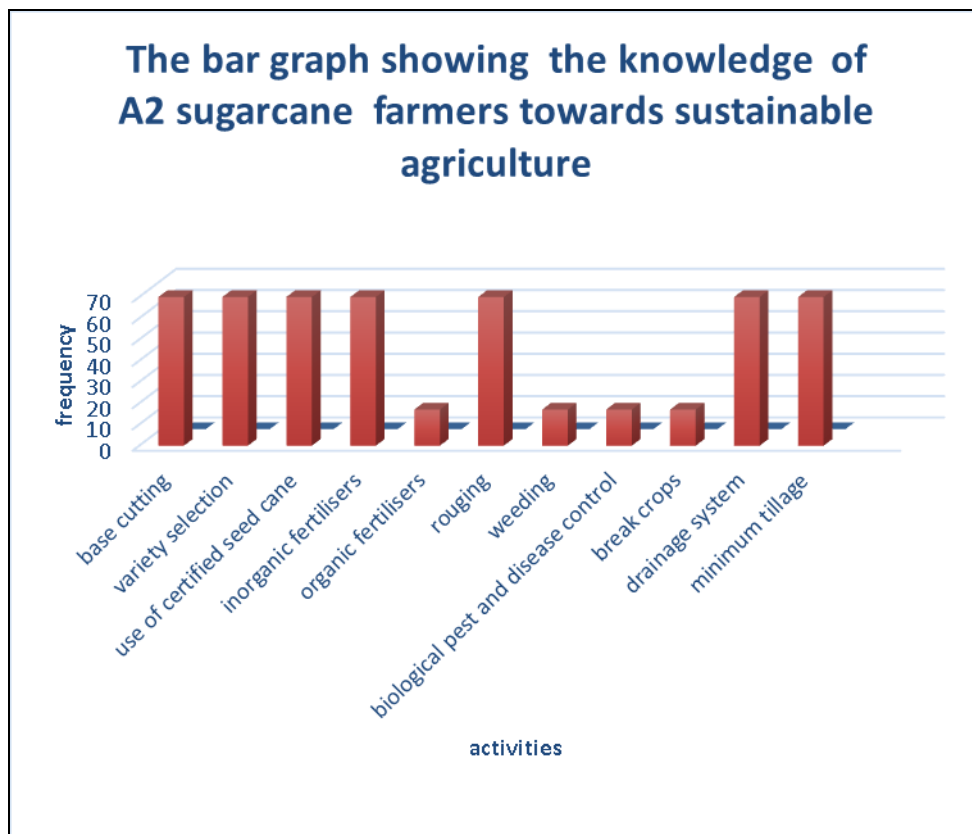


Figure 2: Knowledge of the farmers

9.1 Irrigation methods

Sugarcane has a deep fibrous root system with roots extending to a depth of 24 cm in well drained loam soils (Gandhi, 1971).the frequency and depth of irrigation varies from place to place depending on the season of the year in summer months where the

evaporative demand of the climate is high frequent irrigation becomes necessary to avoid plant stress in this case eight dams were put in place to supply irrigation water to 70 farms and water pumps available to pump water from the main canal to dams, centre pivots and drip irrigation infrastructure. From the observations made by the researcher almost 93% of the farmers used flood, 6% used overhead and 1% use drip irrigation systems.

9.2 Overhead irrigation system

The results from the sampled population shows that, only 6% of the sugarcane out growers were using overhead irrigation system. The farmers explained that, water use is economised as losses by deep percolation can be totally avoided. The soil water content can be easily maintained at a favourable tension for optimum plant growth. However, this type of irrigation system is prone to spray evaporation and drift losses assumed to be at 8% of the net irrigation water applied in the soil (Clowes, 2006). The centre pivots method is subjected to evaporation especially on bare soils in the early season of sugarcane cropping just after harvesting. Relative frequent and small irrigation water application are characteristics of overhead irrigation system because large water application often result in excessive runoff due to high application rates at the out towers. The excess water will run off carrying nutrients into water sources and promote the growth of water weeds and ultimately eutrophication.

9.3 Flood irrigation system

Furrow irrigation refers to irrigating land by constructing furrows between rows of crops ultimately after every two rows. It wets the soil surface partly and water in furrow moves laterally by capillary action to the un wetted areas below the ridge and downward to wet the root zone soil (Clowes 2006). From the observations made by the researcher 93% of the entire sample population were using flood irrigation method it is the most popular irrigation method used by sugarcane farmers in HVE. The amount of water applied per irrigation application is equal to 60% of the total available moisture (TAM) (Clowes, 2006).

However, such performance standards may be very difficult and or costly to achieve depending on a particular field topography and soil characteristics. Due to financial constraints, most farmers are failing to prepare to support this type of irrigation and the result is over irrigation. Over irrigation may lead to impaired soil aeration, toxicity of nutrients, loss of soil fertility and other irrigation induced effects (Majuinder, 2000). In drier areas soil tend to become saltier with over irrigation and reduce its ability to hold air, water and nutrients all important for plant growth. The researcher observed that, is health at the upper end of the field where irrigation water is applied and poor growth at the lower end due to accumulation of salts at the surface of the soil.

9.4 Subsurface irrigation system

The results from the sampled population indicated that, 1% of the farmers have a drip irrigation infrastructure. This type of irrigation system minimizes evaporation of water from the soil surface and no spray evaporation loss is assumed to be minimum for drip irrigation (Fig 3). Drip irrigation method maintains the physical conditions of the soil-water-air balance around the plant base (Clowes, 2006).

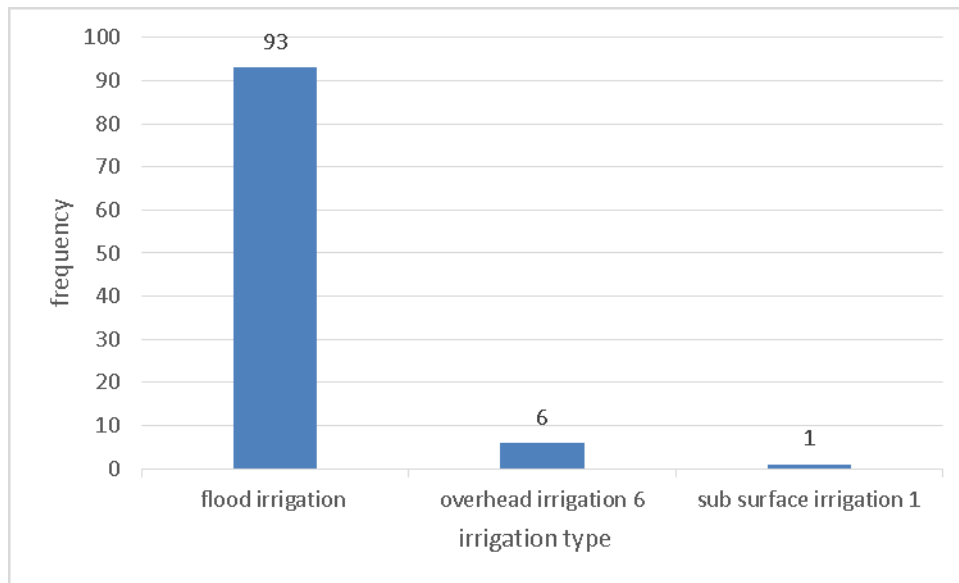


Figure 3: Irrigation methods used by A2 sugarcane farmers

9.4 The knowledge of A2 farmers towards sustainable sugarcane production

The results from the sampled population show that, 70 out of 70 farmers acknowledged that, there are practising base cutting, variety selection, use of certified seed cane, rouging, weeding drainage systems, and minimum tillage in producing sugarcane. The farmers are unintentionally following the habits and customs of those private farmers around them and before them such as Hippo valley estates, whether they under it or not and they are likely to underestimate their innate ability as farmers. However, 17 out of 70 farmers are trying to adopt sustainable organic sugarcane farming techniques by practising biological diseases, weeds and pest control and traditional methods such as rouging and weeding instead of using biocides.

Table 1: The farmer's knowledge towards sustainable sugarcane farming

Activity	Respondents number (N=70)	Percentage
Base cutting	70	100
Variety selection	70	100
Organic fertilisers	17	25,8
Rouging	70	100
Weeding	17	25,8
Biological pest and diseases control	17	25,8
Break cropping	17	25,8
Drainage systems	70	100

Minimum tillage	70	100
Use of certified seed cane	70	100
Use of trash to mulch	17	25,8
Manure	17	25,8

9.5 Challenges faced by A2 farmers towards sustainable sugarcane production

The research also looked at the challenges which affect farmers from adopting sustainable sugarcane production. The lack of government support is the main challenge which affect the adoption of organic farming techniques. The responses from farmers show that, there is lack of government support which makes it difficult for farmers to shift from intensive to sustainable organic farming techniques. The government efforts to propagate organic farming techniques is limited on cash crops such as sugarcane as compared to maize .one of the respondents states that, the lack of government support has led to inadequate scientific research programmes on sustainable sugarcane farming techniques.as discussed in chapter two of this research ,one of the reason why India estate sugarcane plantations were successfully adopted the organic sugarcane farming techniques was that, the government embraced the new ideology of sustainable sugarcane farming with supportive programmes. The government of India has organised the markets for organic produce and incentivised the farmers who adopted the organic farming techniques by providing them with adequate water for irrigation and enough organic inputs in and around their farms.

Political constraints and bad macroeconomic environment of Zimbabwe affect the adoption of organic farming techniques. The political environment of Zimbabwe is not conducive to accommodate widespread adoption of sustainable sugarcane farming techniques both at national and international level. There is lack of awareness by policy makers on the net benefits of organic farming techniques which hinder its adoption.

Land size and ownership is also a challenge which hinders adoption of organic farming techniques in Hippo valley estates. The results from the sampled population show that, the farm units are too small to accommodate a variety of enterprises such animal keeping which may provide manure to the farms. The ownership and tenure rights were reserved to the government of Zimbabwe. This can directly or indirectly influence the current and potential development of organic sugarcane farming techniques. The responses from almost every individual of the sampled population indicated that, they are willing to adopt sustainable sugarcane farming techniques which requires investment in time and or money. The farmers indicated that, they have no choice of using organic manure or chemical fertilizers, rented land tends to receive less manure and more fertilizers than owned.

Unavailability of organic inputs hinders the adoption of organic farming techniques in Hippo Valley. The respondents acknowledged that, organic inputs were not readily available at the market at low prices as compared to agrochemicals and fertilizers. There are economic costs associated with shifting from intensive to organic farming techniques which the farmers avoid since; there is no experimental evidence of the cost benefit ratio of organic sugarcane farming in Zimbabwe.

The respondents highlighted that, there is high start-up cost associated with organic sugarcane farming methods. There is usually a fall in productivity during the transition period until fertility, structure and microbial activity of the soil have been restored and enhanced through organic matter inputs. It may not be feasible for a resource poor A2 farmer to adopt organic sugarcane farming unless short term benefits can be realized. More so farmers expressed fear of changing to organic farming methods for fear of reduced yields and lack of immediate results as reasons for not using organic inputs. The respondents mentioned that, organic manure especially animal manure is associated with problems of increased pests, diseases and weeds.

9.6 Possible solutions to the challenges

The government of Zimbabwe should provide agricultural subsidies as infrastructure to support the adoption of organic farming system. Lohr and Solomonson (2000) found that farmers requiring subsidies tend to manage large and diversified farms and are more concerned with about organic inspection, quality and adequacy of technical advice than are conventional farmers. The United States of America (USA) provide subsidies for organic farming dividing them into three groups which are: subsidies for farms during the period of conversion to organic farming system, subsidies for organic intensification and continuous subsidy schemes for organic farming system. These types of subsidies consist of various types of support for which include those encouraging a reduction in nitrogen fertilizer application.

The government support for organic agriculture is implemented by means of subsidies paid directly to those farmers who adopt or maintain environmentally friendly practices for a period of at least five years. To maintain this support participating farmer must develop production methods that do not involve the application of chemicals such as fertilizers and biocides. Particular focus of the government has been on reducing greenhouse gases (GHGs). Organic farming may contribute to reducing GHGs by promoting the use of reduced amounts of energy which could lessen the negative impacts on the environment relative to intensive farming practices.

Collaborations with private entities is another solution to the challenges hindering adoption of sustainable agriculture. In the USA, most subsidies aim to promote collaboration with private entities. The federal government of USA has provided financial to support farmers who transition from conventional to organic production methods (Best, 2008). Best (2008) documents that, these direct organic transition payments to farmers increased significantly since 1990s and acted as incentives to move towards increasing sustainable agriculture practices. The private agencies also provide financial support for encouraging farmers to modify their production system the government of Zimbabwe should work together with private and multinational Non-Governmental organization for financial support towards adoption of sustainable farming practices.

Market incentives are also a solution to the challenges bar adoption of organic farming practices. The number of farm land under organic management has grown steadily during the last decades in USA as farmers strive to meet the increasing consumer demands for organic food products in both local and international markets, certified organic crop acreage nearly tripled between 2002 and 2014, from 1, 3 to 3, 7 million acres. However, while organic farming continues to grow at an impressive rate worldwide demand for organic food and beverages is far out pacing supply (Neshiem, 2015). The government of Zimbabwe should create markets for organically produced sugar in order to motivate farmers to adopt sustainable sugarcane farming.

10. Conclusions

Opinions about organic farming were divergent especially among the experts, disagreements about the profitability and yield increase in organic farming are acute, but there is strong consensus of its eco-friendly nature and inherent ability to protect human health. There are strong views against organic farming mainly on the grounds of practicability of feeding a billion people, its financial and economic viability, biomass availability and dissemination of know-how. However, many studies have revealed that, organic farming is productive and sustainable. There are many people who, while approving organic agriculture, advocate a careful conversion of farms into organic so that the held loss is taken care to the extent possible.

At the present moment .there is a lack of government support to make conversion to organic status easier. The questions about the yield and financial viability of organic farming system are crucial and there are no empirical studies available in the Zimbabwean context comparing the economic and ecological returns of the organic farms against conventional farms. Organic agriculture has been neglected in the agricultural policy and therefore, there is less government assistance for the promotion of organic agriculture, as it exists for the conventional agriculture in form of subsidies, agricultural extension services, and official research.

Given proper encouragement, organic farming system will progress tremendously in Zimbabwe especially in the dry land regions of the country, taking advantage of the diverse soil and climatic conditions. The adoption of sustainable organic sugarcane farming is an important precursor to the biophysical environment. Not only does it facilitate access to the biophysical environment wellbeing but gives knowledge to farmers and power to manage the natural resource sustainably. This research has highlighted that, the farming strategies being practised by A2 farmers provides the suitable option of organic sugarcane farming system which is environmentally friendly.

10.1 Recommendations

Formation of farmer's organizations has been found to be extremely beneficial for the upholding the farmer's interests. However, it requires considerable support on a number of levels including start-up costs, operational expenses, training and marketing. The state, government or the private sector may assist in this respect. In order for A2 farmers in Hippo Valley to actively shift from intensive to organic sugarcane farming techniques there should be government support in form of subsidies, research, extension services, and creation of markets for organically produced sugar.

The government of Zimbabwe should put effort to propagate organic farming techniques to sugarcane producers through scientific researches in order to embrace new ideology of organic sugarcane farming in this region. Countries such as India, USA and Kenya have fully embraced organic sugarcane farming system through scientific researches.

To ensure sustainable sugarcane production farmers should be given subsidies during the conversion, subsidies for organic intensification and continuous subsidy schemes for organic farming. This will normally motivate farmers to adopt organic farming system since, it is associated with high start-up costs and low yields during conversion periods. Several countries including USA provide farmers a threefold subsidy upon adoption of organic sugarcane farming.

To ensure sustainability in sugarcane production the farmers should be equipped with organic farming skills and knowledge. In recent years, the Department of Agriculture has been training A 2 sugar cane farmers on sustainable ways of farming. This knowledge is a vital tool for addressing environmental challenges such as water logging, salinization, eutrophication and biodiversity loss.

About the Authors

Aaron Dasva is a former BSc Honours student of Geography & Environmental Science at Great Zimbabwe University. While Jemitias Mapira is a professor in the same discipline, Nyashadzashe Ngaza is a lecturer in chemistry and both of them are based at Great Zimbabwe University.

References

1. Breakwell, W and Clowes, M.1988, *Zimbabwe Sugar Cane Production Manual*, ZSA Experiment Station, Harare
2. Campbell, R. G., Willis, J. R.and May, J. T. 1973. Soil Disturbance by logging with rubber-tired skidders, *Journal of Soil and Water Conservation*, 28:218-220
3. Clemmens, A.J. 1971. Accuracy of irrigation efficacy estimates, *Journal of Irrigation Drainage Engineering* 123 (6):443-453
4. Cooper, J. and Dobson, H.2007.The Benefits of Pesticides to Mankind and the Environment, *Crop Protection*, 26:1337-1348

5. Hussein, J.1998. Management and Irrigation of Vertisols derived from basalts in Zimbabwe. In M. St. J. Clowes (ed) *Fourth Zimbabwe Sugar Seminar* (20 August)
6. Johnston, A. E.1986. Soil organic matter Effects on Soils and Crops, *Soil Use Management* 2:97-105
7. KSB. 2008. Kenya Sugar Industry Strategic Plan, 2010-2014, <http://www.kenyasugar.co.ke>
8. Manzungu, E. and Pieter van der Zaag, 1996. *The Practice of Small Holder Irrigation*, University of Zimbabwe, Harare
9. Marris, E., 2011. *Rambunctious Garden: Saving nature in a post-wild world*, Bloomsbury Publishing, New York
10. Matodi, P. 2012. *Zimbabwe's Fast Track Land Reform*, Zed Press, London
11. Ndlovu, L. S. 2000. The Performance of subsurface drip irrigation at Royal Swaziland Sugar Corporation during its first season, *Proc. S. AfrSug Technol Ass* 74: 157-160
12. Nyati, C.T.1998. Agronomy in Zimbabwe Sugar Association Experiment Station Research Report for the years 1996, 1997 and 1998. Zimbabwe Sugar Association Experiment Station, Chiredzi, *Zimbabwe Research*, 3:7-13
13. Singh, K.K., Patra, M.L. and Sharma, H. C.2000. Environmental Protection and Sustainable Agriculture, *Environment and People* 6(9):5-9
14. Soil Science Society of America, 1997, New York
15. Sukume, C. 2010. *Zimbabwe's Land Reform: Myths and Realities*, James Curry, Oxford

Creative Commons licensing terms

Author(s) will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Social Sciences Studies shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflicts of interest, copyright violations and inappropriate or inaccurate use of any kind content related or integrated into the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).