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Clarion University of Pennsylvania, Clarion, Pennsylvania

IMPACT OF MASTER FARMER TRAINING ON SMALLHOLDER FARMERS' RAPOKO *ELEUSINE CORACANA* (L.) PRODUCTIVITY IN BUHERA DISTRICT, ZIMBABWE

Oscar Ndoro[1], Culver Mvumi[1], Petronella Matizanadzo[2], Sekai A. Manyiwo[3]
[1] Zimbabwe Open University, Manicaland Region
[2] Ministry of Agriculture, Mechanization and Irrigation Department, Zimbabwe,
[3] Chinhoyi University of Technology, Zimbabwe

ABSTRACT

Sustainability revolves around many factors which include technological training, number of farmers trained and high yields. The study investigates impact of Master Farmer Training (MFT) on rapoko *Eleusine coracana* (L.) cultivation, considering *in situ* variables in Buhera District. A cross-sectional survey design was used among trained and non-trained farmers. Data analysis was carried out in R version 3.2.3. Chi-squared test for independence was used to confirm association between MFT and rapoko cultivation, and between household gender and rapoko cultivation. MFT had a positive influence on number of farmers (100% were master farmers (MFs), while 23% were non-master farmers (NMFs) who grew rapoko). Yields for MFs were higher than for NMFs. The values for first and second year of t were 3.37 at $P < 0.01$ and 10.75 at $P < 0.01$ respectively. MFT influenced formation of farmer groups which allowed them to get training on rapoko cultivation. More male-headed households (70%) cultivated rapoko than female-headed households (40%).

Keywords: MFT influence, rapoko productivity, gender, institutional and income factors.

INTRODUCTION

Sub-Saharan Africa (SSA) has the highest undernourishment prevalence of all regions because of the harsh conditions, which cause a limited crop growing spectrum (Food Agricultural Organization (FAO), 2014). Ellis (2000) affirmed that reliance on agriculture in sub-Saharan Africa tends to diminish continuously due to the effects of climate change that have undermined the sustainability and reliability of the agricultural sector. Additional reasons to unsustainable productivity include poor choices of crops to grow in dry areas and the lagging behind of research on small grains in Africa. Farmers often tend to prefer maize as the premier crop to any other crop (Taylor, 2003; Mukarambwa & Mushunje, 2010). Crops grown in the region include maize *Zea mays* (L.) sorghum *Sorghum bicolor* (L.), pearl millet *Pennisetum glaucum* (L.) and rapoko *Eleusine coracana* (L). Rapoko is highly valued by local farmers; it is one of the staple food grains, and also most adaptable crop because it withstands the most hardy and drought conditions in SSA, where major cereals cannot be relied upon in terms of providing sustainable yields (Devi, Vijayabharathi, Sathyabama, Malleshi, & Priyadarisini, 2014; Bwai, Afolayan, Odukomaiya, IKokoh, & Orishadipe, 2014). The plant has a dense fibrous root system. Rapoko is a tufted, prostrate and spreading annual grass which can grow in a wide range of soils. Some farmers sow the seed by broadcasting, which increases soil cover through its dense population and vegetation. These factors increase the crop's ability to adapt to marginalised areas; the dense roots and above-ground tufts reduce soil erosion.

The need to integrate and balance locally available resources, adaptable crops in the prevailing environmental conditions and economic concerns, has been lacking in most marginalised areas (Dresner, 2002), including Buhera District, yet this is the core drive towards sustainability. Only about 100 000 hectares of rapoko have been reported to be under cultivation worldwide (World Food Conference, 2013) and annual world production of finger millet is at least 4.5 million tons of grain, of which Africa, where conditions can promote rapoko production, produces only about 2 million tons (National Academy of Sciences, 1996). In adverse agro-climatic conditions which prevail in Gutu (and Buhera) District, food sustainability lugged behind from 2012 and many years back, because crop yields of the common cereals grown (maize and rapoko) were generally low (Mika & Mudzamiri, 2012). Crop production resources, including technical information were not focused on rapoko, but spread over a number of crops. Sustainability is what we need to have to ensure that sustainable development delivers on equitable share of resources at intra- and intergenerational levels, without further harming the already disturbed systems, but work on their restoration (Hattingh, 2001; Birkeland, 2002). High crop yields give livelihood sustainability, and development in a community (Giovannucci, Scherr, Nierenberg, Hebebrand, Shapiro, Milder, & Wheeler, 2012).

Rapoko is a traditional food plant needed for human food, livestock feeds and beer brewing. For example, in Buhera District, Zimbabwe, rapoko is first malted to prepare preferred cultural beer sold locally to fine and expensive beer, which is sold in bars (Malleshi & Alma, 1988). Rapoko's nutritional importance is well recognised because of its high content of about 5–8% protein, 1–2% ether extractives, 65–75% carbohydrates, 15–20% dietary fiber and 2.5–3.5% minerals (Chethan & Malleshi, 2007). It has the highest calcium content among all cereals (344 mg/100 g). Rapoko is known for several health benefits and some of the health benefits for example antiviral effects (Ferguson, 2001), are attributed to its polyphenol and dietary fiber contents.

The crop produces good yield out of little input during growth (Dicko, Gruppen, Traore, Voragen, & Berker, 2005; Taylor, Schober, & Bean, 2006). This can ensure sustainable household and community food security (Leuschner & Manthe, 1996). Despite this, smallholder farmers in Buhera District have persistently faced challenges of low rapoko yields (Sukume, Makudze, Mabeza –Chimedza, & Zitsanza, 2000) since the last famine of 2008 to 2009.

Many farmers in rural areas do not have the most up-to-date knowledge on how to grow small grained food crops in marginalised areas so as to get improved yields. FAO (2010) identified factors that limit rapoko productivity to limited agriculture-related technical training, unfavourable agricultural environment and lack of knowledge of effective agronomic practices. A decline in agricultural growth through low crop yields throws the poor into inevitable poverty, hunger and food insecurity (Rukuni, Tawonezvi, Eicher, Munyuki-Hungwe, & Matondi, 2006). Those with the most rapidly growing agriculture sector generally face the most rapidly declining poverty and malnutrition incidences (World Bank, 2007). Sharma, Crouch, Seetharama, & Hash (2002) opined that there is an urgent need to focus on improving adaptable crops which sustain the livelihoods of smallholder farmers and poor consumers in the developing countries of the semi-arid tropics.

Master Farmer Training (MFT) is a promising solution. It is run by the Department of Agricultural Technical and Extension Services (AGRITEX) whose extension workers are mostly based in communal sectors where the bulk of the farmers are found (Mubonani, 2015). Chipika (1985) and Pazvakavambwa (1994) reported that MFT programme, which provides extension training, originated in the 1930s and was purposefully set up to impart technical skills to competent farmers in semi-arid areas. According to Van Den Ban, & Hawkins (1999), the goal of extension training is to ensure that increased agricultural productivity is achieved by stimulating farmers to use modern and scientific production technologies developed through research. In Zimbabwe, after successfully completing the MFT programme, Master Farmer Certificates were awarded, and badges given to those communal farmers who successfully adopted and implemented the improved methods recommended during the training. The methods should be relevant to their environment. The programme can potentially improve agricultural crop productivity of motivated farmers through agronomic trainings (Feder, Onchan, Chalamwong, & Hongladaron, 1987; Koppel, 1978). The methods and technologies used in crop production have been improving from time to time, and numbers of farmers in rapoko production have been observed increasing. Reports from literature revealed that MFT uses a set of enabling factors and suitable conditions (for instance, new technologies, prevailing environmental factors, training etc.) (Adesina & Zinnah, 1993; Rola, Jamias, & Quizon, 2000; Rosegrant & Cline, 2003), including gender, and translates them into improved yields.

Through farmer training, rapoko yields can increase livelihood sustainability through food security of many of the world's poorest and most food-insecure nations in marginal areas (FAO, 1996). However, there are not many previous studies done on MFT using the aforementioned factors; only one study on MFT on maize, sweet potato *Ipomoea batatas* (L.) and rapoko in one district, Gutu, Masvingo Province, Zimbabwe, was reported (Mika & Mudzamiri, 2012). Basing on continually improving training and technological advancement, a lot more research on MFT delivered by AGRITEX still needs to be done in various other districts to determine its effectiveness on the main (adaptable), yet most economic crops grown in those districts, alongside with gender. The current study seeks to evaluate the impact of MFT on farmers' rapoko productivity in Buhera District, considering the farmers' gender, institutional and income factors.

RESEARCH METHODOLOGY

The study sought to determine the effectiveness of AGRITEX training on smallholder rapoko productivity in Buhera District. The effectiveness was determined by comparing farmers trained under the MFT programme and those not trained, considering specific factors in the study area.

Study area

Zimbabwe has five Natural Regions (NRs) (1-V). The study was carried out in Buhera District in Manicaland Province, south eastern Zimbabwe. The coordinates are: 19° 19' 57.00"S, 31° 26' 6.00"E The specific area of study was Chamutsa East, Ward 29, Buhera District, Manicaland Province. It lies in NR IV. NR 1V has an average annual rainfall between 460mm and 600mm characterised by high temperatures (Moyo, 2000). In this NR, rainfall intensity, reliability and distribution are significantly not conducive for maize production (Igbekele, 1975). Temperature ranges from 32 to 40°C in summer while winter it ranges from 15 to 30°C. The soils are mostly Typic Kandiustaff derived from granitic parent material with relatively low water holding capacity and consists of sandy to loamy sands (Vogel, Nyagumbo, & Olsen, 1994).

Research design

A cross-sectional survey of farmers in the study area was used. A structured and pre-coded questionnaire and face to face interviews were used to collect data from sampled farmers. A checklist was used to obtain views from key informants who included local leaders, NGOs representatives working in the area, AGRITEX personnel, and local business people. This was done in order to complement quantitative data obtained by structured questionnaires and to also achieve triangulation. Research data obtained was from two previous seasons, 2015/15 and 2015/16.

Population and sampling

Chamutsa East, Ward 26, had five villages with a total of 451 households who were all A1 farmers according to information provided by AGRITEX, Buhera District. Of these, 257 (53%) were female-headed households.

Random samples were drawn from trained and non-trained farmers who lived in the five villages. A list provided by AGRITEX was used. Random numbers were generated using MS EXCEL to pick the actual farmers to participate in the survey. A total of 70 farmers participated in the study, 35 of whom were MFT graduates and 35 were non master farmers (NMFs). This was about 16% of the whole population. However, key informants were purposely sampled because they had some knowledge about rapoko cultivation in the area.

Data analysis

Data was first entered into an MS EXCEL spread sheet for checking and validation. After that, it was exported to R version 3.2.3 software for analysis. Hypotheses tests were conducted as well preparation of tables, distributions, charts and graphs. The advantage of R is that it is an open source and has powerful graphics tools.

RESULTS

Table 1: Rapoko production between MFs and NMFs and demographic information

Description	MF		NMF	
	Mean	**S.D/max and min*	*Mean*	*SD*
Household statistics				
Household head education (yrs.)	7.3	3.1	6.4	1.2
Household size (number of people)	3.6	0.83	3.4	1.1
Household age	56.1	10.4	57.3	8.9
Rapoko production statistics				
Proportion of farmers (%)	100		23	
Rapoko area yr 1 (ha)	0.37	0.12	0.18	0.05
Rapoko area yr 2 (ha)	0.79	0.24	0.53	0.23
Rapoko yield Yr. 1 (kg/ha)	981.50	(min-max:472-2667)	596.30	(min-max: 250-900)
Rapoko yield yr 2 (kg/ha)	1235.20	(min-max:600-2170)	445.60	(min-max: 73-1390)
Rapoko output yr1 (kg)	360		102.40	
Rapoko output yr 2 (kg)	1076		252.50	
Seed yr 1 (kg/ha)	6.20	2.00	6.60	2.30
Seed yr 2 (kg/ha)	5.30	0.50	5.30	0.48
Basal fertilizer (kg/ha) yr1*	100		Nil	
Total arable land (ha)	3.20	1.00	3.60	1.12
N	35		35	

Source: Survey data

MFs and NMFs who cultivated the crop were 100% and 23% respectively (Table 1). The survey also revealed that both MFs and NMFs prioritised sorghum as first crop of choice. However, whilst rapoko was second choice for MFs, NMFs prioritised maize as their second crop.

During the two seasons, harvests were only reported for rapoko and groundnuts during the first year. No harvests, except for rapoko, were reported in the second year, due to drought.

The mean household head years of education and household size for MFs were more than for NMF (7.3 and 6.4 years respectively). These differences were not statistically significant ($P = 0.07$ and 0.32 respectively) at 95% confidence level. However mean total arable land and household head age was more for NMFs than for MFs but not statistically significant at 95% level, ($P = 0.91$ *and* $P = 0.69$ respectively).

Mean rapoko area, yield and output were higher for MFs than NMFs during the two seasons. These differences were statistically significant at 95% confidence level with $P < 0.05$. MFs use of rapoko seed in the first year was less than for NMFs, but the mean seed use was the same in the second year.

*SD = standard deviation, *only 8.6% used basal fertilizer, none used top-dressing.

Results concerning comparison of assets ownership between MF and NMFs which influenced rapoko production were obtained (Figure 1).

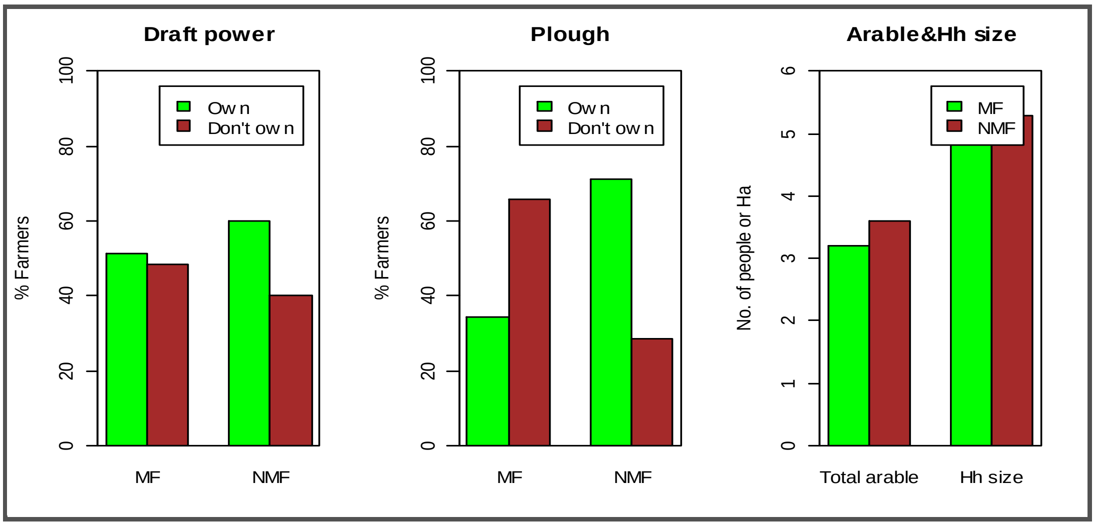

Figure 1: Draft power, plough ownership, total arable land and household size

Source: Survey data

The proportion of draft power owners (52%) and non-draft power owners (50%) were almost the same for MFs, but more NMFs (60%) owned draft power than those without (40%). It is not surprising therefore that fewer MFs owned ploughs than NMFs. Total arable area (3.3 ha and 3.6 ha for MFs and NMFs respectively) and household size (3.6 and 3.4 adults for MFs and NMFs respectively) did not appear to be very different between the two farmer categories and might therefore not influence farmers whether to grow rapoko or not.

Farm system, rapoko preference and decision to grow rapoko, showed some variations (Figure 2). Farm system refers to whether a farmer has crops only or both crops and livestock.

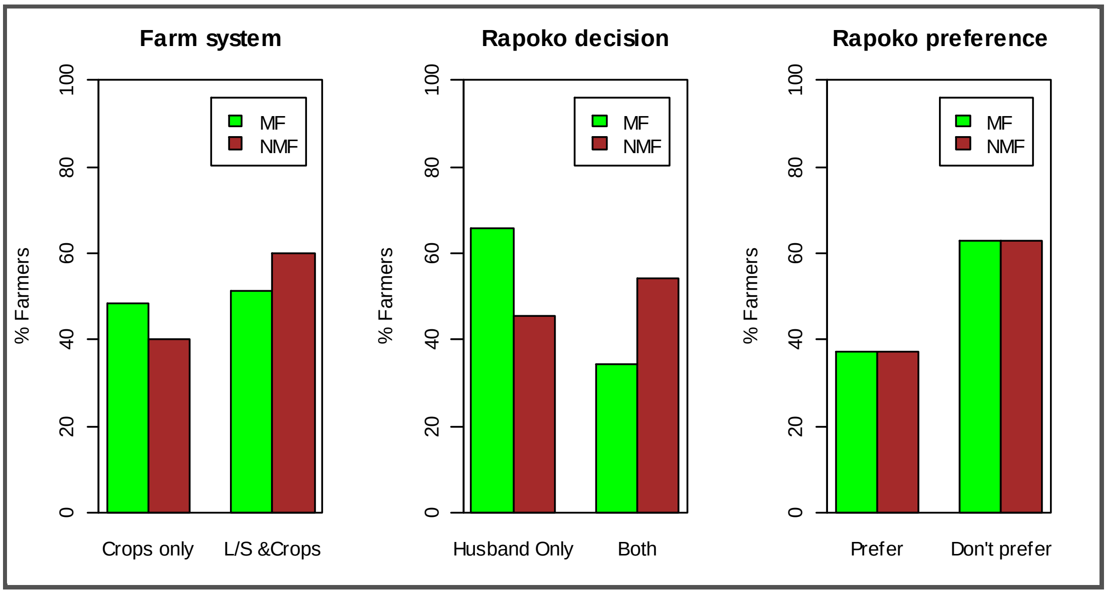

Figure 2: Livestock ownership, rapoko decision and rapoko preference.

Source: Survey data

More MF (50%) than NMF (40%) had crops only systems, while more NMF (60%) had both crops and livestock. Preference for rapoko was not different for MF and NMF suggesting that it did not influence the farmer‘s decision to grow rapoko whether MF or NMF.

Figure 3 shows the results of gender, rapoko seed source and rapoko marketing.

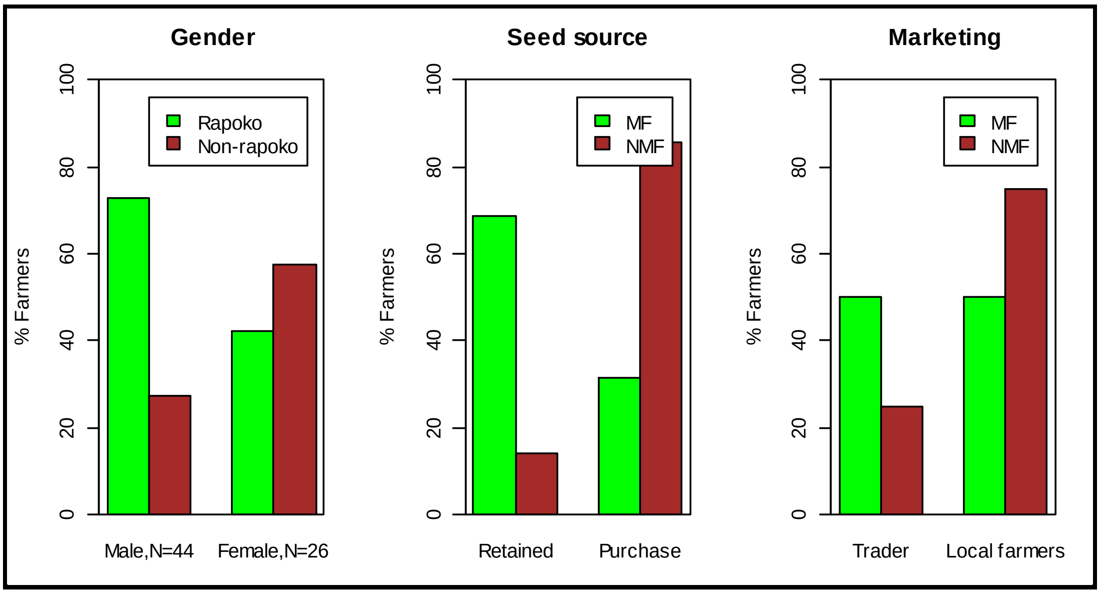

Figure 3: Gender, seed source and rapoko marketing

Source: Survey data

More than 70% male-headed households in the whole sample grew rapoko, compared to 40% for female-headed households. Majority of MF (nearly 70%) used retained seed compared to less than 20% for NMF (Figure 3). 50% MF sold their produce to both traders and local farmers, while the majority of NMF sold mainly to local farmers due to the small volume of production by NMF compared to MF.

Farmer constraints and institutional factors that influence rapoko production

Three main institutional factors considered under the survey were: access to credit, access to extension services and group membership. From the study, all MFs had access to agricultural extension and reported an average frequency of meeting an agricultural extension worker once a month. NMFs also reported having access to extension services but the frequency of meeting extension staff ranged from once in two months (83%) and once in more than two months (17%). 94% of MFs reported being members of a group (group membership), and the main purpose of the group was for agricultural extension worker meetings, whilst the purpose of the second group was for nutrition gardens. AGRITEX extension worker was the sole source of training reported by trained farmers. All NMFs did not belong to a farmer group. Both MFs and NMFs did not have access to credit during the two seasons. The main constraint was observed to be related to farmers' attitudes towards growing rapoko, although lack of a ready market for surplus production was mentioned as one of the other constraints. Farmers used locally purchased or retained seed and this was a constraint for farmers who did not have retained seed, or when there was drought.

Other sources of income and marital status

Survey results showed that about half (49%) of the MFs received some other income in the form of remittance while another half reported getting some income from informal activities. However, the mean monthly income for both sources was below $30 per month. 66% of NMFs received other income in the form of remittance while the remaining 34% got some income from informal activities. The mean monthly other income was about half of that for MFs; it was almost $15. The influence of other sources of income on rapoko productivity could not be tested, although the amounts involved appeared to be too small to have an effect.

A higher percentage of MFs (83%) was married as compared to NMF (57%), while NMFs (43%) were widowed and more than MFs (17%). No category of farmers reported household members who could not work in the fields because of being either too sick or too old. Marital status influenced decision to grow rapoko when the head of household was male for MFs (Figure 3).

Hypothesis test for differences in mean yields between MFs and NMFs.

H_0: There is no difference in mean rapoko yields for MFs and NMFs,

H_1: Mean rapoko yield for MFs is greater than that for NMFs

A one-tailed *t*-test for mean rapoko yields for MFs and NMFs was done in R version 3.2.3 with 35 cases each for MFs and NMFs for the two seasons. The value of t for the first year was 3.37 with 18 degrees of freedom and $P < 0.01$. For the second year the value of t was 10.75 with 69 degrees of freedom and $P < 0.01$.

The null hypothesis was therefore rejected in favour of the alternative hypothesis; the mean rapoko yield for MFs was greater than mean rapoko yield for NMFs at 95% confidence level for the two seasons.

Hypothesis test for association between rapoko and MFT

H_0: There was no association between MFT and rapoko cultivation
H_1: There was an association between MFT and rapoko cultivation.

A Chi-squared test was conducted in R version 3.2.3 for the association between MFT and rapoko cultivation during the first season as per information (Table 2).

Table 2: Contingency table for rapoko cultivation and MFT

Type of Farmer	Rapoko cultivation		Totals
	Yes	No	
Master Farmer	29	6	35
Non-Master Farmer	8	27	35
Totals	37	33	70

Note*:* For MF category, since all farmers grew rapoko, an arbitrary cut-off area of 0.2 ha was taken as non-rapoko cultivation in order for the test to proceed.

The following parameters were obtained:

Chi-squared = 22.73, degrees of freedom = 1, $P < 0$

The null hypothesis was rejected at 95% confidence level in favour of the alternative hypothesis that, there is an association between rapoko cultivation and MFT during the first season. The test could not be performed for the second season because one of the assumptions for a Chi-square test was not satisfied. The assumption that the number of responses for all cells must be five or more was not met.

Hypothesis test for association between rapoko cultivation and household head gender

H_0: There was no association between rapoko cultivation and household gender
$H_{1:}$ There was association between rapoko cultivation and household gender

A Chi-squared test for the association of rapoko cultivation and household head gender was carried out in R version 3.2.3 for the first season as per information (Table 3).

Table 3: Contingency table for rapoko cultivation and household head gender

Household head gender	Rapoko cultivation		Totals
	Yes	No	
Male	32	12	44
Female	11	15	26
Totals	43	27	70

Source: Survey data

The following parameters were obtained:
Chi-squared = 5.16, degrees of freedom = 1, $P = 0.02$

The null hypothesis was rejected at 95% level in favour of the alternative hypothesis that, there was an association between rapoko cultivation and household gender during the first season. The test could not be performed for the second season because one of the assumptions for a Chi-squared test was not satisfied. The assumption that the number of responses for all cells must be five or more was violated.

DISCUSSION

Food insecurity, poverty, and malnutrition due to low yields and droughts are common problems in SSA rural areas. The current study showed that extension training through MFT is a programme which increased crop yields of rapoko, had a positive influence on both number of farmers that grow rapoko, and revealed positive association between rapoko cultivation, inputs and gender.

Proportion of farmers that grow rapoko production of the crop

The result of a large proportion of MFs (100%) who grew rapoko compared to NMFs (23%) suggests that MFT had an influence on decision to grow rapoko (Table 1). A great number of farmers growing a particular crop means they share information and put in practice the technical information they are given. With competition and togetherness in large farmer numbers, higher productivity is ensured, and sustainability is enhanced. Hattingh (2001) maintained that sustainable activities can be maintained indefinitely, leading to sustainable development and economy. Stimulating farmers through use of modern and scientific production technologies is a weapon used during MFT to lure farmers into growing crops which are recommended through research and training; this is used to achieve increased agricultural productivity and sustainability (Van Den Ban & Hawkins, 1999). Therefore, it is important to know how farmers perceive improved practices for better understanding of their choice in deciding whether to grow a particular crop or not (Gwihava, 2015). Transfer of technology signals extensionists and other trainers that farmers have received technical information since farmers demonstrate their ability to choose the right crop or variety to grow in their area (Ingold, 2002). In the current study, the transfer of technology through MFT was effective as it included support, advice and other essentials so that the farmer would have no reason to reject the decision of growing rapoko. It can be realized that an important role of the extension training can be to help farmers to learn much of their chosen crop which they have been growing, so that through this experience, the farmers grow it in their large numbers (Rolling & Pretty, 1997; Veldhuizen, Waters-Bayer, & de Zeeuw, 1997), which guarantees higher productivity and sustainability. The number of farmers that receive information is also dependent on how successful MFT is, or the methods used to influence farmers' decision (Ricker-Gilbert, Norton, Alwang, Miah, & Feder, 2008; Doss, 2006).

Rapoko output was significantly different between MFs and NMFs ($P < 0.05$), and considering that household sizes were almost the same for MFs and NMFs, then NMFs would be more food insecure than MFs, assuming that there were no other alternative sources of grain.

Household assets and rapoko cultivation

More NMFs owned draft animals, in comparison to MFs, although total arable and household size were not significantly different, irrespective of gender. This would make NMFs more likely to cultivate rapoko taking advantage of the draft power owned, but this was not so. A possible reason could be that these farmers derived some food security from ownership of livestock unlike most of the MFs who grow rapoko. This caused them to risk cultivating maize, a less drought tolerant crop compared to rapoko.

From Table 1, the difference between MFs and NMFs in terms of household head education, household size, and access to total arable land were not statistically significant. This implies that there is not enough evidence to suggest that there is a difference in household head education, household size and access to total arable land between MFs and NMFs. These factors may therefore not influence decision to grow rapoko. There was also no significant difference in household demographics between MFs and NMFs. For example, Pender, Nkonya, Pamela, Sserunkuuma, & Ssali (2013) ascertain that more educated households may be less likely to invest in inputs like land or labour, since the opportunity costs of their labor and capital may be increased by education. Thus, Pender et al. (2013) conclude that the net impacts of education on crop production are ambiguous.

The non-significant result of the aforementioned factors fails to agree with, for example, some studies whereby basic education was found to promote innovation and participation in agricultural extension (Gasperin, 2000). Factors such as age and household size would be expected to promote innovation especially by younger farmers, and a large household size would mean more labour availability, especially for a labour intensive crop such as rapoko.

Institutional factors: group membership, access to agricultural extension and credit, output marketing and input markets

From the study, majority of farmers (MFs) who grew rapoko belonged to a farmer group for agricultural extension services which conducted MFT regularly. They were attending agricultural extension worker meetings more often than NMFs. Overall, the findings demonstrate that farmer groups can be, and are, an appropriate channels to enhance early adoption of agricultural technologies and improve household level productivity. It was also documented that farmers' groups acted as the guarantor to enable male and female members who undergo extension training to have enhanced communication, and build social solidarity among themselves (Mattee & Lassalle, 1994). Financers who had links with AGRITEX had links with markets. This enabled MFs to have market access. Farmer groups are more likely to have broader productivity approaches than individuals. This is because farmer groups can internalize transaction costs, facilitate efficient information flow, and reduce both farmers' risk aversion toward new technologies and income shocks through collective risk management (Pingali, Khwaja, & Meijer, 2005; Hogeland, 2006; Shiferaw, Hellin, & Muricho, 2011). However, none had access to credit, and this was reflected by non-use of inputs such as fertilisers, with only 8.6% of MFs using basal fertiliser. However, this did not reduce rapoko yield levels, especially for the MFs, as the crop can yield quite well with very little inputs (Taylor, Schober & Bean, 2006). MFs still produced high yields because of other factors which included the training they received. High yield was the central factor for sustainable livelihoods among MFs. Only MFs could be able to sell surplus rapoko grain due to a higher output compared to NMFs who only sold to local farmers. This is evidence that given ready output markets for rapoko more farmers could grow the crop. Regarding seed source, the only source mentioned was buying from other farmers.

Hypothesis tests; mean yields, association between MFT, gender and rapoko cultivation

Hypotheses tests confirmed that mean rapoko yields for MFs were significantly greater than those for NMFs. Chi-squared tests for independence confirmed an association between MFT and rapoko cultivation, and between household gender and rapoko cultivation.

The study revealed that MFT produced higher rapoko yields than NMF. Previous studies confirm that extension training improves crop yields (Feder et al., 1987; Rosegrant & Evenson, 1992; Rosegrant & Cline, 2003; Dadson, Bakang, & Cofie, 2013; Hasan, Hossain, Islam, & Bari, 2013). However, our findings are not in agreement with findings of (Mika & Mudzimiri, 2012). Perhaps the environmental factors in which the crops were grown, farmer attitudes which lead to the number of farmers willing to train and technology advancement or improved approaches to MFT contributed to difference in the results obtained in the current survey on rapoko cultivation.

Gender results showed that more male-headed households among MFs (70%) grew rapoko more than females (40%) (Figure 3). Gender inequality in access to productive, human and social capital assets has been implicated in low productivity, growth and output in SSA (Blackden & Bhanu 1999). Female headed households own no productive assets like land, livestock, for example cattle and farm machinery which includes tools and other farm equipment (Horrell & Krishnan, 2006). Boserup (1970) asserted that women's productivity in agriculture is sometimes hampered both by their lack of assets and access to resources, and just by being "female". The form of land tenure may also affect households' access to credit, irrespective of being MF or NMF, male or female (Feder, Onchan, Chalamwong, & Hongladaron, 1988; Place & Hazell 1993). Chant (2003) echoed that female headed households are the poorest of the poor and in various forms of intervention and this affects their productive potential. Female heads of households have less decision making power than of men (Song, Zhang, Sun, & Jiggins, 2009; Gindling & Oviedo, 2008). All of these impacts may affect agricultural productivity. One reason for the lack of active decision-making in agricultural production is the socio-cultural bias which has often hindered women's active participation in farmer training centres, extension meetings and most importantly, access to agricultural inputs (e.g. fertilizers), services and economic resources such as credit (Jiggins, Samanta, & Olawoye1997; Voegele, Villarreal, & Cook, 2009) and has affected the sustainability of women's livelihoods. Adeyeye (1991) adds that women's less access to education and training their does not sustain productivity. Therefore female-headed households demonstrate very low yields per acre for staple food crops like maize and rapoko in some areas, despite similar input usage to the male-headed household.

In some different studies done, rural women were found to constitute the more "economically active population" than men in SSA but they were largely not considered productive because they usually worked as unpaid family labour (Olawoye, 1988; Odebode, 2012). Men could probably like rapoko because of its malting characteristics suitable for beer brewing. The possibility of obtaining a surplus rapoko grain for sale (likely to be controlled by men) and the labour intensive aspect of rapoko, may limit the crop's preference by women.

CONCLUSION

The study has shown that MFT promoted rapoko production in the study area. There were more MFs (100%) who cultivated rapoko than NMFs (23%). Extension training through MFT proves that use of transfer of technical knowledge, use of technological inputs and relevant factors in specific regions lure large numbers of farmers and makes scores of overall enhancement of productivity of economically important crops for smallholder farmers. Taken together, we can conclude that MFT, complemented with large numbers of farmers trained and high rapoko yields produced by the farmers, can sustain livelihoods of smallholder farmers. The concept of sustainability is thus useful in giving pointers to progressive development that transforms the economy and society's quality of life.

The mean rapoko yields for MFs during two seasons was found to be greater than for NMFs and statistically significant ($P < 0.05$). From the Chi-squared tests, there was an association between rapoko cultivation and MFT, and between rapoko cultivation and gender. This current study showed that male-headed households were more likely to grow rapoko than female-headed households.

Factors such as rapoko preference, access to arable land, household size, and level of education for household head were found not to be statistically different between MFs and NMFs. One important factor that influences decision to grow rapoko was being a member of a farmer group for extension purposes.

It is recommended that when AGRITEX does MFT, the extensionists of this department choose the crop mostly grown by smallholder farmers in marginalized areas for training so as to capture the highest numbers of farmers willing to be trained. When crops to grow are chosen by large farmer numbers, this encourages formation of farmer groups. Formation of farmer groups in this way enhances increased crop productivity of economically important crops for the benefit of the nation, even the poor. It is also recommended that MFT emphasises cultivation of rapoko in semi-arid Zimbabwe, irrespective of gender. It is indeed imperative that besides men, women also have access to agricultural inputs, training services, economic resources such as credit, and even education to cherish the synergy of both men and women in enhancing crop productivity in semi-arid conditions.

There is need for further research in post-harvest processing technologies of the commonest small grains grown in specific areas of the smallholder sector to encourage women into small grain production, while lessening the burden to them, especially of shelling and any further processing the grain before it is taken for milling.

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ABOUT THE AUTHORS:

Oscar Ndoro, Zimbabwe Open University, Manicaland Region

Culver Mvumi, Zimbabwe Open University, Manicaland Region

Petronella Matizanadzo, Ministry of Agriculture, Mechanization and Irrigation Department, Zimbabwe

Sekai A. Manyiwo, Chinhoyi University of Technology, Zimbabwe