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DETERMINANTS OF CROP DIVERSIFICATION AMONGST AGRICULTURAL CO-OPERATORS IN DUNDWA AGRICULTURAL CAMP, CHOMA DISTRICT, ZAMBIA

Lighton Dube
Faculty of Commerce and Law, Zimbabwe Open University, National Office, Mt Pleasant, Harare, Zimbabwe

Revaux Numbwa
Faculty of Agriculture and Natural Resources, Africa University, Mutare, Zimbabwe

Emmanuel Guveya
AEMA Development Consultants, Zimre Park, Ruwa, Zimbabwe

Abstract

A sound understanding of the socio-economic characteristics of smallholder farmers and how they influence their crop diversification decisions would help policy makers in crafting appropriate measures for promoting crop diversification. The objectives of this study is to assess the degree of crop diversification and the factors influencing crop diversification among the farm households at Dundwa Agricultural Camp of Zambia. The study uses primary data collected from 60 farm households using structured questionnaire during the period October to November 2014. The degree of crop diversification among farm households was measured using the Entropy index. Further, the censored Tobit model was used to examine how the farmers' socioeconomic characteristics influences crop diversification. The mean entropy index is 0.88 and this showsa very high degree of crop diversification among the farmers. The Tobit regression model showed that crop diversification is positively influenced by the gender of head of household, the production of cash crops by the household and household investment in basic farming equipment. On contrary, the age of head of household, total farm size, access to agricultural markets and total area cultivated negatively influenced crop diversification. The study recommends for increased capacity building of female headed households in farm decision-making and promoting household investment in basic farming implements as measures to promoting crop diversification.

Keywords: Crop diversification, entropy index, Tobit regression, agricultural cooperatives

1. INTRODUCTION

Agricultural cooperatives have long been seen as an important vehicle for achieving agricultural development and household food security. Smallholder farmers benefit from cooperatives through improved bargaining power, resource sharing and creating sustainable rural employment that lead to food security and poverty reduction. Producer cooperatives offer smallholder farmers market opportunities, and improved access to services such as better training in farm and natural resource management, information, technologies, innovations and extension services.

Corresponding author's
Name: Lighton Dube
Email address: *dubelig@gmail.com*

IFAD (2011) notes that in 2009 cooperatives were responsible for 37.2 percent of Brazil's agricultural GDP and 5.4 percent of total GDP, and received about US$3.6 billion from exports. In Mauritius, cooperatives account for more than 60 percent of national production in the food crop sector while in Kenya the savings and credit cooperatives have assets of US$2.7 billion, which account for 31 percent of gross national savings. Cooperatives operate in all sectors of the economy, have more than 800 million members and employed 100 million people worldwide that are 20 percent more than multinational enterprises. In 2008, 300 leading cooperatives of the world had an aggregate turnover of US$1.1 trillion, and this is equal to the GDP of many large economies (IFAD, 2011).

In Zambia (then Northern Rhodesia) the first cooperative was started in 1914 by the European settler farmers as a means of marketing agricultural produce to the newly opened copper mines in the copper belt of Southern Zaire and Northern Zambia. The initial cooperatives were largely restricted to the Eastern and Southern provinces of Zambia. Zambia currently has about 20379 registered cooperatives from all provinces (Mtonga, 2012).

A major worrying aspect of most agricultural cooperatives in Zambia is mono cropping. Most agricultural cooperators are reliant on maize cultivation for their livelihoods. Given the poor climatic conditions the country has been facing of late, the Government of Zambia, with the support of a number of Non-Governmental Organizations (NGOs), has been promoting crop diversification by farmers through cultivating other crops like cotton, sunflower, soya beans, and cowpeas, groundnuts, mixed beans, cassava and vegetables. These crops offer a huge potential income source for farmers as they are of high value and are currently produced in small quantities.

Government has also put in place a number of measures and agricultural policies regarding co-operative productivity and crop diversification in terms of farmers' input support programmes and marketing of agricultural produces. During the 2013/2014 production and fiscal year, the Government of Zambia allocated 7.2 percent of the budget to agriculture sector. Of this amount, 51 percent was reserved for programs that could make the divergence in the sector. The Government asserts that there is an advantage in diversified farming than the mono-cropping of maize to boost co-operators' household economic development and thereby, offering a viable channel for Co-operators to come out of the vicious cycle of rural poverty. Many countries have also pursued diversification of the agricultural sector as a way to improve the long-term viability as well as to enhance the profitability and stability of the sector.

2. STATEMENT OF THE PROBLEM

There has been a slow shift to other crops or economic activities by agricultural co-operators in Zambia despite government support in the shape of more supportive policies and improved infrastructure for supporting diversification programs. Co-operators have year in and year out remained cultivating the same crop – mostly maize. Therefore, a sound understanding of the socio-economic characteristics of co-operators and how these characteristics influence farmers' crop diversification decision making would help in formulating appropriate policies regarding Agricultural Co-operative Societies crop diversification levels in Zambia. This study therefore seeks to assess the major socioeconomic factors influencing diversification by agricultural co-operators in Choma district of Zambia.

2.1. Objectives of the study

The major objectives are:

i) To assess the extent of crop diversification by cooperative members of Dundwa camp, Choma district, Zambia.
ii) To determine the influence of socio-economic characteristics of cooperative members on crop diversification.

3. REVIEW OF RELATED LITERATURE

3.1. Agricultural cooperatives, types of agricultural cooperatives and their role in development

The International Co-operative Alliance (ICA) defines a co-operative as *"an autonomous association of individuals voluntarily united to meet their common economic, social and cultural needs through a jointly-owned and democratically controlled enterprise".* A cooperative is also defined as a private business group owned and controlled by its members. Cooperatives in agriculture offer to producers the opportunity to own and control businesses related to their farming operations thereby allowing them to deal with common problems as well as develop market opportunities together.

Agricultural cooperatives can be classified broadly into (i) supply cooperatives; (ii) marketing and processing cooperatives; and (iii) new generation cooperatives. The purpose of supply cooperative is to provide members with inputs and services at competitive prices. The purpose of a marketing and processing cooperative is to market and process member goods. New generation cooperatives add value to member goods through the combined processing of raw commodities and its members are the producers who purchase shares obligating them to deliver a specified volume of raw product to the processing facility.

Cooperative enterprises worldwide employ 250 million people, and generate 2.2 trillion USD in turnover while providing the services and infrastructure society needs to thrive (http://ica.coop/en/whats-co-op/co-operative-identity-values-principles, accessed 6/11/2015). Cooperatives empower people to collectively realize their economic aspirations, while strengthening their social and human capital and developing their communities. Co-operatives contribute to sustainable economic growth and stable, quality employment, employing 250 million (indirect and induced employment not included). Within the G20 countries, co-operative employment makes up almost 12 % of the total employed population (http://ica.coop/en/whats-co-op/co-operative-identity-values-principles, accessed 6/11/2015).

In agriculture, co-operative businesses offer small scale farmers distinct advantages by addressing a variety of market situations and issues. Through agricultural co-operatives smallholder producers realize economic benefits which they could not otherwise achieve alone. Agricultural co-operatives allow smallholder farmers to address common problems, develop new market opportunities or expand existing markets. Some of the benefits smallholder agricultural producers derive from cooperatives include: (a) Improved bargaining power; (b) Reduced costs; (c) Economies of scale; (d) Increased returns; (e) Improved product and service quality; (f) Reduced risk; and (g) Improved access to needed products or services.

3.2. Crop diversification, drivers of crop diversification and constraints to crop diversification

Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from value-added crops with complementary marketing opportunities (http://www.climatetechwiki.org/content/crop-diversification-and-new-varieties, accessed 6/11/2015). It can also be defined as a cropping system where a number of different crops are planted in the same general area and may be rotated from field to field, year after year. There are two methods to crop diversification in agriculture. The horizontal diversification; which is primary approach to crop diversification in production agriculture. The vertical diversification approach; in which farmers and others add the value to products through processing, regional branding, packaging and merchandising etc. Opportunities for crop diversification vary depending on risks, opportunities and the feasibility of proposed changes within a socio-economic and agro-economic framework.

Farmers diversify their crops in response to both opportunities and threats. Some of the major factors driving diversification include the need to: (i) increase income on small farm holdings; (2) withstand price fluctuations; (3) mitigate ill-effects of weather; (4) balance food demand; (5) improve fodder for livestock animals; (6) conserve natural resources (soil, water, etc.); (7) minimize environmental pollution; (8) reduce dependence on off-farm inputs; (9) decrease insect pests, diseases and weed problems; (10) increase community food security; (11) mitigate the negative impacts of climate change; (12) mitigate domestic policy threats; (13) address the pressures of urbanization in fast developing countries; and (13) address international trade opportunities and threats (Singh, 2011).

On the other hand, the main problems and constraints in crop diversification are due to following reasons: (i) Most countries and in particular developing countries are completely dependent on rainfall for cropping and this limits opportunities for crop diversification (ii) Sub-optimal and over-use of resources causing a negative impact on environment and sustainability of agriculture (iii) Insufficient supply of seeds and plants of improved cultivars (iv) Highly fragmented land holdings that are less favourable to modernization and mechanization of agriculture (v) Deprived basic infrastructure like rural areas roads, power supply, transportation and communications etc. (vi) Inadequate post-harvest technologies and infrastructure for post-harvest handling of perishable horticultural produce (vii) Weak agro-based industry (viii) Feeble research - extension - farmer linkages (ix) Un-trained human capital together with persistent and large scale illiteracy amongst farmers (x) Host of diseases and pests affecting most crop plants (xi) Poor database for horticultural crops and (xii) Decreased investments in the agricultural sector over the years.

3.3. Determinants of crop diversification

A number of studies from developing countries have shown that factors like rapid economic growth accompanied by slowdown of demand for cereals coupled with increasing demand for high value commodities, increasing availability of advanced technologies, declining agricultural prices, changing role of government, expanding role of private sector, improving supply chain management, improving food safety and better quality, emerging trade liberalization and liberalization of capital flows are fostering the process of crop diversification (Sharma, 2011). Market availability and size, price risk, land suitability and land rights, irrigation infrastructure and labour supply have been identified as major constraints in accelerating the process of crop diversification (Joshi *et al.*, 2007; Benziger, 1996; Dorjee *et al.*, 2003; Pingali *et al.*, 2005; Braun, 1995; Pingali, 2006). Sichoongwe (2014) found that farm area size, access to inputs such as fertilizers, availability of farming implements, and access to the market in terms of distance influenced the extent of crop diversification in the Southern province of Zambia. Pingali and Rosegrant (1995) also noted that several forces influence the nature and speed of agricultural diversification from staple food to high value commodities. Earlier evidence suggests that the process of diversification out of staple food production is triggered by rapid technological change in agricultural production, improved rural infrastructure, and diversification in food demand patterns. Ndhlovu (2010) in their study in Malawi also found that the fertilizer subsidies had an impact on farm households' cropland allocation and crop diversification decisions. They attest to the general picture of the relationships between farm households' access to fertilizer subsidy and their crop diversification levels, crop choices and cropland allocation patterns.

4. RESEARCH METHODOLODY

4.1. Study area and data collection

Dundwa Agricultural Camp is located about 65km north of Choma town. The camp covers a radius of about 20km. It is one of the oldest well-established camps in Zambia which also acted as an agricultural skills training centre. A seasonal stream runs through the area making vegetable gardening possible for the households that live closer to the stream. The Choma - Namwala road, a tarred road that connects the two districts runs through the area making transportation easier for

those who can afford. Within the Camp there is an established Food Reserve Agency (FRA) holding depot where the Farmers take their maize for sale. The map below shows the location of Dundwa camp in Zambia.

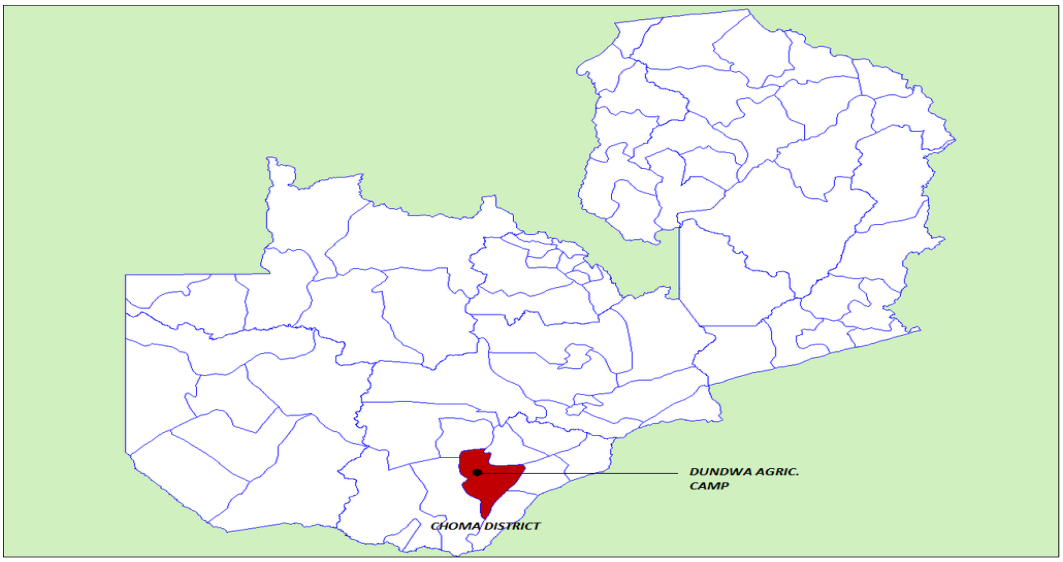

Figure 1: Location of Dundwa camp

Source: Map data Google 2015

4.2. Sampling design and data collection methods

Within this camp a sample of twelve (12) Agricultural Co-operatives was purposefully sampled with the help of the enumerator who was the camp officer. From each Co-operative five (5) Co-operators (member farmers) was purposefully sampled, identified by the chairperson for each co-operative. This gave a total sample population of sixty (60) respondents. Data collection took place during the period October to November 2014.

4.3. Methods of data analysis

Descriptive and inferential statistics were used in the study. Descriptive statistical tools applied include simple percentage means, standard deviation, and frequency table.

Crop diversification was then measured using the Entropy index of crop diversification given as;

$$EI = \sum_{i=1}^{n} p_i \log p_i$$

Where, P_i is the area share or proportion of crop i out of the total area cultivated.

The examination of the determinants of crop diversification was addressed through application of a Tobit regression model. The Tobit model allows for the estimation of linear relationships between variables when there is either left- or right-censoring in the dependent variable. The farm level Entropy Index values are used in the regression model to show the relationship between the measurement of crop diversification and socioeconomic characteristics of farmers. The determinants of farm crop diversification are assessed using the following multiple regression function:

$$EI = ß_0 + ß_1 HHAge + ß_2 HHGender + ß_3 HSIZE + ß_4 FARMSIZE + ß_5 LANDHRTD + ß_6 LABHIRED + ß_7 MARKET + ß_8 AREACULT + ß_9 PCCROP + ß_{10} FARMINVEST + \mu_t$$

Table 2 below presents the variables used in the Tobit regression together with their a priori expectations.

Table 2: Description of Variables -Tobit regression model

Variable	Variable Description	Hypothesis
	Dependent Variable	
EI	Entropy Index	
	Independent/Explanatory Variables	
HHAge	Age of head of household in years	-
HHGender	Dummy variable for gender of household head: 0 = Female headed; 1 = Male headed	+
HSIZE	Household size	+
FARMSIZE	Total farm size in hectares	+
LANDHRTD	Dummy variable for access to inherited land: 0 = No; 1 = Yes	+
LABHIRED	Dummy variable for use of hired labour: 0 = No; 1 = Yes	+
MARKET	Access to markets: 0 = No; 1 = Yes	+
AREACULT	Total area being cultivated in hectares	+
PCCROP	Dummy variable on whether farm produces cash crops: 0 = No; 1 = Yes	+
FARMINVEST	Dummy variable for basic farm investment in farming equipment: 0 = No; 1 = Yes	+

5. RESULTS AND DISCUSSION

5.1. Demographic characteristics

Fifteen percent of the sampled households were female headed. Male headed households are more likely to be more diversified than female headed households as diversification often require skill and there are also high demands for frequent and early ploughing (Mesfin *et al*., 2011 and Fetien *et al*., 2009).

Forty-seven percent of the household heads are aged 50 years and above compared to 53 percent who were aged below 50 years (Table 3). The number of households with heads below 50 years is more than double for male headed households compared to female headed households. Age is one of the factors that influence farm production decision making. Elderly farmers tend to look at farming as just a way of life, whereas young farmers may be more inclined to look at farming as a business opportunity in order to financially support their families and self-employment creation. Previous studies suggest that older farm operators are less likely to diversify (Mishraand El-Osta, 2002).

Table 3: Distribution of age of head of household by gender

Head of Household	Percent Households		
Age Category (Years)	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
≤ 50	22.2	58.8	53.3
>50	77.8	41.2	46.7

The mean household size was 8.97 with a minimum of 3 and a maximum of 22. Thirty percent of the households have up to 6 members per households while 18.3 percent of the households have household sizes above 12 members (Table 4). None of the female headed households have more than 12 household members while 72.6 percent of the male headed households have more than 6 household members compared to 55.6 percent of female headed households. The maximum household size for male headed households is almost twice that for female headed households.

Family size is more likely to positively influence crop diversification as larger families are more likely to also have a larger family labour pool (Abdalla *et al*., 2013, Weiss & Briglauer, 2000, Benin *et al*., 2004). Culas 2006) also found that increased use of both family and hired labourpositively influences crop diversification.

Table 4: Distribution of household size by gender

Household Size Category (Number of Members)	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60+
≤6	44.4	27.5	30
> 6≤ 12	55.6	51	51.7
>12		21.6	18.3
Mean	6.89	9.33	8.97
Minimum	3	3	3
Maximum	12	22	22

5.2. Farm size

The mean farm size for the sample is 6.2 hectares with a minimum of one hectare and a maximum of 20 hectares (Table 5). Female headed households have an average farm size of 4.2 hectares compared to 6.6 hectares for male headed households. The maximum land size for male headed households (20 hectares) is twice that for female headed households (10 hectares). A majority of the female headed households (77.8%) have farm sizes of 5 hectares and less while more than 50 percent of the male headed households have farm sizes greater than 5 hectares.

Table 5: Distribution of farm size by gender

Farm Size Category (Hectares)	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
≤ 5	77.8	43.1	48.3
>5 ≤ 10	22.2	45.1	41.7
>10		11.8	10
Mean	4.22	6.55	6.20
Minimum	1	2	1
Maximum	10	20	20

Previous studies have shown that there is a positive relationship between diversification activities and farm size (Weiss & Briglauer, 2000, Benin *et al.,* 2004, Mwangi *et al*., 2011,Mishraand El-Osta, 2002; Fetien *et al*., 2009; Culas and Mahendrarajah, 2005). Thus male headed households in this study are expected to be more diversified than female headed households as the majority have larger farms when comapred to female headed households.

Ninety-seven percent of the households indicated that they have access to inherited land and only 3 percent have no access. Access to inherited land increases the landholding for a household and this is expected to have positive effect on diversification. Limited or no access to inherited land is assumed to have a limiting effect on crop diversification.

The mean area cultivated is 4.4 hectares and the minimum is 0.9 hectares and the maximum is 11.7 hectares (Table 6). The mean area cultivated by male headed households is twice that cultivated by female headed households while the maximum area cultivated by male headed households is 3 times that cultivated by female headed households.

Table 6: Area cultivated by gender

Area Cultivated Category (Hectares)	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
≤ 3	77.8	25.5	33.3

>3≤ 6	22.2	54.9	50
> 6		19.6	16.7
Mean	2.2	4.8	4.4
Minimum	0.9	1.3	0.9
Maximum	3.6	11.7	11.7

5.3. Hired labour

Seventy percent of the households indicated that they do not use hired labour (Table 7). The percent male headed households indicating using hired labour is higher (31.4%) than that for female headed households (22.2%).

Table 7: Use of hired labour by gender

Use of hired labour	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
No	77.8	68.6	70
Yes	22.2	31.4	30

5.4. Market availability and access

Seventy-five percent of the households indicated that they have access to agricultural markets for both inputs and their produce (Table 8). The female households (44.4%) with no access to agricultural markets are twice for male headed households (21.6).

Table 8: Access to agricultural markets by gender

Access to agricultural markets	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
No	44.4	21.6	25
Yes	55.6	78.4	75

Previous studies on farm diversification highlighted the importance of proximity to main roads and markets for development of other farm enterprises (Benin *et al*., 2004 and Joshi *et al*., 2003). Crop diversification in recent years has been market driven and markets are therefore considered to be an important determinant of crop diversification.

5.5. Farm investment

Ninety percent of the households indicated that they have invested in the basic farming equipment (Table 9). However, the percent female headed households indicating not having invested in basic farming equipment is almost three times that for male headed households.

Table 9: Farm investment in basic farming equipment by gender

Investment in basic agricultural farming equipment	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
No	22.2	7.8	10
Yes	77.8	92.2	90

Farmers who own more farm tools and implements are more likely to diversify than those with fewer basic farm tools (Mishraand El-Osta, 2002 and Babatunde and Qaim, 2009).

5.6. Cash crop production

Less than half of the sampled farmers indicated producing cash crops while 90 percent of the female headed households indicated not producing cash crops and this compares to 47 percent for male headed households (Table 10).

Table 10: Cash crop production by gender

Produces cash crops	Percent Households		
	Female Headed (n=9)	Male Headed (n=51)	Total (n=60)
No	88.9	47.1	53.3
Yes	11.1	52.9	46.7

5.7. Crop production and extent of crop diversification

Twelve different crops are being grown among the co-operators in Dundwa Agricultural camp (Figure 2). All the households grow maize and groundnuts and the percent male headed households growing sweet potatoes, sunflowers, cotton, vegetables, soyabeans, cassava and sorghum is higher than that for female headed households. On the other hand, the percentage of female headed households producing cow peas, sugar beans and round nuts is higher than that for male headed households.

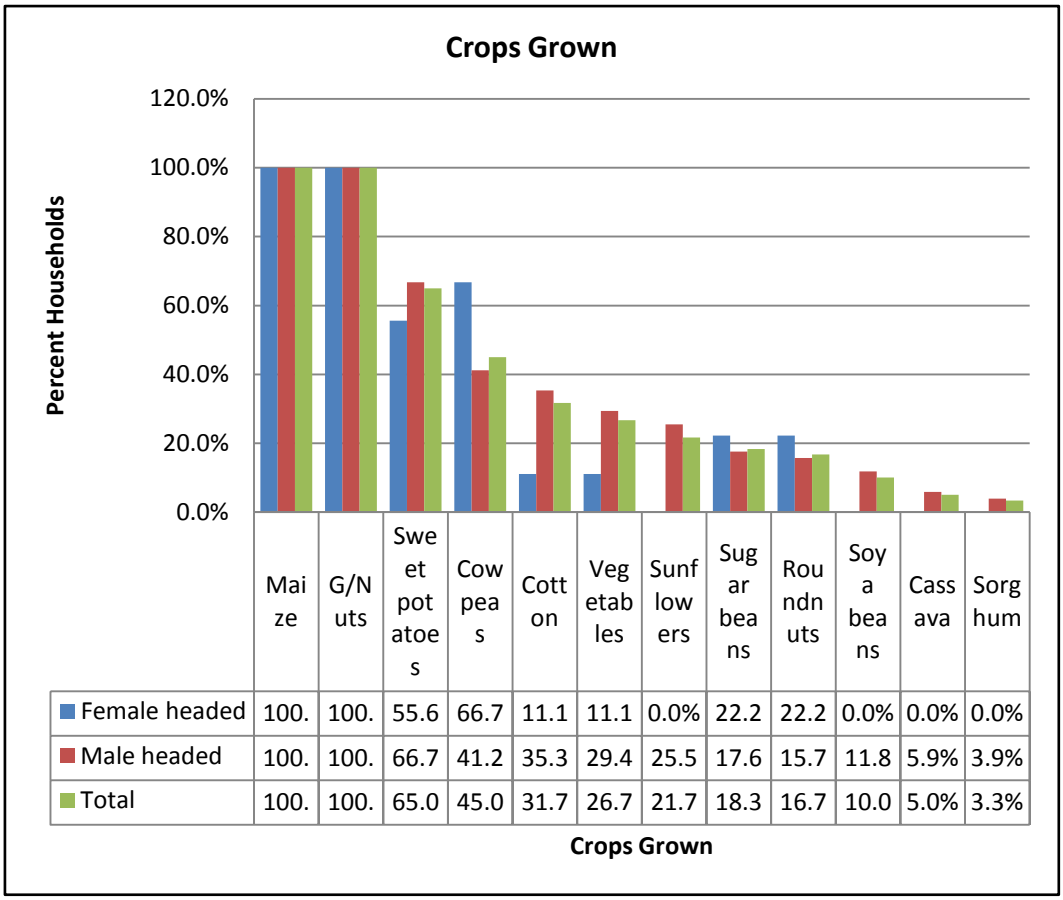

Figure 2: Crops being grown by farmers at Dundwa Agricultural Camp

The mean number of crops being grown is 4.4 with a minimum of 2 and a maximum of 7. Thus none of the sampled households at Dundwa Agricultural Camp are practicing mono-cropping and over 80 percent are growing at least 4 crops (Figure 3)

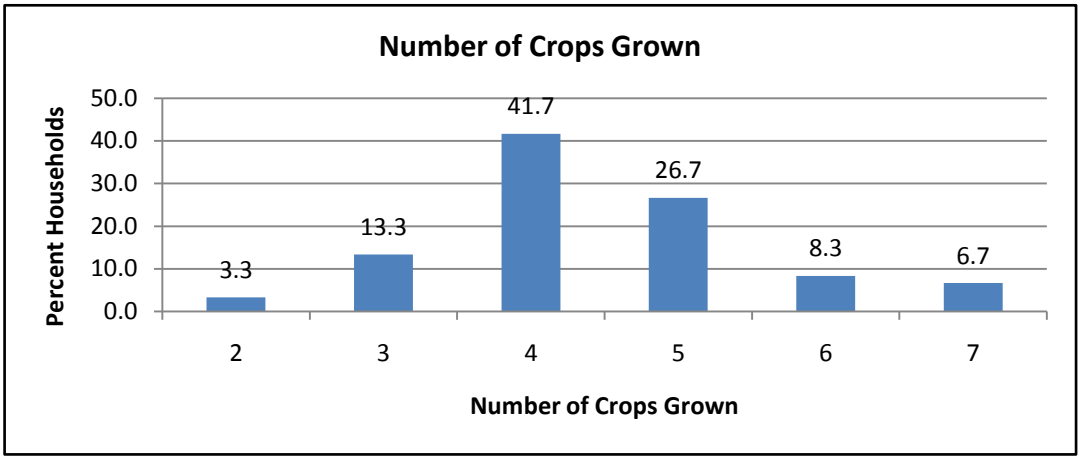

Figure 3: Percent households growing different crops

The mean entropy index is 0.88 and 85% of the households have an diversification index of more than 0.6 showing that the sample farmers are highly diversified (Figure 4).

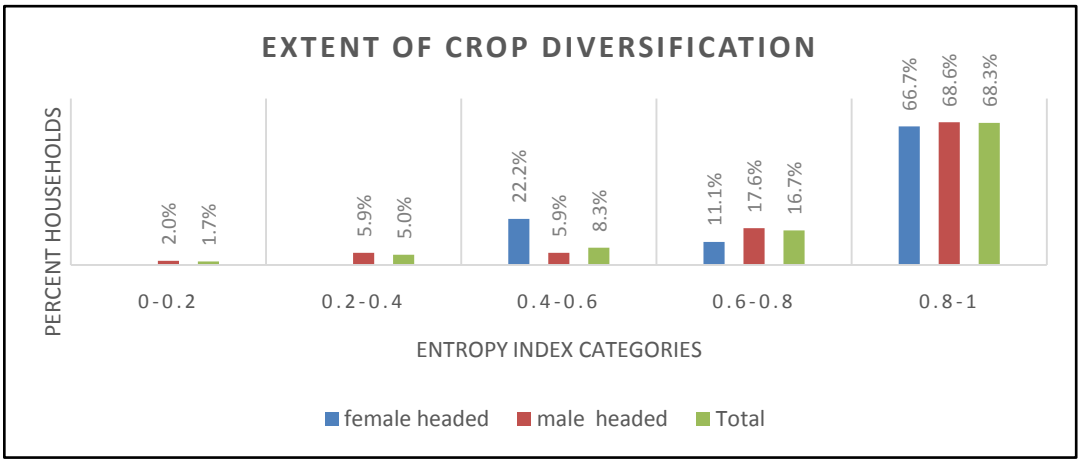

Figure 4: Distribution of crop diversification

The percent male households with a diversification index of more than 0.8 is similar to that of female headed households while the percent female headed households with a diversification index of 0.6 and below (22.2%) is almost 3 times that of male headed households.

5.8. Determinants of crop diversification

All the model variables have expected signs except for total farm size (FARMSIZE), access to agricultural markets (MARKET) and total area cultivated (AREACULT). The log likelihood for the fitted model is6.69 and the chi-square is 34.05 and strongly significant at 1% level. Thus the overall model is significant and the explanatory variables used in the model are collectively able to explain the variations in farm crop diversification.

The variables that do not significantly influence crop diversification at Dundwa Agricultural Camp are household size (HSIZE), access to inherited land (LANDHRTD), and access to hired labour (LABHIRED).

Variables that significantly and positively influence crop diversification are gender of the head of household (HHGENDER), the production of cash crops by the household (PPCROP) and

household investment in basic farming equipment (FARMINVEST). On the contrary the age of the head of household (HHAGE), total farm size (FARMSIZE), access to agricultural markets (MARKET) and total area cultivated (AREACULT) significantly and negatively influence crop diversification.

Table 11: Tobit regression estimates of factors influencing crop diversification

Variable	Coefficient	Std. Error	T	Sig.
Constant	0.684	0.208	3.290	0.002
HHAge	-0.110	0.067	-1.640	0.107
HHGender	0.165	0.100	1.660	0.103
HSIZE	0.012	0.009	1.350	0.182
FARMSIZE	-0.022	0.011	-1.940	0.058
LANDHRTD	0.166	0.163	1.020	0.312
LABHIRED	0.075	0.064	1.180	0.244
MARKET	-0.151	0.070	-2.140	0.037
AREACULT	-0.051	0.020	-2.580	0.013
PCCROP	0.198	0.063	3.150	0.003
FARMINVEST	0.216	0.097	2.220	0.031
Log likelihood = 6.69				
LRchi^2(10) = 34.05				
Prob>chi^2 = 0.0002				
Pseudo R^2 = 1.647				

The results indicate that male headed households are more diversified that female headed households and is significant at 10%. The probability of crop diversification is 16.5% higher for male headed households compared to female headed households. This result is supported by Akaakohol and Aye (2014), Fetien *et al*. (2009) and Mwangi *et al.* (2013).

Households producing cash crops have a 19.8% more probability of diversifying their crop production activities when compared to households not producing cash crops and the result is significant at 1%. The production of cash crops is more likely to give the farmer more income to invest in new cropping enterprises. This is consistent with the findings of Ibrahim *et al*. (2009) and Abdalla *et al.* (2013).

The study also found that having basic agricultural equipment has a positive and significant influence on crop diversification at the 5% level of significance. Households with basic agricultural equipment for their farming operations have a 21.6% more probability of crop diversification when compared to farmers without. Similar studies by Seng (2014), Mesfin *et al.* (2011), Mishra and El-Osta (2002) and Sichoongwe *et al*. (2014) also reported a positive relationship between possession of farm implements and machinery by a farmer and crop diversification.

The study further revealed age negatively and significantly affected crop diversification in the study area at 10% level of significance. A one year increase in age reduces the probability of crop diversification by 11%. This agrees with the findings of Ojo *et al*. (2014) and Bandara and Thiruchelvam (2008) who also found that a farmer's risk bearing ability reduces as his/her age increases.

Farmers with access to agricultural markets are 15% less likely to diversify their crop production when compared to farmers with no access to agricultural markets and this is significant at 5% level. This finding is consistent with Akaakohol and Aye (2014), Kankwamba *et al*. (2012) and Abebe (2013). However, previous studies by Benin *et al.* (2004), Mwangi *et al.* (2013), and Sichoongwe *et al*. (2014) found that access to agricultural markets positively influences crop diversification.

Finally, the study also revealed that crop diversification is negatively and significantly influenced by total area under cultivation. A one hectare increase in total area under cultivation reduced the probability of crop diversification by 5% and this result is significant at 5% level. This maybe because farmers already cultivating larger areas of current crop enterprises will not have enough time and labour to diversify into new crop enterprises.

6. CONCLUSION

This study aimed to find the extent of crop diversification and the determinants of crop diversification among cooperators at Dundwa Agricultural Camp using the entropy index and the Tobit regression model respectively. The study found that the farmers at Dundwa Agricultural Camp are highly diversified as shown by a mean entropy index of 0.88. The Tobit results show that gender of the head of household, the production of cash crops by the household and household investment in basic farming equipment positively and significantly influence crop diversification while the age of the head of household, total farm size, access to agricultural markets and total area cultivated were fund to significantly and negatively influence crop diversification. The study therefore recommends enhanced decision-making of the female headed households and promoting household investment in basic farming implements as measures to promoting crop diversification.

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