Rooting out hunger in Malawi with nutritious orange-fleshed sweetpotato: A baseline survey report. Blantyre, Malawi

K. Sindi[1], C. Kiria[1], J. Low[1], O. Sopo[2]* and P.E. Abidin[2]

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Executive summary

Deficiencies of micronutrients such as vitamin A are widespread, especially in Africa. In Malawi, vitamin A deficiency is a public health concern. About 60% of children under five, 57% of non-pregnant women, and 38% of men and school-age children have vitamin A deficiency. Orange-fleshed sweetpotato (OFSP), one of the crops biofortified for provitamin A using conventional methods, is high in beta-carotene (provitamin A) and it is a possible solution to VAD and undernutrition.

Sweetpotato is an important food staple in many countries of Sub-Saharan Africa. This is because most varieties tolerate drought better than most crops and this is often the crop that is relied upon in the event of other crops' failure. In Malawi, sweetpotato is increasingly becoming an important crop in terms of its contribution to food security. Owing to the fact that OFSP is drought tolerant, it can be used to address VAD and food insecurity. Access to clean planting material, however, remains a challenge in sweetpotato production. Past studies have shown that occurrence of viruses and diseases in sweetpotato drastically reduce its yields. Therefore, there is a need to ensure that clean planting material is used at all times.

This study was undertaken as a baseline study for the project 'Rooting Out Hunger in Malawi with Nutritious Orange-fleshed Sweetpotato'. The project aims to improve vitamin A and energy intake for at least 70,000 rural households with women and young children using OFSP-based approaches, and to ensure that at least 20% of households growing OFSP earn at least US$100 per year from OFSP sales, and increase their average sweetpotato yields by 50%. This will be achieved through: effective establishment of decentralized vine multipliers (DVM) and a media-based demand creation campaign of OFSP; increased effective demand by changing the perception of sweetpotato and development of fresh root marketing chains for OFSP; increased productivity and quality of sweetpotato by intensifying farming systems to ensure surplus production for sale; and increasing the Department of Agricultural Research Services' (DARS) capacity to produce clean tissue culture sweetpotato plantlets.

From the results, we find that the majority of the households produce sweetpotato on pure stands, and they mainly produce the tuber for household consumption. Of the total land holding, 97% was under crop production and OFSP accounted for 3%. Owing to the fact that most of the land holding is already under crop production, OFSP production can be achieved by intercropping it with other crops. Farmers therefore need to be advised and encouraged on the intercrop system.

Further, the results showed that there is a need for training in sweetpotato production and management systems. More than half of the farmers have not had any training in sweetpotato production and management systems, which could be seriously affecting their sweetpotato productivity.

Farmer-to-farmer exchange of sweetpotato planting materials was noted as the dominant seed dissemination system, although, after long dry periods, commercialized systems are noted among farmers who do not conserve seed. There is a need to develop a sweetpotato seed system in the area to ensure that clean planting material is available to farmers. This can be achieved by training local farmers in proper vine multiplication systems, which will increase sweetpotato productivity and, at the same time, be a source of income for the vine multipliers.

This study also finds that people have a positive attitude and perceptions towards OFSP and sweetpotato in general. About 59% strongly agreed that OFSP is more nutritious than WFSP, and 79% strongly disagreed that sweetpotato is food for women and children only. On the other hand, however, more than a third of the respondents would eat less sweetpotato if they became richer. This may be an indication that consumption of sweetpotato is associated with being poor. Changing the perception that people have of sweetpotato and OFSP generally is vital in increasing consumption of OFSP, which would help alleviate VAD.

Dietary diversity results revealed a high dependence on starchy staples which do not have

vitamin A. Overall, more than 90% of both household members and children were highly

dependent on these starchy staples. Furthermore, more than half of households and children have

low dietary diversity, which is an indication of insufficient consumption of micronutrients.

Increased consumption of OFSP in the intervention area would diversify their food basket, which

would raise their food diversity level.

Acknowledgements

The project "Rooting out Hunger in Malawi with Nutritious Orange-fleshed Sweetpotato" gratefully acknowledges the leadership and support by the Government of Malawi that has enabled the project to implement its activities and has spearheaded sweetpotato development in the country. The project equally acknowledges the continued financial support from Irish Aid who has provided funding for this Baseline Survey.

The Baseline Survey was carried out through government agricultural staff in District Agriculture Development Office in Dedza (Enock Mthepheya, Lughano Tomoka), Zomba (Francis Mpeketula), Chikhwawa (L.Y. Lipenga) and Phalombe (Brazio Mphepo) districts, and through Agriculture Extension Development Coordinators and Agriculture Extension Development Officers who participated directly or indirectly in the targeted Extension Planning Areas. Civil society implementing partner organizations and their staff provided important institutional support to the research teams at community level, and we thank in particular Concern Universal in Dedza and Phalombe (namely Lovely Chizimba, Hazel Mwalwembe and Themba Madise), Millennium Villages project in Zomba (Phelire Nkhoma and Timothy Kamlingeni), and the Catholic Development Commission of Chikhwawa Diocese (Mr. Raymond Chimsale and the late Mr. Chaima).

Research assistants Dziwani Kambauwa, Sophie Matete, Isaac Jambo, Vitumbiko Zgambo, Grace Wani and Gladys Chisusu, who conducted the individual interviews and contributed to data entry, demonstrated great commitment and skills, and the Survey would not have been successful without them. At CIP, special thanks for technical and institutional support go to Dr Sindi Kirimi, Dr Jan Low, Dr Paul Demo, Mr. Snowdean Njiwa, and Mr. Owen Sopo. We are also grateful to Mrs. Brandy Wood for editing the report.

Last but not least, the project would like to thank all the farmers who spared their precious time to participate in the individual interviews. The invaluable information collected from them and presented in this report has gone a long way in providing benchmarks for monitoring and evaluation and useful insights that have helped shape future implementation strategies.

January 2013

Dr. Putri E Abidin – Project Leader – CIP, Malawi

Acronyms

AE	Adult equivalent
DVMs	Decentralized Vine Multipliers
EPAs	Extension Planning Areas
FAO	Food and Agriculture Organization
FCS	Food consumption score
Ha	Hectare
HDD	Household dietary diversity
HDDS	Household dietary diversity score
HH	Household
IDD	Individual dietary diversity
IDDS	Individual dietary diversity score
kg	Kilograms
km	Kilometers
MwK	Malawi Kwacha
NGOs	Non-Governmental Organizations
OFSP	Orange-Fleshed sweetpotato
SARRNET	Southern Africa Root Crops Research Network
SSA	Sub-Saharan Africa
US$	United States of America Dollar
VAD	Vitamin A deficiency
WFSP	White-Fleshed Sweetpotato
WHO	World Health Organization
WFP	World Food Program

1. INTRODUCTION

1.1 Background

Malnutrition remains a serious problem in Sub-Saharan Africa (SSA), the only region in the world where both the number and the proportion of malnourished children is on the rise. Each year, more than four million children under the age of five die in Sub-Saharan Africa and malnutrition causes 55% of these deaths (UNICEF, 2007). Across the developing world, 178 million or 32% of children under five years are stunted and 112 million or 20% of the children under five years are underweight (Black, *et. al*., 2008). The region has difficulty matching its food production with its population growth. People are malnourished if their diet does not provide adequate calories, protein and micronutrients for growth and maintenance, or if they are unable to fully utilize the food they eat due to illness (under-nutrition) (UNICEF, 2006). One of the major nutritional problems facing developing countries is micronutrient deficiency, in particular of vitamin A deficiency (VAD) (West & Darnton-Hill, 2001), which predominantly affects low-income groups (Ruel, 2001). VAD is a leading cause of early childhood death and a major risk factor for pregnant and lactating women. Globally, it is estimated that 250 million children are vitamin A-deficient, putting them at risk of night blindness and other related diseases.

In Malawi, vitamin A deficiency is a public health concern. About 60% of children under five, 57% of non-pregnant women, and 38% of men and school-age children have vitamin A deficiency (MOHP, 2003). The Malawian government has been distributing vitamin A capsules to malnourished children and lactating mothers to reduce vitamin A deficiency in the country. Supplementation as a method of reducing micronutrient deficiency, however, is a short-term, limited and unsustainable solution. Where supplementation is used as a long-term solution, deficiencies may reoccur in times of economic or political crisis, indicating that supplementation efforts may be subject to the effects of social instability (Underwood, 1999).

Other approaches used to alleviate micronutrient deficiencies include diversification of food production, fortification and biofortification. Orange-fleshed sweetpotato (OFSP) is an example of a bio-fortified crop, in which the micronutrient status of staple foods is enhanced through plant breeding to the point where impact on micronutrient status can be achieved (Bouis, 2002). Biofortification, the improvement of the nutritional quality of staple foods, has high potential to alleviate micronutrient deficiencies and is relatively cheap (Bouis, 1999, Meenakshi, *et.al*., 2010). The OFSP biofortified for provitamin A using conventional breeding methods, released and promoted in many African countries (Low, *et. al*., 2007). Traditionally, sweetpotato cultivars have

pale-colored flesh. OFSP cultivars are high in beta carotene (provitamin A) which is important in addressing VAD and undernutrition. It can supply significant amounts of vitamin A and energy simultaneously.

Sweetpotato forms part of the world's most important and versatile food crops. With annual production of about 107.3 million tons; it is recorded as the fifth most important food crop in developing countries (FAO, 2009). This tuber is an important food security crop worldwide. In Africa, sweetpotato is the second most important tuber crop after cassava, with its production concentrated in the Eastern and Southern Africa countries. Sweetpotato production is projected to expand in Africa, and has been increasing steadily in importance in most countries in Eastern and Southern Africa.

In Malawi, sweetpotato is increasingly becoming an important crop in terms of area planted and its contribution to food security. A food security study undertaken in 2002 by Southern Africa Root Crops Research Network (SARRNET) revealed that there is high demand of the tuber on the fresh market in both the urban and the rural area (SARRNET, 2003). The increase in demand could be explained by the rising levels of poverty in both rural and urban centers, such that most households are looking for cheaper foodstuffs to replace what have become luxury foods. Furthermore, to the producers, the following advantages of sweetpotato are documented: tolerance to drought, capacity to provide yields in agro-ecologies and seasons where other crops would fail, low requirements for external inputs such as fertilizers, flexibility in planting and harvesting, convenient in-ground storability, low demands on soil nutrients, and reduction in soil erosion (SARRNET, 2003).

1.2 Research aims and objectives

This study was undertaken as a baseline study for the project '*Rooting out hunger in Malawi with nutritious Orange-fleshed sweetpotato'* funded by Irish Aid. The baseline study will eventually help in assessing the impact of the intervention on the households in the intervention area.

The overall objective of the project is to improve vitamin A and energy intake for at least 70,000 rural households, with women and young children using OFSP-based approaches; and to ensure that at least 20% of households growing OFSP earn at least US$100 per year from OFSP sales, and increase their average sweetpotato yields by 50%.

The specific objectives of the project by the end of the project, as laid out in the project document are:

a. To improve vitamin A intake for vulnerable rural groups in Malawi through the effective establishment of decentralized vine multipliers and media-based demand creation.
b. Increase effective demand by changing the perception of sweetpotato; develop fresh root marketing chains for OFSP in the Blantyre market; and reduce fluctuations in overall sweetpotato supply to the fresh market.
c. Increase the production and quality of sweetpotato by intensifying farming systems to ensure surplus production for sale and decrease the length of the hunger season.
d. Increase the capacity of DARS to produce clean, tissue culture sweetpotato plantlets, maintain primary multiplication sites, and design and conduct seed systems and integrated crop management research.

2. DESCRIPTION OF THE STUDY AREA, RESEARCH METHOD AND DATA

2.1 Area of study

The study was undertaken in four districts of Malawi; Dedza, Zomba, Chikhwawa and Phalombe. These are the four districts where the *Rooting out Hunger* project has set up its program. Dedza lies in the Central region of the country, while the other three districts are in the Southern region. Both of these regions are dominated by the matrilineal system, where husbands leave their homes to live with the wives' family, and cultivation rights are inherited by the wives. In total, two regions, four districts, eight EPA's, 70 villages and 484 households were visited, as tabulated in Appendix A.

2.2 Sampling and data collection

The survey was conducted between September and October 2010. A total of 484 households were interviewed from four districts in two regions of Malawi, as earlier mentioned. Selected households were in two categories; target and control groups. Target households were households in the areas where project partners were in existence and control households were in areas where project partners were not working.

The study was undertaken by the International Potato Centre (CIP), through government agricultural staff in the District Agriculture Development Office (DADO) in Dedza districts, Agriculture Extension Development Coordinators and Agriculture Extension Development Officers (AEDO), who participated directly or indirectly in the targeted Extension Planning Areas-;, and implementing partner organizations Concern Universal in Dedza and Phalombe, Millennium Villages Project in Zomba, and the Catholic Development Commission of Chikhwawa Diocese.

For households to qualify to be in the study they had to be sweetpotato farmers with children below five years, the group most vulnerable to VAD. All eligible households in the four districts were listed and then randomly sampled to attain the said sample size of 484 households.

Both qualitative and quantitative data were collected using structured questionnaires, specifically designed for this study. Moreover, enumerators who administered these questionnaires were trained on how to collect data using the questionnaires. Prior to data collection, the questionnaires were pretested to ensure that all enumerators were conversant with their usage and also to ensure that all questions were flowing as required.

The targeted respondents in this study were mainly women, who are supposedly the main people concerned with sweetpotato production and the primary food providers. In very few cases where there was no woman in the household, or no woman was available, the husband was interviewed. In each household, the respondent was asked identification questions and questions about household capital, income, agricultural production, participation in social networks, perceptions and attitude on sweetpotato, practice for sweetpotato, and vitamin A knowledge. Also, they were asked questions on food diversity and food security. Then, the respondent was asked questions on characteristics of his/her main house and the household's assets.

After data collection, the information was double-entered in CSpro software, and then transferred to SPSS statistical software where cleaning and analysis were done. During data cleaning, consistency checks and other checks were performed.

3. HOUSEHOLD DEMOGRAPHIC RESULTS AND DISCUSSIONS

In this section, demographic characteristics of the household heads and respondents are presented. First, characteristics of the household heads of the sampled households, respondents and their farms will be presented. Then, their farming characteristics will follow.

3.1 Characteristics of household heads, respondents, their households and their farms

Farmers differed slightly in their characteristics by study area within the sampled population. The average household size was 4.9 members in Dedza and Zomba, 5.8 members in Chikhwawa and 5.6 members in Phalombe (Table 3.1). Overall, all the households in the sampled population had an average of 5.3 members. Adult equivalents (AE) in each household were calculated by assigning a value of 1.0 to all household members over 14 years of age and a value of 0.5 to all younger household members, leading to 2.9 AE in Dedza, 3.0 in Zomba, 3.3 in Chikhwawa and 3.2 in

Phalombe. Overall, all the sampled households in the four districts had an average AE of 3.1. The difference between the average household size and the average AE reflects the larger number of young children in the sampled households.

Table 3.1: Characteristics of households in study areas

Districts	N	Household size			
		Members		Adult equivalents*	
		Mean	Median	Mean	Median
Dedza	118	4.9	5.0	2.9	2.8
Zomba	127	4.9	5.0	3.0	2.5
Chikhwawa	112	5.8	6.0	3.3	3.0
Phalombe	127	5.6	5.0	3.2	3.0
Overall	484	5.3	5.0	3.1	3.0

*A household member over 14 years old was assigned one adult equivalent. A household member aged 14 years or less was assigned 0.5 adult equivalents.

Zomba had the highest proportion of female-headed households (16.5%), followed by Dedza (14.4%), Phalombe (8.7%) and Chikhwawa (8.0%) as shown in Table 3.2. Household heads in all the four districts were relatively young with an average age of 36.2 years. The heads of households in Phalombe district were the youngest (35.2 years), followed closely by those in Dedza (35.5 years), then in Zomba (36.0 years), and finally the Chikhwawa household heads (38.5 years). Average education levels were quite low across districts, ranging from an average of 4.8 years in Dedza, to over 5.6 in Chikhwawa, 6.3 in Phalombe to 6.9 years in Zomba. Overall, heads in all the households had an average of six years of education, indicating that most of the household heads had not finished primary education.

Table 3.2: Characteristics of household heads in study areas

Districts	Household head				
	% female (n=484)	Age (years) (n=435)		Education (years) (n=484)	
		Mean	Median	Mean	Median
Dedza	14.4	35.5	33.0	4.8	4.5
Zomba	16.5	36.0	34.0	6.9	8.0
Chikhwawa	8.0	38.5	38.0	5.6	6.0
Phalombe	8.7	35.2	33.0	6.3	6.0
Overall	12.0	36.2	34.0	6.0	6.0

The majority of the household heads in all the four districts were married (89.8%), (either monogamous or polygamous marriage), and only 1.9% of the household heads were single (Figure 3.1). This shows that the family unit is strong in the sampled population, which will be an

important factor to consider during the promotion of OFSP in the area of study. It will guide in the selection of the appropriate messages to be passed on to the people.

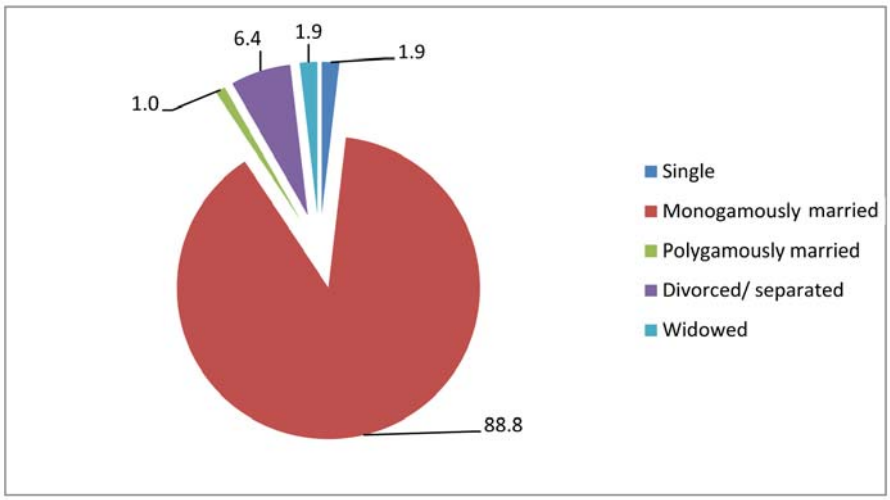

Figure 3.1: Marital status of household heads
N=484

Most of the respondents in the entire sampled population were female (77.3%). The trend is similar across the four districts, ranging from 75.4% in Dedza to 78.7% in Zomba and Phalombe (Table 3.3). The project has a particular focus on women and children (the group most vulnerable to VAD). Therefore, getting responses from women was important for the project so that promotion of OFSP can be done as desired by women in the target area.

Respondents in the area of study were relatively young, as was the case with household heads. Phalombe had the youngest respondents (31.3 years) while respondents in Chikhwawa had an average of 34 years (Table 3.3). Overall, respondents in all the four districts had an average of 32.6 years. The level of education among the respondents was equally low. On average, all the respondents had 4.7 years of formal education, which shows that the majority of them had not completed primary education. The trend was similar across the four districts of study, with Chikhwawa respondents having the lowest level of education (3.4 years), and respondents in Zomba having the highest level of education (5.9 years); though still lower than primary education.

Table 3.3: Characteristics of respondents in study areas

Districts	Respondents				
	% female (n=484)	Age in years	(n=459)*	Years of formal education (n=484)	
		Mean	Median	Mean	Median
Dedza	75.4	32.4	29.0	4.0	4.0
Zomba	78.7	33.0	31.0	5.9	6.0
Chikhwawa	75.9	34.0	33.0	3.4	3.0
Phalombe	78.7	31.3	29.0	5.2	5.0
Overall	77.3	32.6	31.0	4.7	5.0

* 25 respondents could neither remember their age nor when they were born

The majority of the respondents were spouses of the household heads (67%), whereas 33% were household heads themselves, and only 0.2% was either a brother or sister of the household head (Figure 3.2). Interviewing the household head or spouse was important in this study since the study rotated around the daily happenings at the household, household food consumption, crop production activities, and also demographic characteristics of the household. Therefore, to ensure that information was correct, a member of the household who plays a part in household decision making was the right person to be interviewed. Moreover, it was critical for the project since it would give an idea of level of nutritional awareness, attitude, behavior, and practices of a main decision maker in the household. This would help the project to know whether more awareness is needed in the study areas or not.

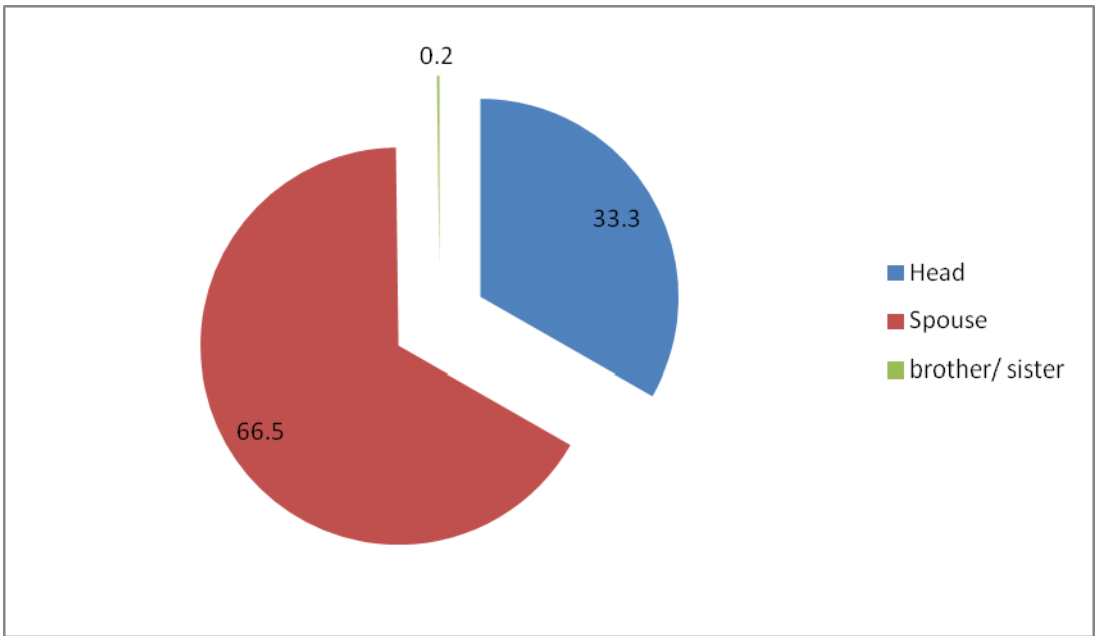

Figure 3.2: Relationship of respondents to household head

As shown in Figure 3.3, agriculture was the principal activity for the majority of the household heads in the sampled population (83.1%). About 15.7% reported agriculture as their secondary activity and only 1.2% of the household heads were not involved in agriculture. This was expected because the survey targeted households in the rural areas, most of which are farm households.

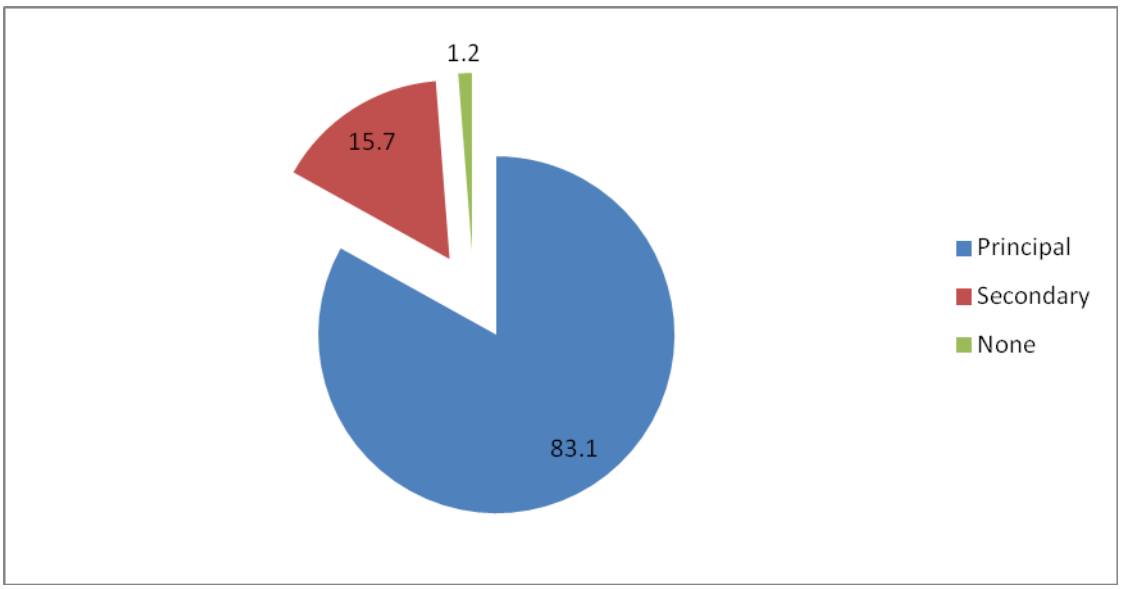

Figure 3.3: Whether agriculture is the principal or secondary activity of the household head

Further analysis on the importance of different economic activities to households in the study area revealed that agriculture was the most important source of income (Table 3.4). About 67.2% of the respondents reported sale of agricultural products as the highest income earner, and 22.3% as the second highest income earner. Only 5.6% of the interviewed respondents reported the sale of agricultural products not to have fetched any income in their households. Casual labor was reported as the second highest income earner (26.7%) and also the third highest income earner (16.9%).

From the study area, there is a clear indication that the majority of the households were not in any kind of formal employment, but relied heavily on farming for their income. Therefore, a project like '*Rooting out hunger in Malawi with nutritious OFSP',* which seeks to increase the productivity and quality of Sweetpotato, and specifically OFSP, in these rural areas, thereby increasing surplus for sale, will have a big impact on the rural communities in the targeted areas.

Fish sales fetched the least income, with 99% of the respondents having reported no income from this activity. Other economic activities reported by respondents to have fetched some income for the family include; sale of horticultural crops and fruits, sale of products like milk and eggs, sale of animals, salaries, self-employed activity outside agriculture such as trading and sale of charcoal,

and remittances or pensions. The importance of these economic activities was, however, not comparable to the sale of agricultural products.

Table 3.4: Proportions of respondents indicating Importance of different economic activities in the households

Cash income activity	Highest income earner	Second highest income earner	Third highest income earner	Lower than third highest income earner	No income
Sale of agriculture products	67.1	22.3	4.3	0.6	5.6
Horticultural crops and fruit sales	5.2	4.3	7.2	2.1	81.2
Sale of products like milk, eggs	0.4	0.4	0.6	0.2	98.3
Animal sales	2.1	8.3	5.2	4.3	80.2
Fish sales	0.0	0.0	0.6	0.4	99.0
Salaried work	5.0	5.6	0.8	0.6	88.0
Self-employed activity outside agriculture, such as trading, sale of charcoal	9.5	17.4	4.3	0.8	68.0
Received remittances or pension	0.8	1.9	4.1	3.1	90.1
Casual labor	9.9	26.7	16.9	3.3	43.2

N=484

To understand the level of wealth accumulation (or poverty incidence) among households in the area of study, several criteria were used. First, value of households' assets was calculated for each household in local currency (MwK) and then converted to US dollars using the average conversion rate during the survey period (October to November 2010). This was then analyzed by district. Households in Dedza had the highest asset value, US$ 110.6, while those in Zomba had an average of US$ 84.5, those in Chikhwawa US$ 73.6, and those in Phalombe only US$ 61.5 (Table 3.5).

Table 3.5: Household asset value in Malawi Kwacha and US $ per district

District	Mean (MwK)	Mean (US$)	Median (MwK)	Median (US$)
Dedza	16887.8	110.6	8700.0	57.0
Zomba	12907.4	84.5	7850.0	51.4
Chikhwawa	11243.4	73.6	7300.0	47.8
Phalombe	9385.4	61.5	6555.0	42.9
Overall	12566.3	82.3	7275.0	47.7

1 MwK= US $ 0.00655
N=463

Secondly, an analysis of the type of roofing material for the household's main house was made. Most of the households in the study area had grass thatched roofs (77.5%) compared to other types of roofing material (Figure 3.4). This could be an indication of low wealth accumulation in those households. Dedza had the highest number of households whose main house roof was grass thatched (94.1%) followed by Zomba (76.4), then Chikhwawa (72.3) and Phalombe (67.7). On the other hand, Phalombe had the highest percentage of households with houses roofed with iron sheet (32.3%), followed by Chikhwawa (25.9%), then Zomba (23.6%) and Dedza (5.9%). Only 1.8% of households in Chikhwawa had houses roofed with palm leaves.

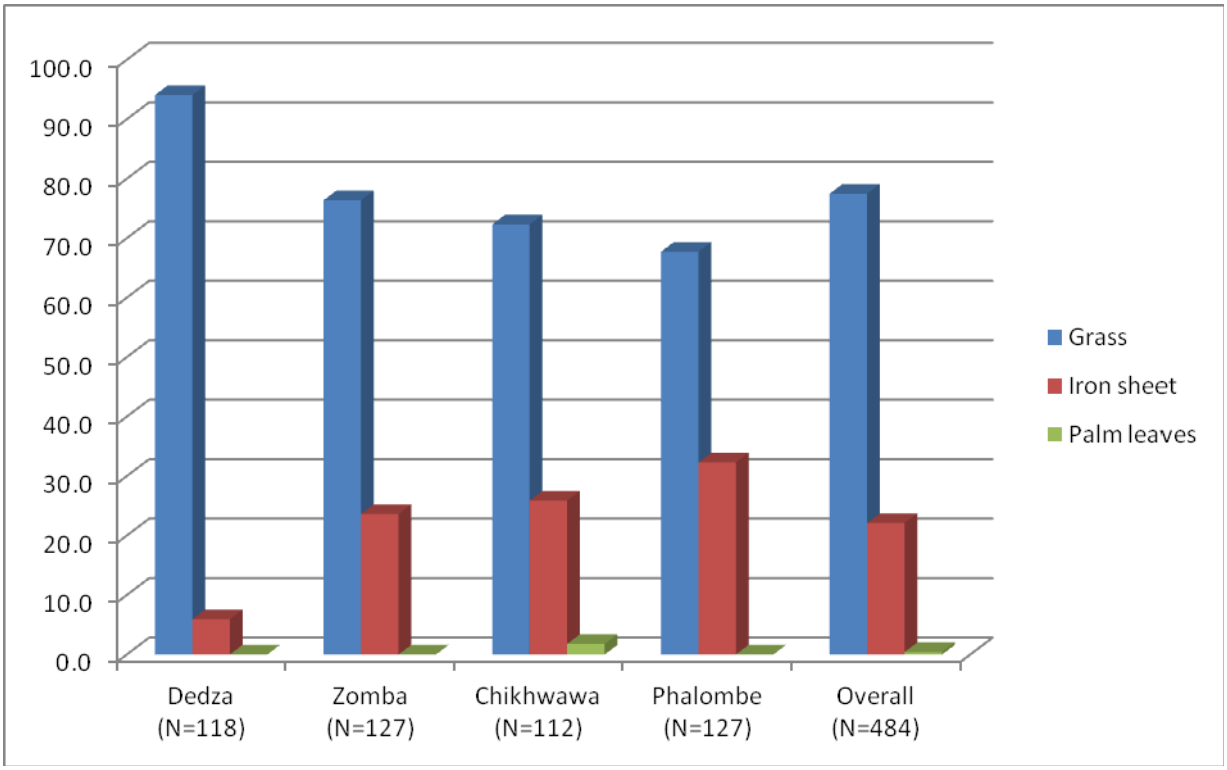

Figure 3.4: Percentage of households with different types of roofing for main house by district

There lies a clear difference between households in Dedza and those in Phalombe. Phalombe district has the lowest percentage of households with grass-thatched roof (67.7%) and the highest number of households with iron sheet roof (32.3%). In contrast, Dedza district had the highest number of households with grass-thatched roof (94.1%) and the lowest percentage of households with iron sheet roof (5.9%). This could be an indication of lower wealth accumulation in Dedza than in Phalombe.

Table 3.5 shows that Dedza households have the highest asset value among the four districts, yet in Figure 3.4, Dedza district has the highest number of households with grass-thatched houses. On the other hand, households in Phalombe district have the lowest asset value, yet in Figure 3.4,

Phalombe district has the lowest number of households with grass-thatched houses. This discrepancy could be a result of respondents overestimating the value of their assets. Further analysis on indicators of wealth accumulation was performed to ascertain this.

Analysis on the type of wall for the household's main house was also done to further understand the households. Just as previously noted in Figure 3.4, Dedza had the highest number of households whose main house was made of mud (73.1%), and the lowest percentage of households with houses made of bricks or stones (9%) as shown in Figure 3.5. On the other hand, Phalombe district had the lowest number of households whose main house was made of mud (10.1%), and the highest percentage of households with houses made of bricks or stones (86.1%). This could be a further indication of poverty incidence in Dedza district compared to Phalombe district.

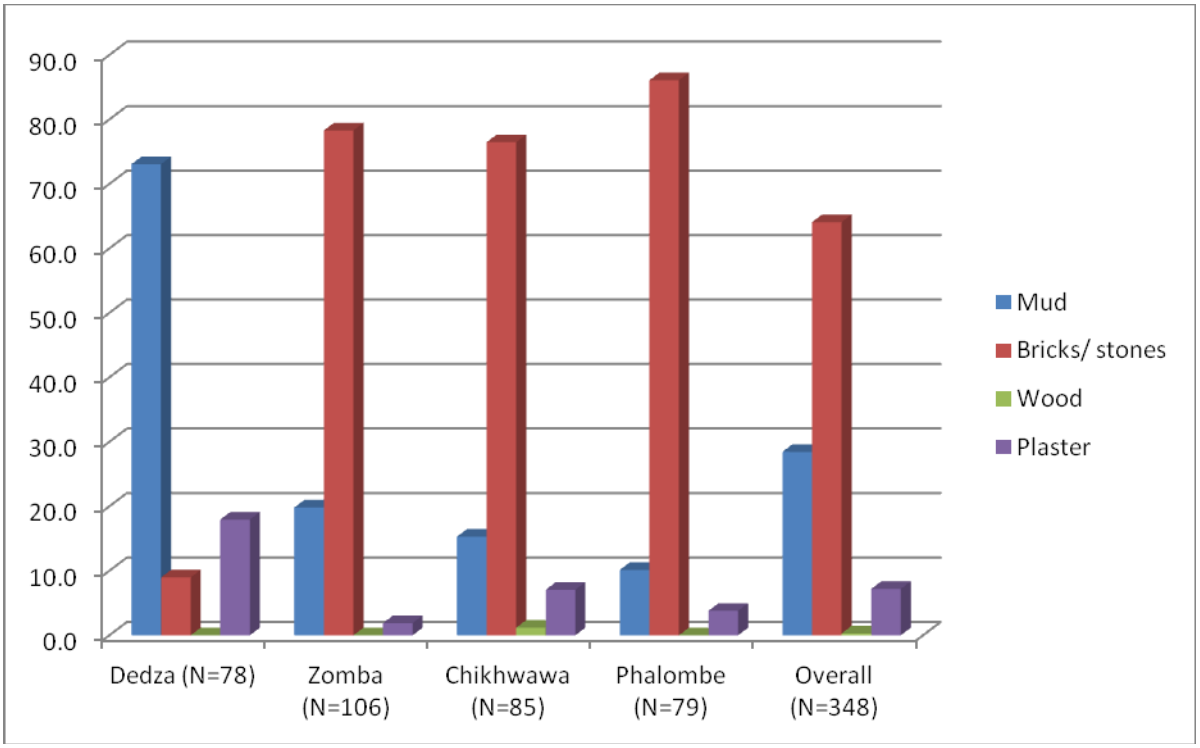

Figure 3.5: Percentage of households with different type of wall for main house by district

In Zomba district, 78.3% of the households had houses made of bricks/stone walls, 19.8% mud and 1.9% plastered[1] walls. In Chikhwawa district, 76.5% of the households had houses made of bricks/stone walls, 15.3% mud, 7.1% plastered walls and 1.2% walls made of wood.

[1] In this study, a plastered wall is defined as a mud wall with a cement plaster finishing, on both the inside and the outside of the house

3. MARKET ACCESSIBILITY AND MEMBERSHIP TO GROUPS

4.1 Accessibility to markets

The importance of infrastructure in agriculture and rural development is well documented. It is estimated that 15% of crop produce is lost between the farm gate and the consumer in the world because of poor roads and inappropriate storage facilities alone, adversely affecting the income of farmers (World Bank, 1997). Strengthening rural infrastructure can lead to lower production costs which can further augment agricultural output and income for rural farmers.

Distances to both inputs and output markets have a direct effect on agriculture marketing through the cost of transport and other transaction costs, hence affecting the marketing margins. More so, the distance to the inputs markets has a direct effect on agricultural production as it affects the accessibility of the markets and also the cost of inputs.

In this study, farmers in the study area were reported to cover an average distance of 2.7 km to the nearest market where they could buy or sell farm produce (Table 4.1). Those from Dedza district were reported to cover the largest distance to the output market (4.1 km) compared to those in Zomba (2.3 km), Chikhwawa (2.3 km) and Phalombe (2.4 km) districts. The nearest market for farm inputs was however, reported to be further than the nearest output market. Overall, farmers covered 4.7 km to access farm inputs like fertilizer and seed. Those in Dedza covered the longest distance to reach the nearest market where they could buy the farm inputs (6.4 km), followed by farmers in Chikhwawa (5.2 km), and those in Zomba and Phalombe covered the shortest distance (3.8 km).

Table 4.1: Average distance to output and input markets in km by district

		Dedza (n=97)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=463)
Output market	Mean	4.1	2.3	2.3	2.4	2.7
	Median	2.0	2.0	2.0	1.2	2.0
Input market	Mean	6.4	3.8	5.2	3.8	4.7
	Median	3.0	2.0	3.0	4.0	3.0

Most of the roads that provided access to villages in the area of study were secondary earth roads. Overall, 72.7% of the roads were secondary earth roads, 13.4% primary earth or murram (laterite) roads, 10.5% foot paths and only 3.3% were tarmac roads (Figure 4.1). Zomba district had the highest percentage of tarmac roads (8.7%) followed by Chikhwawa (4.5%). Villages in Dezda and Phalombe districts did not have any tarmac roads.

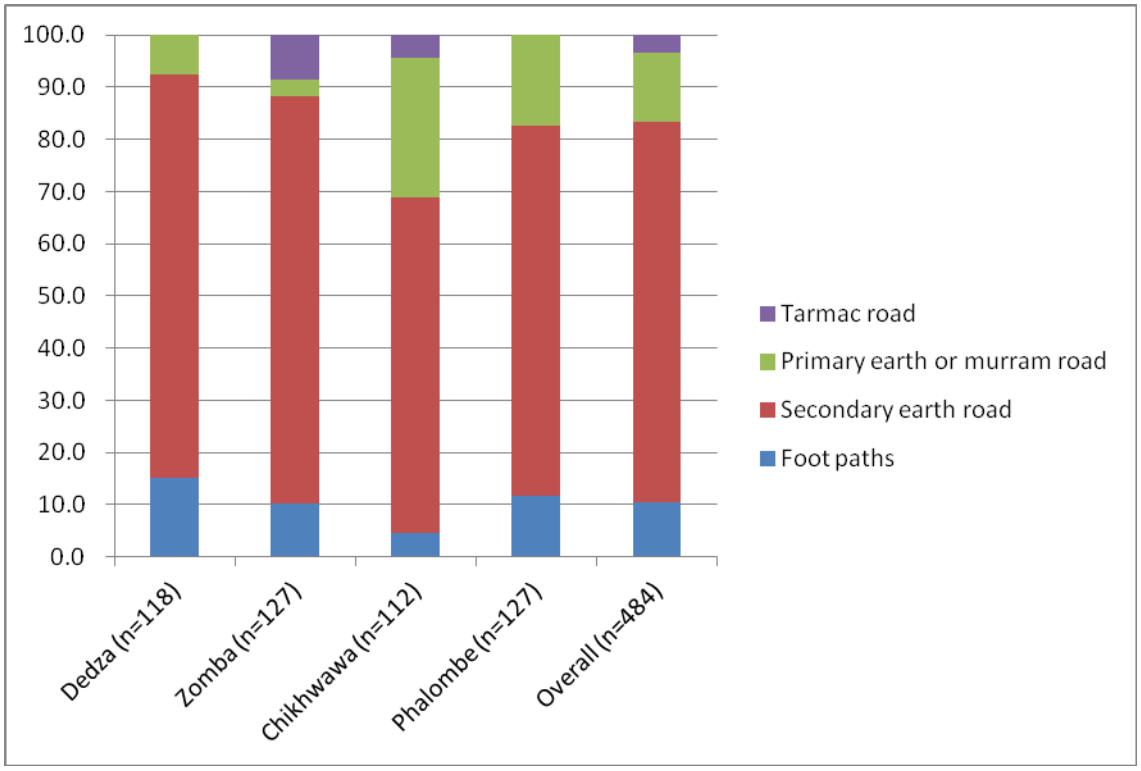

Figure 4.1: Type of roads that provide main access to different villages within the districts

The high percentage of secondary earth roads in the study area shows that during rainy seasons, there is a likelihood of farmers experiencing difficulties accessing the output and input markets within the villages. This could be a challenge to both the producers who rely on agriculture as a source of income, and also the consumers who rely on purchasing the farm produce from the farmers. As a result, the farmers will not be able to sell their produce, hence no income, and the consumer will not access food from the markets, hence leading to food insecurity in the area.

It is important to improve roads in the rural areas to enhance easy transportation of agricultural produce to and from the markets all the year round. Moreover, easier access to markets allows an expansion of the production of perishable and transport-cost-intensive products. It can also lead to a conversion of latent demand into effective commercial demand. A past study has shown that such effects of infrastructure accentuate the process of commercialization in agriculture and the rural sector (Steven J. & Morton J., 1995).

Analysis was done to find out the main mode of transport from villages in the areas of study to the nearest market. As shown in Figure 4.2, the majority of the people from the study area walked to the nearest market (79.8%). Dedza reported the highest percentage of people who walked to the market (87.3%), and they walked the longest distance compared to people in the other three districts, both to the input (6.4 km) and output markets (4.1 km), as was previously reported in

Table 4.1. Zomba district had the second largest number of people who walked to the market (81.9%) closely followed by Phalombe (81.1%), and Chikhwawa had the lowest number of people who walked to the market (67.9%). Chikhwawa had the largest percentage of people who went to the market by bicycle (29.5%). In Phalombe, no one went to the market by car/truck or by bus/small van or by motorcycle. All people either walked to the market or used bicycles.

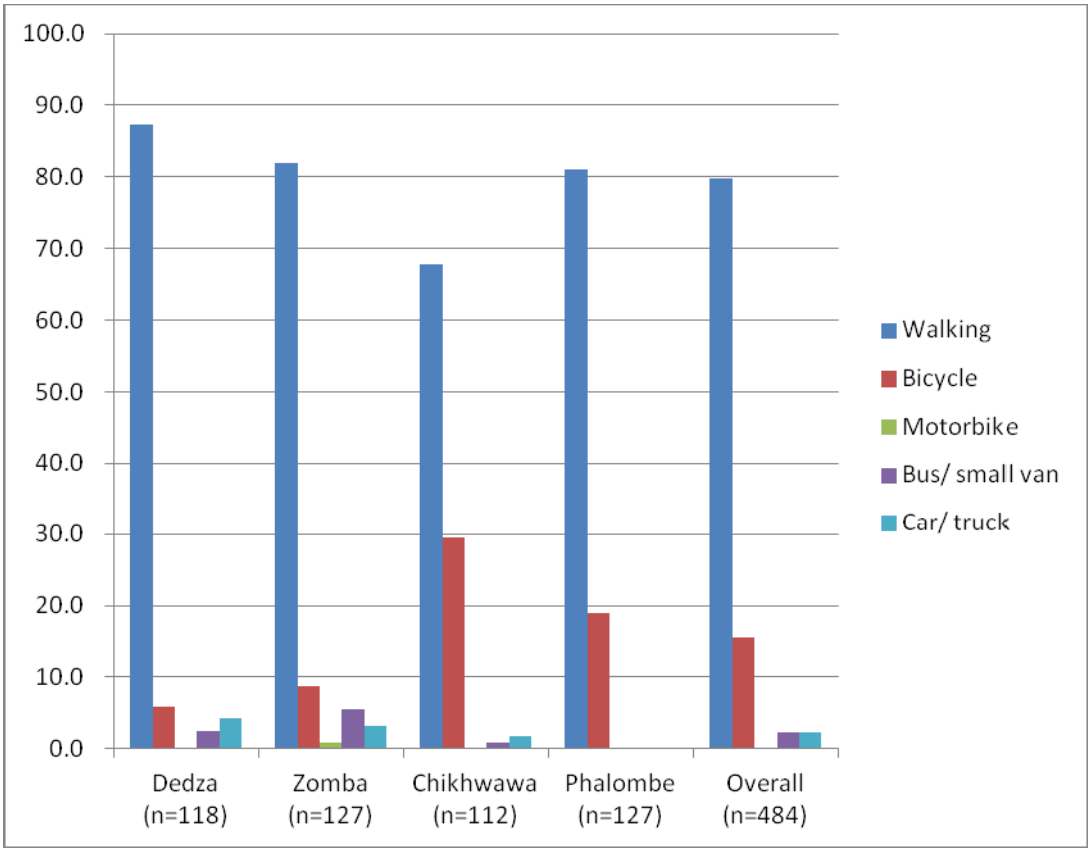

Figure 4.2: Main mode of transport to nearest market

4.2 Membership to farmers' groups or associations

Farmer groups are a form of social capital that promotes agricultural production and marketing. Through these social networks, farmers can reduce costs of accessing inputs, production technologies, information and markets by sharing the costs among members of the group, hence leading to lower individual costs.

In the current study, an average of 39.7% of the interviewed respondents were reported to be members of a farmer's group (Table 4.2). Chikhwawa had the highest proportion of respondents who were members of farmer's group (50.9%), while Phalombe had the lowest proportion (28.3%). From the sampled households, an average of 60.5% of all household members belonging to

farmer's group in the area of study were women. There is not much diversity in the proportion of female household members belonging to farmers' groups across the districts. The proportion ranges from 64.7% in Dedza to 58.2% in Chikhwawa.

About 65.9% of the farmers who were members of farmers' groups received a new crop variety through the group. Zomba had the highest proportion of farmers who received a new crop variety through groups (75.3%) and Chikhwawa had the lowest percentage (53.2%). This clearly reveals the importance of farmers' groups in agricultural production. The socio network helps farmers acquire new crop varieties which could be of higher quality than the indigenous crops. Therefore, it would be important if the project worked with group members in OFSP production from vine multiplication to marketing of OFSP products.

Table 4.2: Proportion of farmers belonging to groups/associations by district

	District				
	Dedza	**Zomba**	**Chikhwawa**	**Phalombe**	**Overall**
Respondents belonging to a farmers' group (N=484)	33.1	47.2	50.9	28.3	39.7
Female household members belonging to a group or association (N=276)	64.7	58.4	58.2	61.5	60.5
Percentage receiving new crop variety through groups (N=276)	70.6	75.3	53.2	65.4	65.9

Besides new crop varieties, group members acquired several other products and services from the groups in the past two years preceding the study. About 25.8% of the respondents indicated that they had received inputs from groups, 24% reported that they had attained training through groups, 21.4% seed, 7.7% financial assistance, 3% goats and only 18.1% did not receive any product or service from groups (Figure 4.3). This further shows the importance of groups to the project '*Rooting out Hunger in Malawi with Nutritious OFSP*'. The project can work with group members during awareness workshops, seed multiplication training events, and marketing. By so doing, the group members will easily identify sources of clean planting material, thereby reducing chances of crop loss through diseases. Moreover, they can market their harvests together, thus benefiting from the advantages of economies of scale.

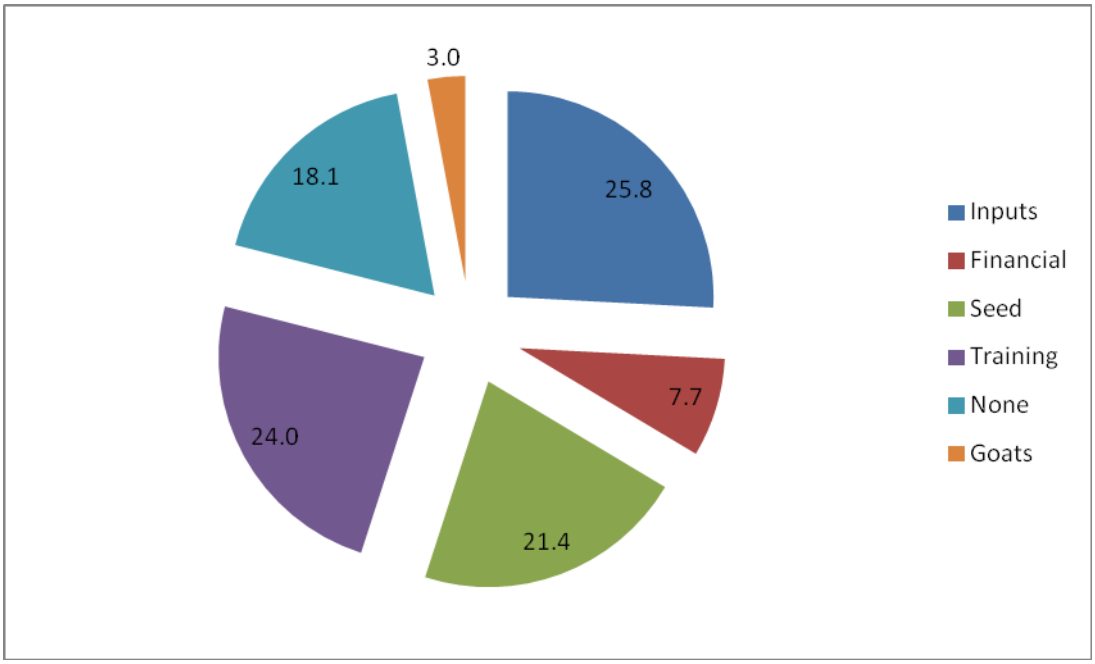

Figure 4.3: Services received by group members in the last two years

Sweetpotato, OFSP and cassava average productivity was reported to be higher among farmers who were members of farmers groups than was the case for non-members (Figure 4.4). For members, average sweetpotato productivity was 7491.9 kg/ha, which was much higher than for the non-members (5803.8 kg/ha). For OFSP, average productivity among members was 4486.1 kg/ha against for non-members 2525.6 kg/ha. Cassava average productivity was 3763.0 kg/ha among members and 3351.2 kg/ha among non-members.

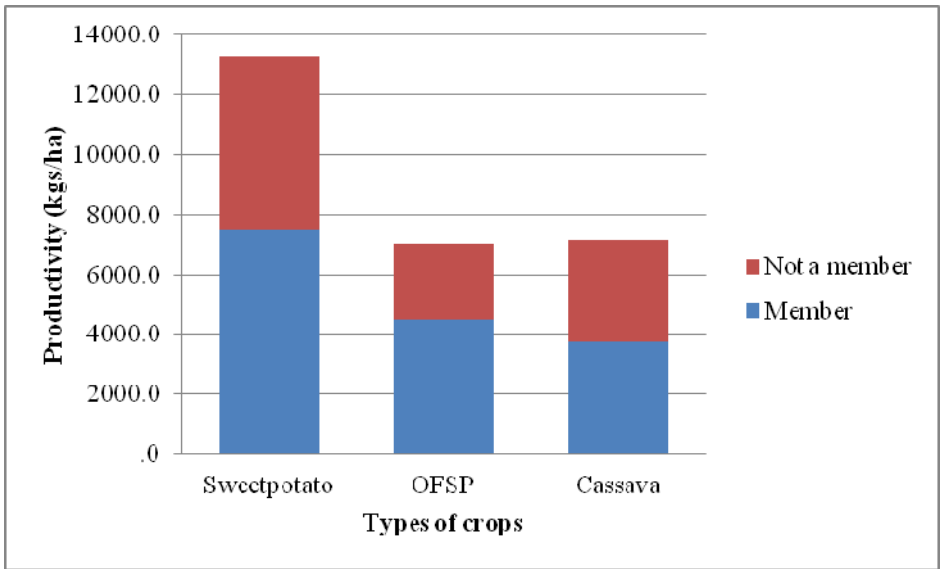

Figure 4.4: Average productivity of sweetpotato and cassava per hectare by membership to a farmers' group

In this section, it is noted that OFSP productivity was lower than that of other sweetpotato varieties. This however, could have been as a result of factors such as whether clean planting material was used and whether the crop was planted on time, among others. Clean planting material, one of the objectives of the project *'Rooting out hunger in Malawi with nutritious OFSP',* is a main factor in ensuring high productivity in any crop. Sources of planting material by farmers in the study area will be discussed in detail later in the report.

Results in this section show the importance of groups in agricultural production. Through the farmers' groups, farmers are able to access farm inputs at a lower cost since they can afford to purchase inputs in bulk. At the same time, dissemination of new technology becomes cheaper both for the person disseminating the technology and for the farmers. Even more so, in the case of new technology, group members improve their ability to produce more since they share the technology. This, therefore, shows that it is important to work with group members in promoting OFSP in the intervention area.

5. LAND HOLDING, UTILIZATION AND CROP PRODUCTION

5.1 Land holding and utilization

Availability of farming land is an important factor in agricultural production. Areas with higher farming potential, however, have historically attracted more people, hence leaving a small amount of farming land per household.

In the current survey, households in the study area reported that they owned an average of 1.24 ha of land during the cropping year 2009/2010 (Table 5.1). Those in the Dedza district owned larger pieces of land (1.45 ha) than those in Chikhwawa (1.35 ha), Phalombe (1.28 ha), and Zomba (0.91 ha). Of the total land that was at households' disposal during that cropping year (2009/2010), 97.1% was cultivated. There was not much diversity in proportion of land cultivated across the districts. Phalombe, however, had the highest proportion of land cultivated (99.06%) and Chikhwawa had the lowest proportion (94.08%).

Table 5.1: Ownership and utilization of land in hectares during 2009/2010 cropping year by district

Districts	Mean land ownership (ha)	Mean land utilization (ha)	Proportion of land utilized (%)
Dedza (N=118)	1.45	1.42	97.93
Zomba (N=127)	0.91	0.89	97.06
Chikhwawa (N=112)	1.35	1.27	94.08
Phalombe (N=127)	1.28	1.27	99.06
Overall (N=484)	1.24	1.20	97.10

This analysis shows that there is very little land left idle in the area of study. A past study has shown that about 85% of the population in Malawi is rural and is dependent on agriculture. Hence, the long duration of natural fallows that were traditionally used to overcome soil fertility depletion are no longer possible due to increasing population pressures on the land (Nye & Greenland. D.J., 1960).

This, therefore, shows that any new crop that is being introduced in these areas has to be competitive in terms of production traits, consumer preference, nutritional benefits or any other trait that farmers would consider important and worth substituting some of their current crops with the new crop. To promote OFSP in the area of study, farmers need to be informed of its nutritional benefit. This would considerably be a driving factor to the adoption of OFSP given the high vitamin A deficiency prevalence recorded in Malawi (MOHP, 2003). Moreover, studies have shown that people have become keener in their consumption behavior than before, and there is a tendency to consume foods that have a nutritional benefit for their bodies.

On the other hand, farmers can be encouraged to intercrop OFSP with other crops. This would benefit the farmers in that they would consume OFSP, which is rich in Pro-vitamin A, and at the same time the crop would act as soil cover in the area planted, hence reducing the effects of soil erosion.

Households in the study area cultivated about three separate plots of land during the 2009/2010 crop year. Of the three plots, only one plot was on fertile land. It was important for the project to find out whether women have control on any land. This is because sweetpotato has previously been viewed as a woman's crop, and therefore, if women do not have control over land, there is a likelihood that they would not have access to land for sweetpotato production. From this study, however, women had control on what is grown in at least two plots out of the average three plots cultivated by each household. Therefore, women in the study area can have access to land for sweetpotato production.

5.2 Crop production

Malawi enjoys only one rainy season, between October and April, which is followed by a long dry spell from May to September. Most of the time, there is no hunger during the dry season since it is the period of main harvest (Figure 5.1). The majority of the farmers in the area of study wholly depend on agricultural activities for their households' daily upkeep. Hence, the rainfall and harvest calendar is of much importance to them.

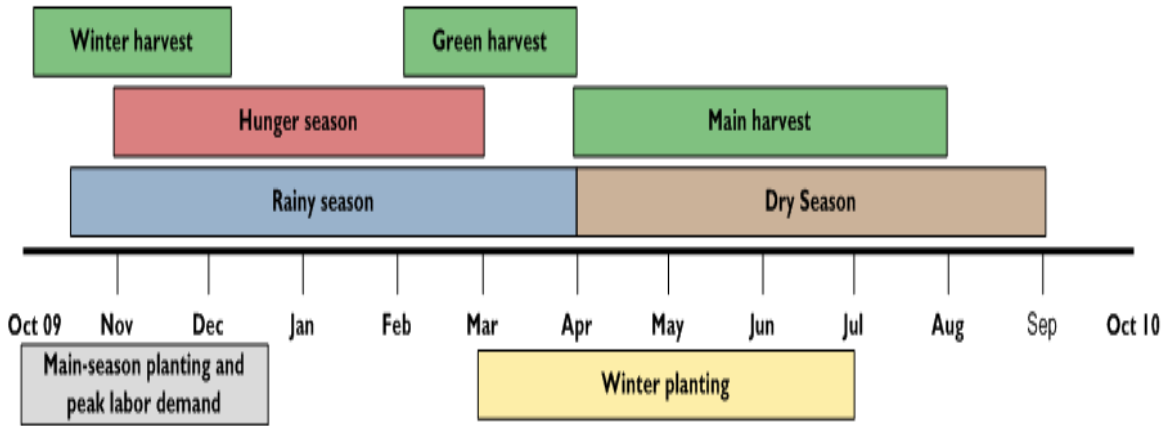

Figure 5:1: Seasonal calendar and critical events timeline
Source: FEW NET

As previously noted, agriculture is the most important activity in the study area as it generated the highest income among the interviewed households. Moreover, all the interviewed households engaged in crop production during the 2009/2010 crop year. Among the crops produced during the 2009/2010 crop year, sweetpotato was the second most produced crop. It was produced by 87.8% of the households (Figure 5.2), coming second after maize which was produced by 96.5%. Beans came third (52.5%) and vegetables were produced by the\ fewest farmers (1.9%).

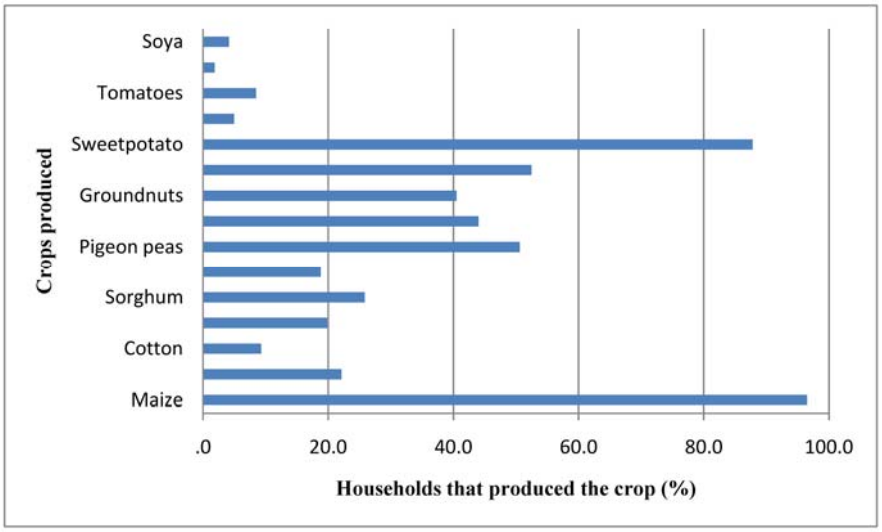

Figure 5.2: Proportion of households that produced different crops during the 2009/2010 crop year (N=484)

To find out the importance of different crops produced in the study area, respondents were asked to rank the importance of all crops produced during the crop year 2009/2010, starting with the most important, then the second most important, etc., to the least important. Maize was indicated as the most important crop by the highest proportion of respondents (93.3%), 51.4% of the respondents indicated rice as the second most important crop and 29.1% of the respondents indicated sweetpotato as the third most important crop (Table 5.2). Figure 5.3 clearly illustrates proportions of households that ranked different crops in the top four positions.

Table 5.2: Proportion of households indicating importance of different crops in the study area

Order of importance	Maize (n=466)	Rice (n=107)	Sorghum (n=122)	Cassava (n=205)	Sweet-potato (n=422)	Beans (n=249)	Ground-nuts (n=188)	Bananas (n=86)	Irish potatoes (n=93)	Cotton (n=45)	Pigeon peas (n=239)
First	93.3	2.8	13.1	1.0	2.1	0.4	0.5	0.0	5.4	11.1	1.3
Second	2.4	51.4	16.4	12.2	23.0	29.3	13.8	2.3	37.6	37.8	34.3
Third	1.5	23.4	15.6	24.9	29.1	26.9	21.8	7.0	15.1	17.8	28.0
Fourth	1.7	9.3	11.5	26.3	23.7	19.3	23.4	19.8	21.5	13.3	20.5
Fifth	0.4	5.6	19.7	20.0	14.7	12.4	22.9	17.4	14.0	8.9	8.8
Sixth	0.4	4.7	12.3	14.1	6.4	6.0	11.7	31.4	5.4	6.7	5.0
Seventh	0.2	2.8	11.5	1.5	0.9	5.6	5.9	22.1	1.1	4.4	2.1

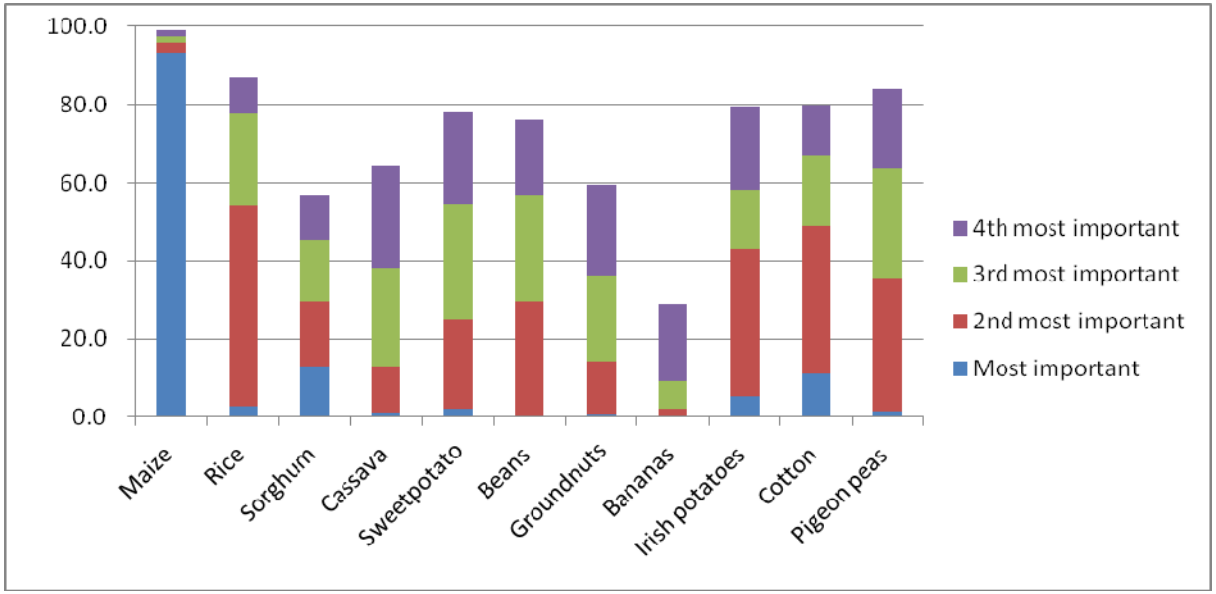

Figure 5.3: Proportion of households indicating importance of different crops in the study area

Respondents were further requested to state the three most productive crops during the 2009/2010 crop year. Maize was recorded as the most productive crop by 74.1% of the respondents, whereas 3.5% recorded sweetpotato as the most productive crop (Figure 5.4). Sweetpotato was reported as the third most productive crop by majority of the respondents (24.1%), and 18.0% reported sweetpotato to be the second most productive crop. Taking the sum of respondents who reported the top three most important crops, sweetpotato was reported to be in the top three most productive category of crops by the second majority of the respondents (cumulative total of 45.6%), coming second after maize (cumulative total of 89.7%).

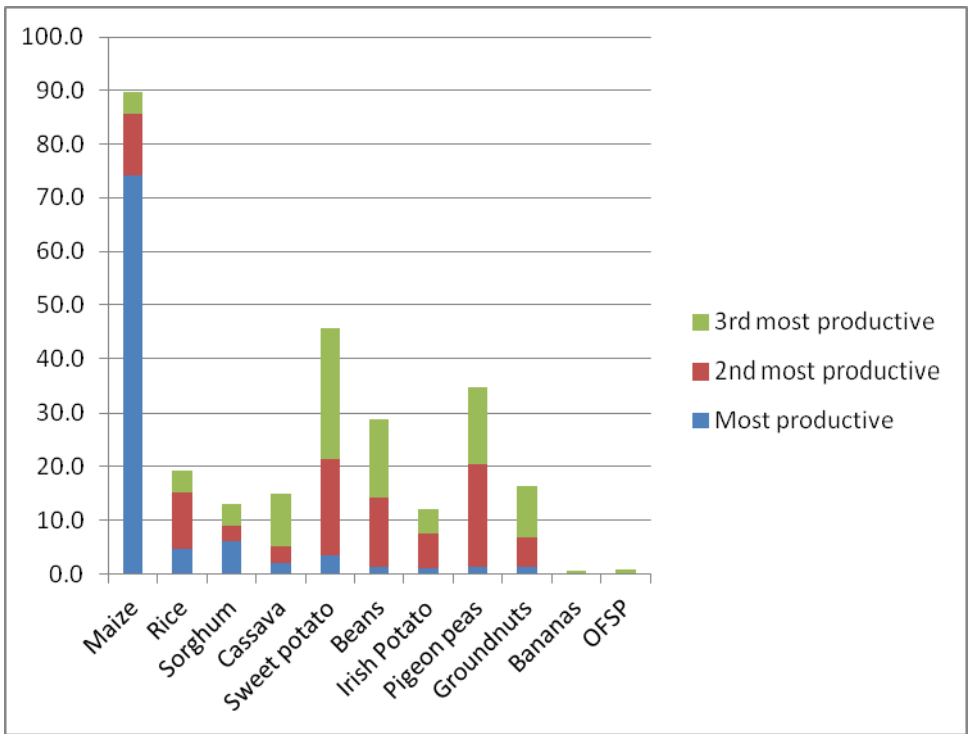

Figure 5.4: Proportion of households indicating the three most productive crops

Labor is an important input in crop production. Farmers can choose to use family labor, salaried labor and/or casual labor. In this study, more than half of the households (55%) indicated that they do not use either salaried or hired labor (Figure 5.5). On the other hand, 36% indicated that they had used only hired labor, 8.9% both salaried and hired labor, and only 0.2% had used salaried labor only.

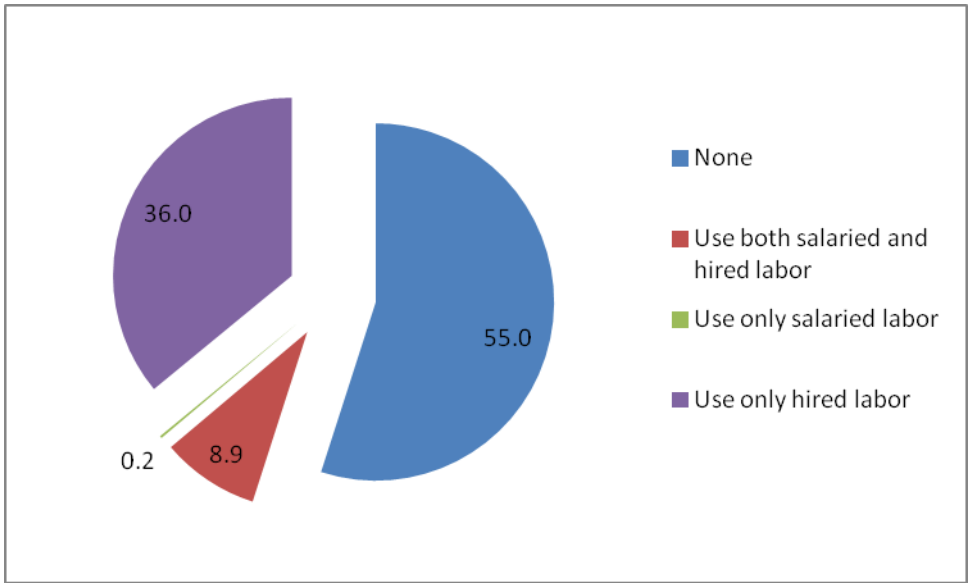

Figure 5.5: Proportion of households that used either salaried and/or hired labor

When respondents were asked to rank the importance of different sources of labor in their crop production, the highest proportion of households (88%) reported family labor by women as the most important source of labor, followed by family labor by men (82.6%), then hired labor came third (10.5%), as shown in Table 5.3. Salaried labor was the least important source of labor for crop production in the study area, used by only 7.9% of the households, and only 2.3% reported it as an important source of labor.

Table 5.3: Importance of different sources of labor in crop production

	Hired casual labor	Salaried labor	Family labor by men	Family labor by women	Group labor
Very important	10.5	2.3	82.6	88.0	3.9
Important	23.3	1.2	7.6	10.5	1.4
Somewhat important	6.6	0.8	1.9	0.8	4.1
Least important	5.2	3.5	1.7	0.6	7.2
Not Used	54.3	92.1	6.2	0.0	83.3

Among the interviewed households, 97.7% indicated that labor was readily available for hiring whenever needed. From the above results, it is clearly seen that farming households in the study area mainly relied on family labor, only supplementing it with casual laborers and, to a small extent, group labor.

5.3 Sweetpotato and cassava production

Both sweetpotato and cassava are important crops for food security since they are drought-resistant. In Malawi, the significant contribution that root crops can make to food security,

especially in densely populated areas with constrained landholding size, has been recognized. Since the 1990's, the government of Malawi has been promoting sweetpotato and cassava as crops that are more drought-tolerant than maize. A study undertaken by SARRNET in 2002 shows that the country has experienced a rapid increase in both the production and the consumption of cassava and sweetpotato over the last decade (SARRNET, 2003). This was highly linked to persistent drought in the country and problems in soil fertility management which have forced farmers to diversify out of maize, the leading food grain.

In this study, all the interviewed farmers are sweetpotato farmers even though, as reported in section 5.2, not all of them produced sweetpotato during the 2009/2010 crop year. Among the households that grew sweetpotato during the referenced crop year, 55.9% produced OFSP and 98.8% produced other sweetpotato types (Table 5.4). Some farmers planted both OFSP and other types of sweetpotato, whereas others planted either OFSP only or other sweetpotato only. A significant number of households growing OFSP in the study area are noted. The highest percentage of farmers producing OFSP was noted in Zomba (80.3%), which was much higher than those in Phalombe (52.8%), Chikhwawa (46.4%) and Dedza (41.1%). This high proportion of OFSP farmers can be explained by the fact that this study was undertaken when the project had already begun in the Zomba and Dedza districts. Distribution of OFSP planting material by an implementing partner of the project *'Rooting out hunger in Malawi with OFSP'*, had begun a year prior to the project.

Table 5.4: Percentage of respondents who grow cassava and sweetpotato by district

	Dedza (n=118)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=484)
Households growing sweetpotatoes (%)	94.9	100.0	100.0	100.0	98.8
Households growing OFSP (%)	41.1	80.3	46.4	52.8	55.9
Households growing cassava (%)	48.3	85.0	34.8	68.5	60.1

About 60.1% of the households in the study area produced cassava during the 2009/2010 crop year. Zomba had the highest percentage of these households (85.6%), while Chikhwawa had the fewest households (34.5%).

Overall, 9.1% of households' total landholding was under sweetpotato (Table 5.5). There was slight variability of land under sweetpotato among the four districts. Proportions varied from 10.2% in Dedza to 8.0% in Phalombe. Considering OFSP, an average of 2.8% of households' total landholding was under OFSP. Zomba had the highest percentage (4.9%), followed by Dedza (3.5%), then Chikhwawa (2.1%), and Phalombe (1.2%). This high percentage of OFSP in Zomba and

Dedza could be explained by the fact that dissemination of OFSP seed had begun a year prior to this study, as indicated earlier.

Table 5.5: Proportion of total land holding under sweetpotato and cassava by district

Districts	OFSP	Sweetpotato	Cassava
Dedza (N=118)	3.5	10.2	4.8
Zomba (N=127)	4.9	9.8	7.4
Chikhwawa (N=112)	2.1	8.3	2.1
Phalombe (N=127)	1.2	8.0	5.2
Overall (N=484)	2.8	9.1	4.8

Land under cassava was also relatively high. Overall, 4.8% of households' total land was under cassava. Zomba had the highest proportion of land under cassava (7.4%) while Chikhwawa had the lowest (2.1%).

During this study, farmers were asked to name the two most preferred sweetpotato varieties among the varieties that they grow. Kenya was reported as the most preferred variety by 29.3% of the farmers, and still, the second most preferred variety by 11.9% of the farmers (Appendix B). Nsanje came second with 6.4% of the farmers indicating that it was their most preferred variety, and 11.7% their second most preferred variety. Zondeni, an OFSP variety, was indicated as the most preferred variety by 4.3% and second most preferred variety by 4.8% of the respondents. Appendix B shows sweetpotato varieties reported as the most and second most preferred by the farmers in the study area.

From the study area, it was clearly seen that sweetpotato is produced mainly as a food crop. About 67.6% of all households indicated that they produced sweetpotato for food (Figure 5.6). Few households grow sweetpotato as a cash crop alone (1.5%), whereas a significant number of households grow sweetpotato for both food and sales (29.9%). Only 1% of the households produced sweetpotato simply because it is the only food that can tolerate drought.

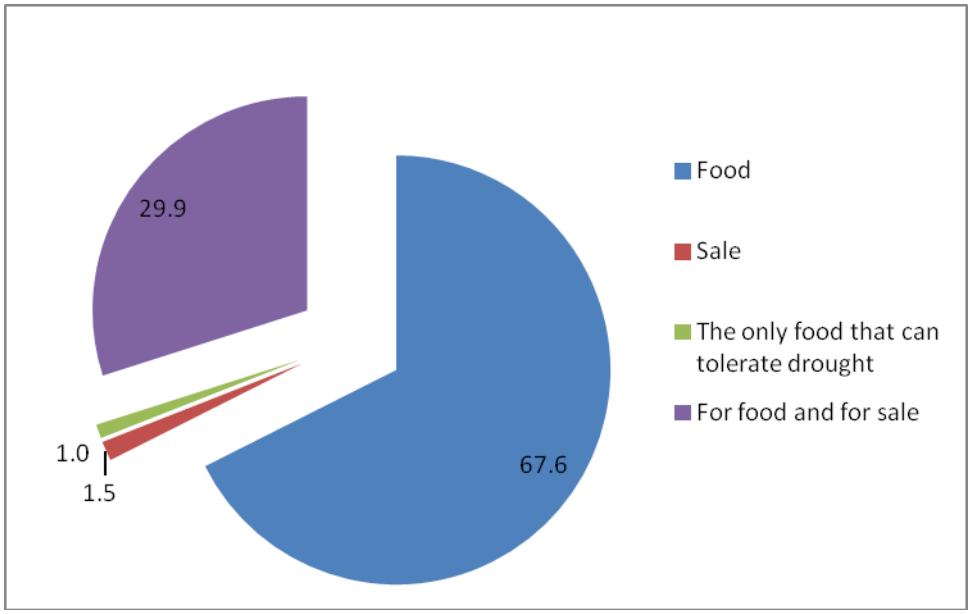

Figure 5.6: Why households grow sweetpotato

To find out whether reasons for producing sweetpotato varied by gender, results for growing sweetpotato were analyzed by gender of the respondent (Table 5.6). There was, however, no significant difference between genders. Still, the highest proportion of the households produced sweetpotato as a food crop as indicated by both female (68.0%) and male (66.1%) respondents. Few households produce sweetpotato as a cash crop alone, from both female (1.6%) and male (0.9%) respondents.

Table 5.6: Reasons for growing sweetpotato by gender of the respondent

Main reason for growing sweetpotato	Gender of the respondent		
	Female (n=369)	Male (n=109)	Overall (n=478)
Food	68.0	66.1	67.6
Sale	1.6	0.9	1.5
The only food that can tolerate drought	1.1	0.9	1.0
For food and for sale	29.3	32.1	29.9

The predominant system of sweetpotato production in the study areas is the pure stand system. Overall, 89.6% of sweetpotato planted in the study area during the 2009/2010 crop year was on pure stand (Figure 5.7). Zomba had the highest percentage of sweetpotato produced on a pure stand (96.9%), followed by Dedza (94.8%), then Phalombe (89.0%), and lastly Chikhwawa (76.8%). Only 9.6% of the households intercropped sweetpotato with other crops and 0.8% produced sweetpotato both as a pure stand and a mixed crop.

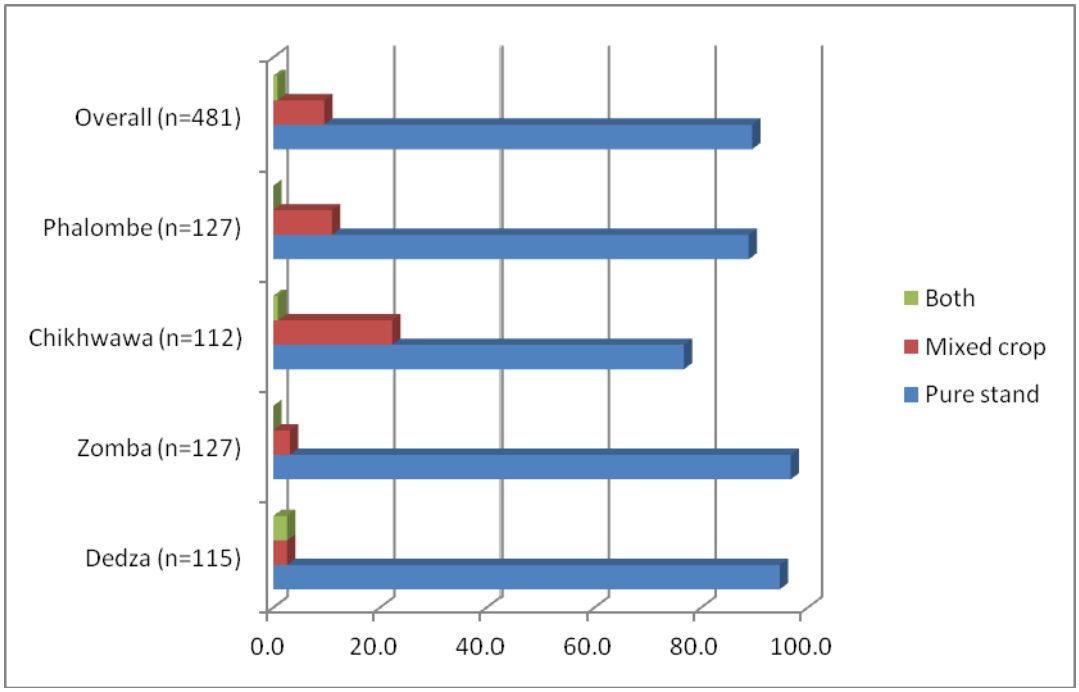

Figure 5.7: Proportion that grow sweetpotato as a mixed crop or pure stand

Farmers who produced sweetpotato as a mixed crop were asked to name the crops that they intercropped sweetpotato with. The majority of the households intercropped sweetpotato with maize (76.0%), while a few others intercropped with beans (6.0%), vegetables (6.0%), cassava (2.0%), groundnuts (2.0%), cow pea (2.0%), green grams (2.0%), pumpkins (2.0%), and okra (2.0%), as shown in Table 5.7. In Dedza, all the households that cultivated sweetpotato as a mixed crop intercropped it with maize, in Zomba, half of them intercropped sweetpotato with maize, a quarter with beans, and the other quarter with green peas.

Table 5.7: Proportion of farmers that intercrop sweetpotato with different crops by district

Crops intercropped with sweetpotato	Dedza (n=3)	Zomba (n=4)	Chikhwawa (n=25)	Phalombe (n=14)	Overall (n=46)
Maize	100.0	50.0	92.3	42.9	76.0
Cassava	0.0	0.0	0.0	7.1	2.0
Beans	0.0	25.0	3.8	7.1	6.0
Groundnuts	0.0	0.0	0.0	7.1	2.0
Vegetables	0.0	0.0	0.0	21.4	6.0
Cow pea	0.0	0.0	0.0	7.1	2.0
Green peas	0.0	25.0	0.0	0.0	2.0
Pumpkin	0.0	0.0	0.0	7.1	2.0
Okra	0.0	0.0	3.8	0.0	2.0

As previously mentioned, farmers need to be encouraged to intercrop sweetpotato, and specifically OFSP, with other crops in their farming enterprise. Increasing the percentage of farmers intercropping sweetpotato with other crops will increase OFSP production in the intervention areas.

Several constraints surround sweetpotato production, among them attack by pests and diseases, drought, and availability of planting material before the onset of the rains. Proper management of sweetpotato during production can, however, aid in reducing some of these constraints. During this study, 77.9% of the respondents reported that their sweetpotato farms had previously been infested by weevils (Figure 5.8), hence reducing their sweetpotato productivity. The project will play an important part in disseminating important information on production and general management of sweetpotato to households in the intervention area.

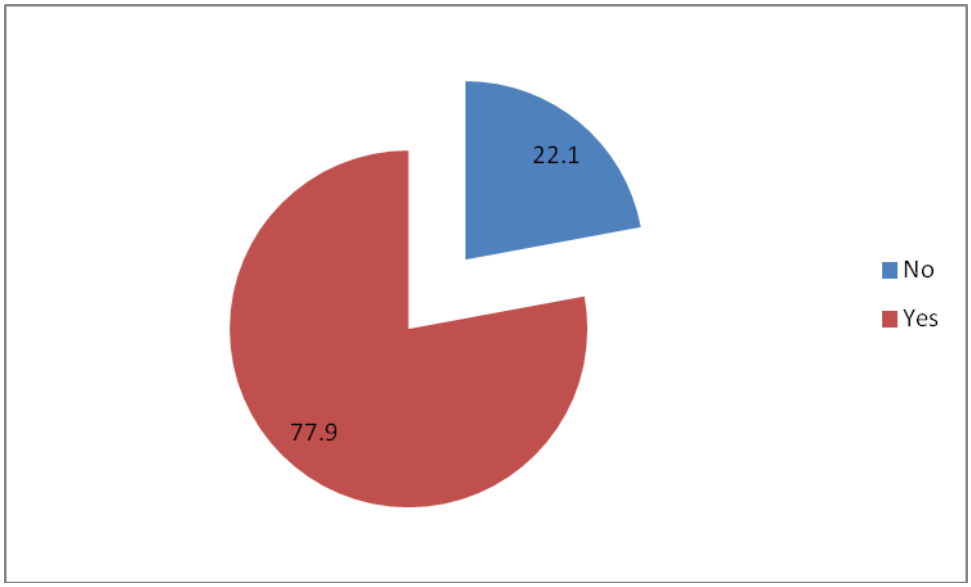

Figure 5.8: Has your sweetpotato ever suffered from sweetpotato weevil?

When respondents were asked whether they had previously received any training on sweetpotato production and management, only 14.5% reported that they had received any training to date (Figure 5.9). No wonder that when they were shown a picture of a sick plant and asked whether the plant was sick or healthy, more than half could not identify a sweetpotato plant infected by sweetpotato virus. This underscores the need for farmer education on general sweetpotato management practices and disease management to improve sweetpotato productivity.

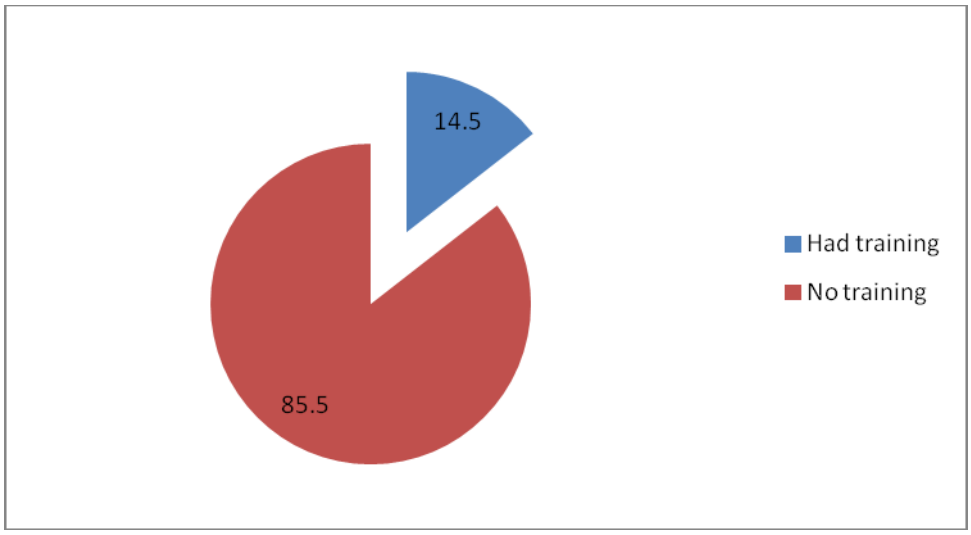

Figure 5.9: Whether respondents had previously received training in sweetpotato production and management

It is widely recognized that the use of modern inputs, such as fertilizers and improved seed is closely linked to higher agricultural productivity and food security. In Malawi, a fertilizer subsidy program has been in operation for a long time. The subsidy however, is only for fertilizer use in maize enterprise. It is expected that some farmers would divert the use of some of these fertilizers to other crops. Moreover, if maize is intercropped with other crops, those other crops would benefit from the fertilizer used in maize.

In this study, however, the majority of the farmers used fertilizer neither in sweetpotato root production nor in vine production during the 2009/2010 crop year. In root production, only 7.5% used inorganic fertilizer, 8.9% manure, and 2.3% used both inorganic fertilizers and manure (Figure 5.10). The highest inorganic fertilizer use was recorded in Dedza district (20.9%) while no farmer in Phalombe reported having used inorganic fertilizer. Also, Dedza had the highest proportion of farmers who used manure (14.8%) followed by Zomba (7.9%).

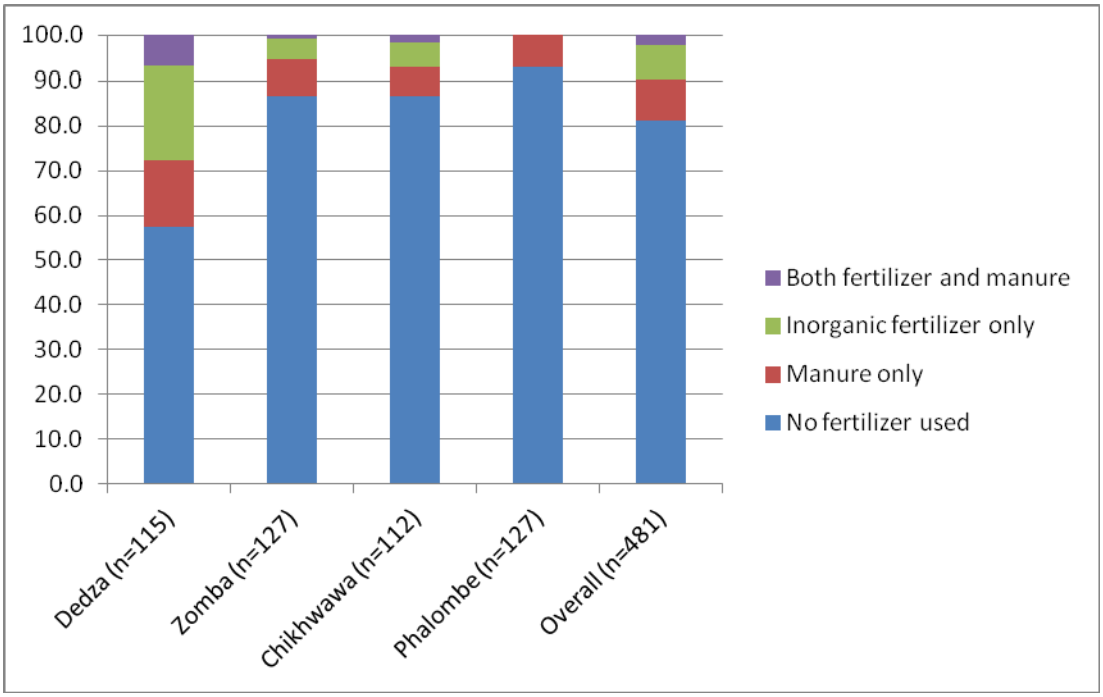

Figure 5.10: Proportion of respondents using organic and/or inorganic fertilizer in sweetpotato root by district

The trend of fertilizer use in sweetpotato vine production was not different from that of root production across the districts. Still, the majority of the farmers in the area of study did not use any type of fertilizer (Figure 5.11). Only 6.4% recorded use of manure, 6.2% inorganic fertilizer, and 1.9% both inorganic fertilizer and manure. As was the case in root production, Dedza recorded the highest proportion of farmers who used inorganic fertilizer (15.7%) and Phalombe had the lowest proportion (0.8%). In addition, manure use was also highly recorded in Dedza (9.6%), followed by Zomba (7.9%). The high percentage use of both inorganic fertilizer and manure in Dedza and Zomba could have been encouraged by partners who had gone there previously to promote OFSP.

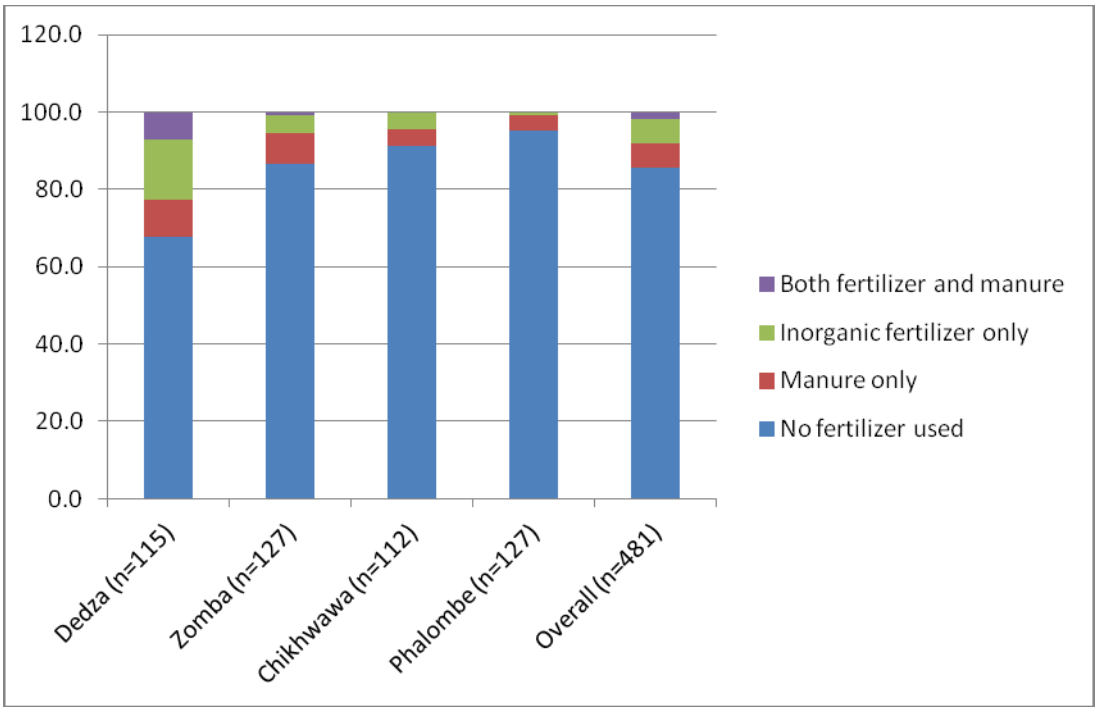

Figure 5.11: Proportion of respondents using organic and/or inorganic fertilizer in sweetpotato vine production per district

Another factor that could affect sweetpotato production is availability of labor. More than three quarters of the interviewed households (86.4%) indicated that they do not hire labor for sweetpotato production activities. This is consistent with prior results that showed that the majority of the households used family labor in crop production activities. Among those who hired labor for sweetpotato production, 76.5% indicated that they hired labor specifically for land preparation, 55.2% for weeding sweetpotato farms, 28.4% for harvesting sweetpotato and 20.9% for planting (Table 5.8).

Table 5.8: Proportion of households that hired labor for sweetpotato production activities

Land preparation	**76.5**
Planting	20.9
Weeding	55.2
Harvesting	28.4

In Malawi, women make up 70% of the food production group, and they are the most important group in the production of subsistence food crops (Quisumbing, *et al*., 1995). More specifically, sweetpotato is mainly considered to be a woman's crop, although the trend seems to change. In this study, respondents were asked the most responsible gender for each of the sweetpotato production activities. The findings show that men are actively involved in sweetpotato production

(Appendix C). The highest percentage of respondents reported men to be equally responsible with women, in ploughing (48.1%), ridging (48.8%), bed preparation (7.9%), planting vines (41.9%), weeding (58.3%), harvesting (51.9%), bagging (43.6%) and deciding how the sales money is spent (19.2%). On their own, men were reported to be the most responsible gender in preparing mounds (5.2%), and women dominated in cutting vines (31.2%), carrying vines to the plots for planting (39.5%), transporting sweetpotato to the market (15.7%) and selling in the market (20.5%). With men getting more interested in sweetpotato production, it becomes easier to promote OFSP production since there is a likelihood that they will support women in OFSP production. Even more so since the project promotes production of OFSP both as a food crop and a cash crop.

5.3.1 Sweetpotato seed systems

Healthy seed is the basis of obtaining a healthy crop. As previously mentioned, obtaining clean planting material at the right time (before the onset of rains), has been cited as one of the major constraints in sweetpotato production. This study reveals that farmer-to-farmer exchange of sweetpotato planting materials was the dominant seed dissemination system. From the four districts of study, an average of 63.5% of the households used sweetpotato planting material from their own farms (Table 5.9). Farmers from Zomba led in this category (85.0%), followed by Dedza (71.2%) and those in Phalombe (48.8%), and lastly Chikhwawa (48.2%). Male neighbor was reported as the second most common source of planting material (11.9%), then female neighbor (6.5%). Only 2.1% of the overall respondents indicated a far away vine multiplier as the source of their planting material.

Table 5.9: Sources of sweetpotato vines in percentages by district

Sources of sweetpotato vines	Dedza (n=111)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=477)
Own farm	71.2	85.0	48.2	48.8	63.5
Male neighbor	9.9	2.4	17.9	18.1	11.9
Female neighbor	3.6	3.1	14.3	5.5	6.5
Relatives	8.1	3.9	6.3	10.2	7.1
Farmer group	0.9	0.0	0.0	0.8	0.4
Research institution	0.0	0.0	2.7	0.0	0.6
Vine multipliers far away	3.6	0.8	1.8	2.4	2.1
NGO	1.8	3.1	0.9	7.1	3.4
Purchase from the market	0.9	0.8	3.6	3.1	2.1
Buy from those who have them locally	0.0	0.8	3.6	3.1	1.9
Agricultural office	0.0	0.0	0.9	0.0	0.2
ADMARC	0.0	0.0	0.0	0.8	0.2

Farmers were further asked to name their sources of new sweetpotato varieties. Again, fellow farmers dominated this category, where an overall average of 52.1% of the farmers indicated local nearby farmers, 13.4% farmers far away, 9.0% NGOs, and only 5.2% indicated extension agents and 2.9% specialized multipliers (Table 5.10). This shows that if a new agricultural technology is passed to a few farmers, the technology can easily diffuse into the community. The project's aim to work with local farmers and train them in sweetpotato production and also train vine multipliers in the production of clean planting material is, therefore, likely to diffuse in the village among the non-sampled population and benefit the entire population. This will have achieved the project's objective of attaining clean planting material, hence increasing productivity so that farmers produce sweetpotato both as a food crop and as a cash crop, thereby helping to reduce vitamin A deficiency in developing countries.

Table 5.10: Sources of new sweetpotato varieties in percentages by district

Sources of new sweetpotato varieties	Dedza (n=112)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=478)
Local nearby farmers	42.9	53.5	57.1	54.3	52.1
Farmers far away	17.0	9.4	15.2	12.6	13.4
Specialized multipliers	6.3	3.9	1.8	0.0	2.9
Extension agents	7.1	6.3	4.5	3.1	5.2
Research stations	0.9	2.4	2.7	0.8	1.7
Markets	2.7	8.7	2.7	5.5	5.0
NGO	5.4	9.4	6.3	14.2	9.0
Irrigation scheme	0.0	0.0	1.8	0.0	0.4
Buy	0.0	0.8	0.0	1.6	0.6
Agricultural office	0.0	0.0	0.0	0.8	0.2
Have nowhere to get new variety from	8.9	3.9	0.9	1.6	3.8
Had never obtained a new variety before	8.9	1.6	7.1	5.5	5.6

Farmers, neighbors and villagers make up the informal farmer-to-farmer seed system. Past studies have indicated that the informal seed system is the most used seed system by farmers in developing countries, since farmers consider it to be easily accessible and affordable, although it does not necessarily offer quality seed and at the right time. When farmers were asked whether they were satisfied with the quality of planting material available at planting time, overall, 23% indicated that they were not satisfied, 26.2% were somewhat satisfied and 50.8% were satisfied (Figure 5.12). There was not much diversity in the level of satisfaction across the districts. There was, however, no follow-up question on what farmers considered to rate their level of satisfaction. Furthermore, as was earlier reported in this report, most of the farmers could not tell whether a

root was infested by weevils or not. Therefore, there is a likelihood that they cannot tell good quality planting material.

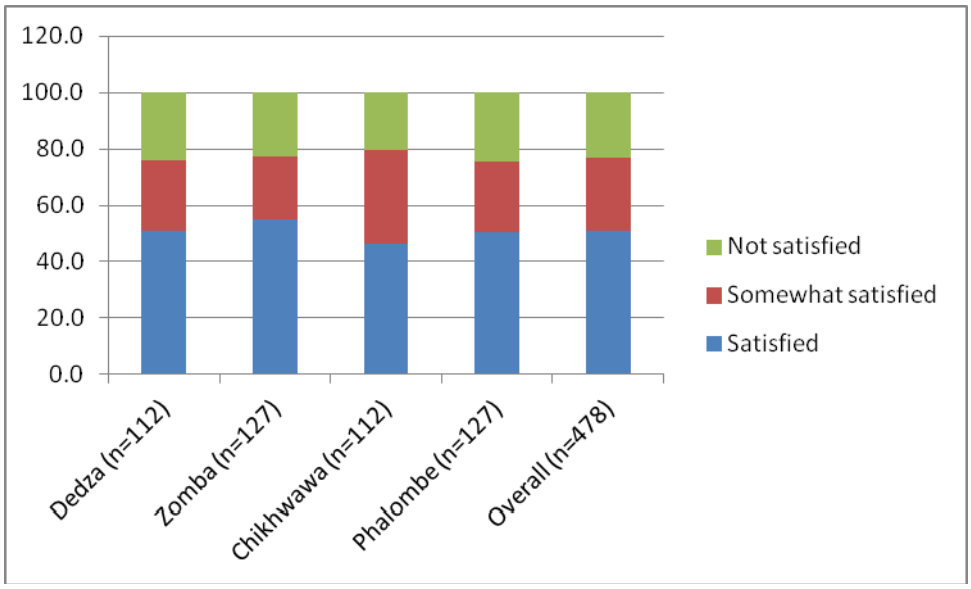

Figure 5.12: Farmers' satisfaction with quality of vines available at planting time by district

Respondents were further asked whether they gave out planting materials to their fellow farmers. About three quarter of the respondents reported that they had given out planting material to their fellow farmers, even though 50.7% of the receivers were reported to be a relative. Also, 15% indicated that the receiver was a group member. The gender of the giver did not differ much between male (51.0%) and female (46.6%). Only 2.4% of the respondents indicated the giver of the vines to be a Non-Governmental Organization (NGO). These farmers were asked whether they gave planting material to their fellow farmers before start of rains, two to three weeks into the rainy season, after most of the rain had fallen, or at all times. Results displayed in Table 5.11, below, reveal that the majority of the farmers gave out planting material two to three weeks into the rainy season (71.3%). Zomba had the highest percentage of farmers in this category (88.4%), while Dedza had the lowest percentage (59.1%). In Dedza, a third of the farmers gave out planting material before rains started, while in Phalombe, a quarter of the farmers gave out planting material after most of the rain had fallen.

Table 5.11: When sweetpotato vines were given to the farmers

	Dedza (n=44)	Zomba (n=95)	Chikhwawa (n=98)	Phalombe (n=104)	Total (n=341)
Before rains started	31.8	7.4	16.3	6.7	12.9
2-3 weeks into the rainy season	59.1	88.4	64.3	67.3	71.3
After most of the rains have fallen	6.8	4.2	19.4	26.0	15.5
All	2.3	0.0	0.0	0.0	0.3

On the other hand, farmers were asked whether they received planting material from their fellow farmers. About 70% of the farmers reported to have received planting material from their fellow farmers. The timings when planting material was received were consistent with previous results of when planting material was given (as discussed in Table 16 above). The majority of the farmers (77.3%) reported that they had received planting material two to three weeks into the rainy season (Table 5.12), while 13.9% said they had received planting material after most of the rains had fallen, and only 8.6% had received planting material before the onset of the rains.

Table 5.12: When sweetpotato vines were received by the farmers

	Dedza (n=34)	Zomba (n=114)	Chikhwawa (n=90)	Phalombe (n=101)	Overall (n=339)
Before rains started	23.5	5.3	7.8	7.9	8.6
2-3 weeks into the rainy season	50.0	90.4	70.0	78.2	77.3
After most of the rains have fallen	26.5	3.5	22.2	13.9	13.9
All	0.0	0.9	0.0	0.0	0.3

Women formed the highest proportion of sweetpotato vine recipients (52.6%), as shown in Figure 5.13. These results also clearly display the high participation of men in sweetpotato production, forming 41.7% of the recipients of vines, and 5.1% of recipients are both men and women.

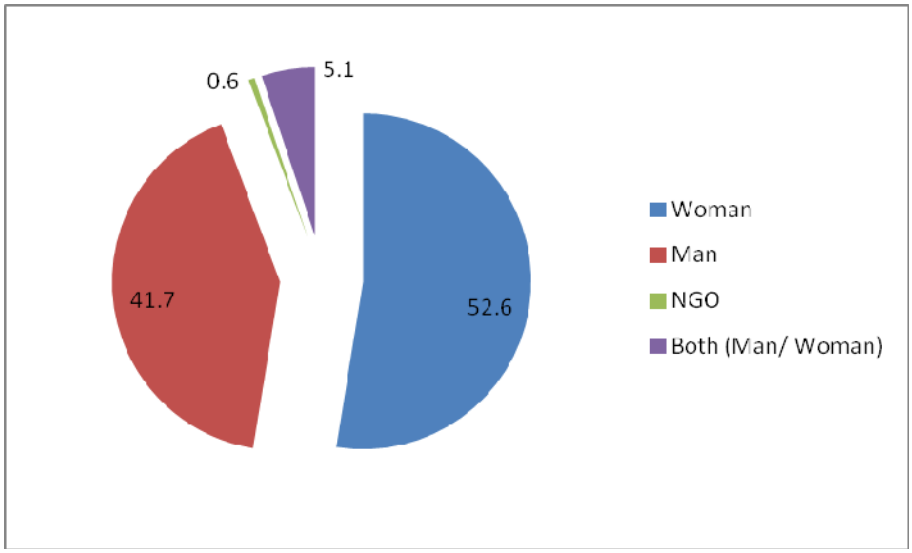

Figure 5.13: Gender of recipients of sweetpotato vines

From the above analysis, it can be argued that the availability of seed before the onset of rains still remains a challenge. The majority of the interviewed farmers plant sweetpotato two to three weeks after the onset of rains, and worse still, a quarter of the farmers in Dedza and Chikhwawa plant sweetpotato after most of the rains have fallen. As a result, farmers may not be able to attain maximum yields from their crops. This underscores the need for timely availability of clean planting material to increase sweetpotato productivity. The approach taken in the intervention in Malawi, therefore, comes in handy where local diversified vine multipliers are being developed and trained to provide quality clean vines to other farmers.

When farmers were asked why they did not plant sweetpotato before the onset of rains, various reasons were spelled out. Among them, prioritizing in planting other crops was the most important reason in the study area as reported by 49.6% of the farmers (Table 5.13). This shows that farmers divert all the farm labor to plant other crops, then later start sweetpotato production. Furthermore, it was previously reported in this report that farmers in the study area mainly depend on family labor and only a very small percent used casual labor in crop production. If farmers change their level of importance for sweetpotato, then it means that they would give more attention to sweetpotato planting during the first week of rainfall or even before the onset of rains. This could be possible if nutritional information regarding OFSP is well disseminated to the farmers, as well as the fact that farmers can also produce it for sale.

A quarter of the households indicated that they did not plant sweetpotato during the first week of onset of rains as they were waiting for enough rains for better soil moisture. This was the second

most important reason given. Lack of planting material was reported by only 4.1% of the households.

Table 5.13: Reasons for not planting SP within one week of start of rains (in percentage)

By that time, the vines are not mature enough	**1.6**
Not sure whether the rains will continue or not	1.4
Difficult for sweetpotato to establish	1.9
Prioritize planting other crops e.g maize, cotton, tobacco etc during the first rains	49.6
Soils to get enough moisture because sweetpotato requires too much moisture to establish well	24.7
For more yields	2.7
To match with rain pattern	0.8
To delay production hence conserve planting material	0.3
Lack of planting materials/Waiting to get vines from other people after the vines grow	4.1
Wait for rains to stabilize to avoid it from stopping when they have already planted	1.6
To delay the harvest period (food security tactic)	0.5
To avoid the plants from being eroded by too much water	1.4
Sweetpotato doesn't grow better with too much rains so they wait until rain is about to stop	3.6
They plant sweetpotato in dimba (low lying wet areas) so they wait up to June to start planting	0.5
Waiting for cold season/sweetpotato does well during winter	1.4
Too much water not good for sweetpotato	1.6
The plot is used for growing other crops first so after they harvest, they grow sweetpotato	0.8
It is their tradition, they found it this way and will remain to do it	1.4

5.3.1.1 Sweetpotato vines conservation

During the long dry periods, 74.6% of the households in the study area conserved sweetpotato seed, and they used several strategies. Planting vines in the lowland area without fencing was the most dominant strategy in the four districts of study. Overall, 68.7% of the farmers who conserved seed used this strategy (Figure 5.14). Zomba district had the highest proportion of farmers who employed this method of seed conservation (74.8%), followed by Phalombe (72.4%) and Dedza (65.0%) and then Chikhwawa (58.7%).

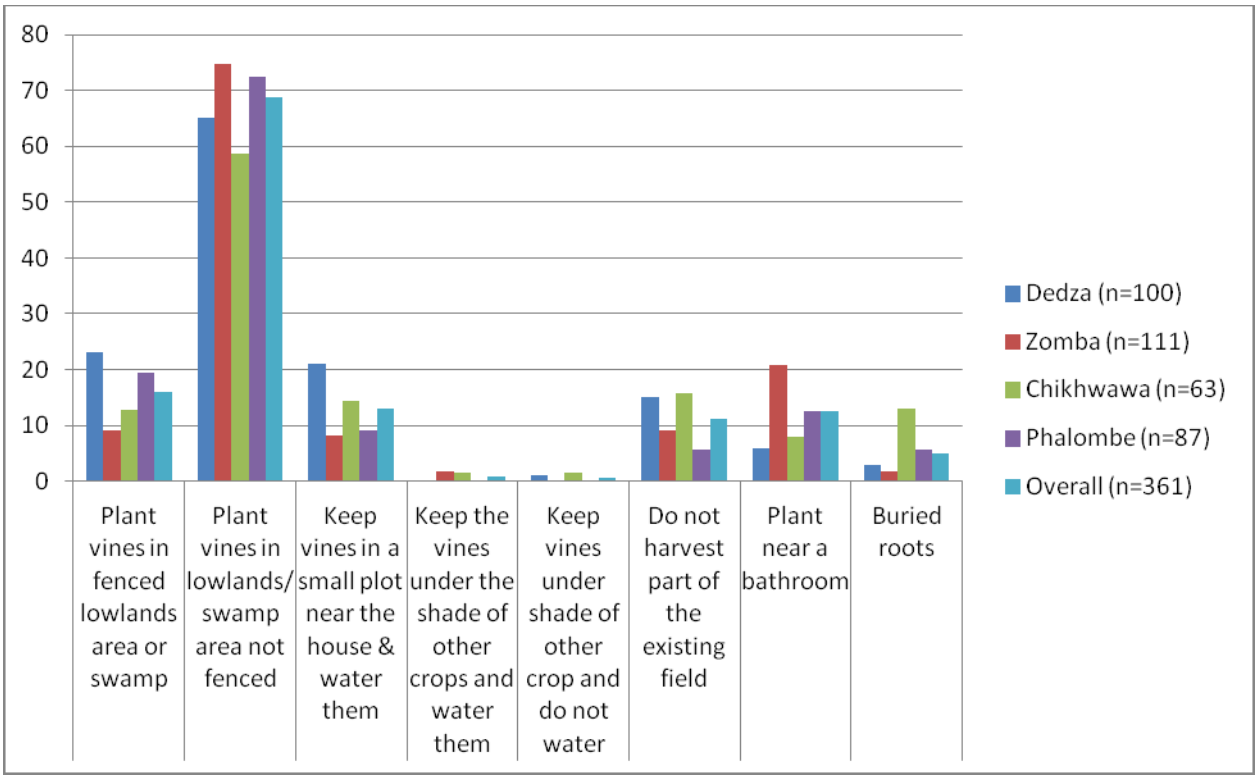

Figure 5.14: Proportion of respondents using different sweetpotato seed conservation measures among those conserving by district

There is a high diversity between the most used strategy and the second most used strategy. Planting vines in fenced lowlands, the second most used seed conservation method was only used by an overall average of 16.1% of the farmers. Other methods used by farmers to conserve seed are keeping vines in small plots near the house and watering them, planting vines near a bathroom, leaving part of existing field without harvesting, burying roots, keeping vines under the shade of other crops and watering them, and keeping vines under shades of other crops without watering.

Keeping vines under shades of other crops with or without watering were the least used methods of seed conservation among the sampled farmers. Only 0.8% and 0.6% of the overall farmers employed each method respectively. The intercrops provide shade and reduce moisture loss during the dry period ensuring the vines do not die. The crop is left in the farm till the next rains. Once the rains fall, farmers weed for the seed crop and wait till the sprouts of vines are long enough to plant. This strategy, however, does not always work for the farmers since they often lose at least a month before they are able to plant the next crop after the onset of rains because they have to wait for the vines to sprout and grow to the required length.

A quarter of respondents who had indicated that they do not conserve seed during long dry periods, were asked sources of their planting material. Overall, purchase was the main source of vines for the non-conserving farmers (46.5%), as shown in Figure 5.15 below. Relatives were the second main source of vines for these farmers (28.5%), and neighbors came third (6.4%). Zomba, Chikhwawa, and Phalombe districts were dominated by purchase of vines, and closely followed by relatives as sources of vines for the non-conserving farmers. Unlike these three districts, in Dedza, over half of the farmers asked relatives for vines (52.9%) and 29.4% bought vines.

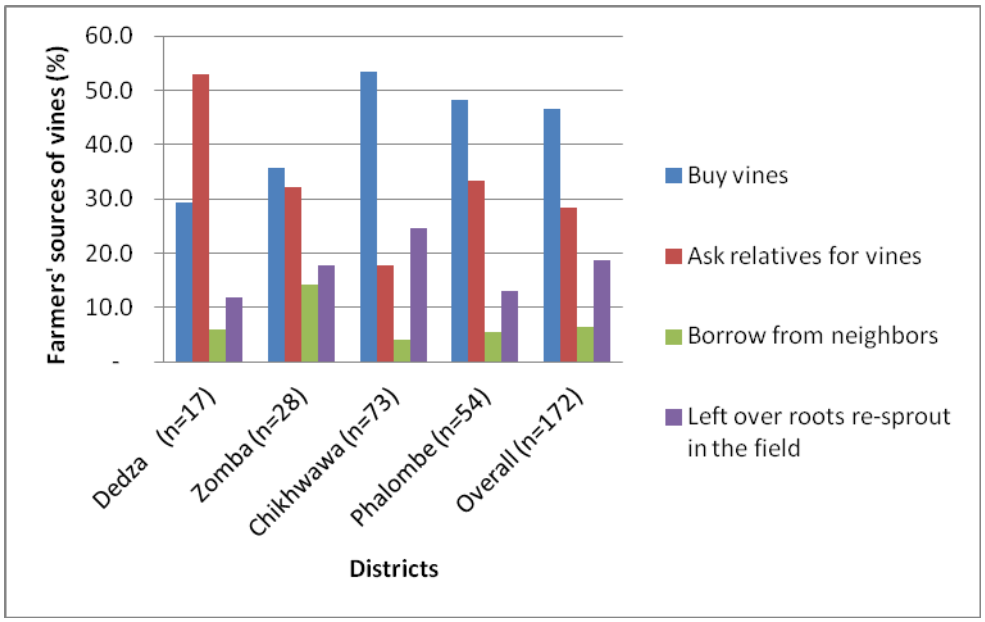

Figure 5.15: Sources of sweetpotato vines for those not conserving vine by district (in %)

In this analysis, purchasing vines comes out as an important source of planting material. This shows that multiplication of clean seed can be a viable business in the study area. If, in this project, vine multipliers are trained to produce clean seed for the farmers, it is expected that farmers would purchase the vines and some would conserve planting material while others would continue purchasing their planting material from the vine multipliers due to the long dry periods.

5.3.2 Sweetpotato harvest and root conservation

In Malawi, most of the sweetpotato is planted between October and March, during the main season (Minolt, 2010). In some other areas, some farmers plant a second crop in July using residual moisture to harvest in September. Therefore, at the time of this survey, the majority of the farmers had minor harvests from their sweetpotato farms.

When respondents were asked months of major and minor harvests of sweetpotato in the previous 12 months, June and July appeared to be the main months of major and minor harvest (Figure 5.16). This was the same case for OFSP harvest. The majority of the households, however, identified sweetpotato production throughout the year to have minor harvest, with only a small proportion indicating major harvest. As a result, the minor harvest chart in Figure 5.16 was always above the major harvest. This was the case for both OFSP and other sweetpotato types.

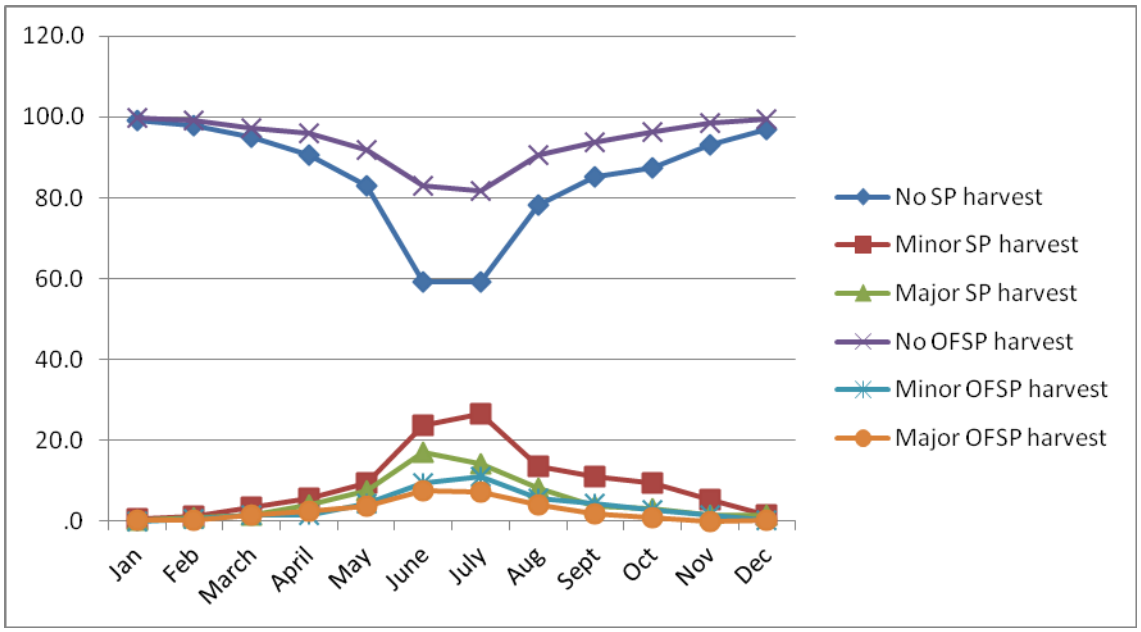

Figure 5.16: Months of minor, major and zero harvest of sweetpotato in the past one year

In January, almost all respondents reported not to have any harvest from both OFSP and other sweetpotato types. This period is during the rainy season; hence most of the sweetpotato is in the farm. The trend changes from around March, where minor and major harvests start to be realized. Production increases until June and July, when OFSP and other sweetpotato production are at their maximum for both minor and major harvests. From July, both minor and major harvests start dwindling as the curve for no production goes up for both OFSP and other sweetpotato. This trend continues until December, when again, most of the farmers did not have any sweetpotato harvests.

Among farmers who harvested sweetpotato, some stored the roots while others did not. Among those who stored, an average of 94.4% stored the roots whole and fresh (Figure 5.17). Chikhwawa district had the highest proportion of farmers who stored sweetpotato roots whole and fresh (97.3%), while Dedza had the least percentage (92.2%). These farmers used different methods to store the roots. Figure 5.18 shows the different storage methods, proportion of households that

used each method, and the average maximum period that the roots were stored, for each storage method used.

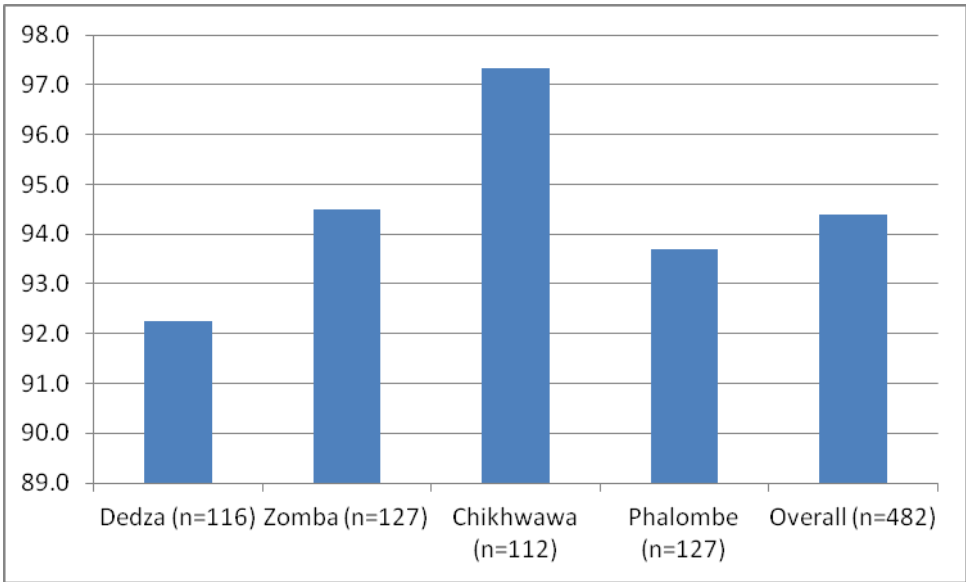

Figure 5.17: Proportion storing SP root whole and fresh by district

The predominant method of sweetpotato root storage in the study area was piling the roots in the house. This method was used by 66.5% of the households, and these households stored the roots for an average maximum period of 16 days. Storing roots in a pit with ash was the second most used method (43.2%), and the roots were stored for an average maximum period of 101 days. The third most used method of root storage was putting in sacks (15.3%), and the roots stayed for an average maximum period of 18.6 days.

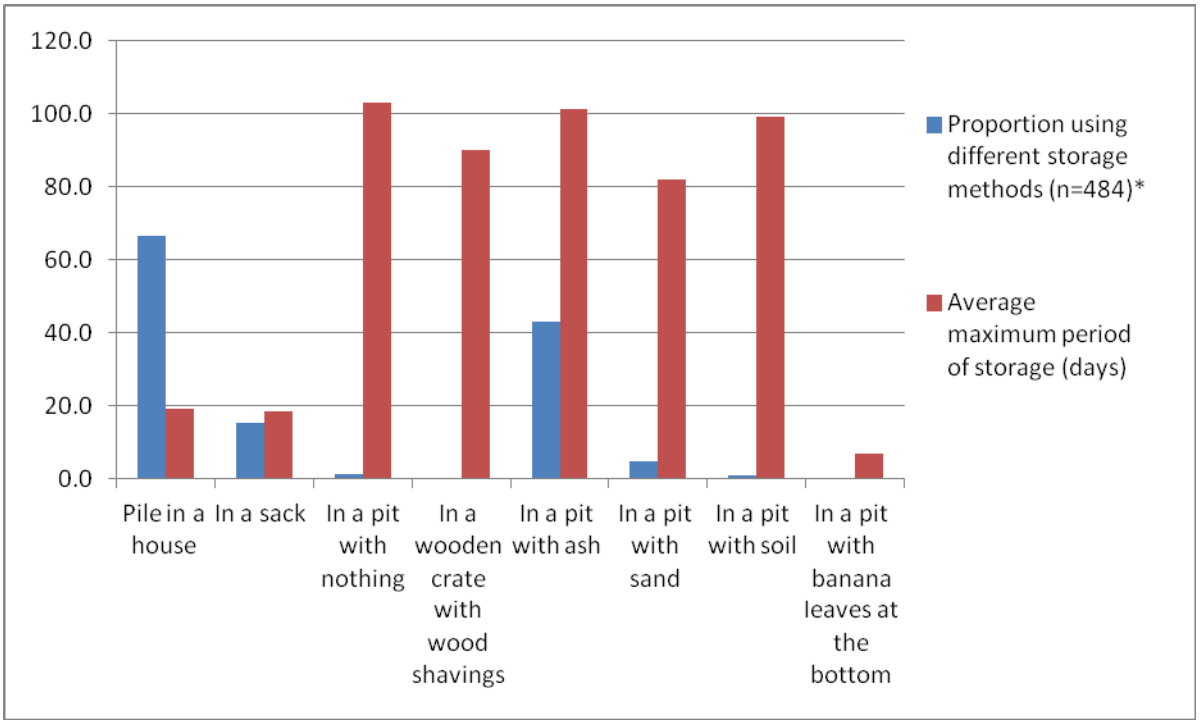

Figure 5.18: Proportion using different sweetpotato root storage methods
N=484

Storing roots in a pit with nothing added, had the highest average period of root storage (102.9 days), even though only 1.4% of the households used this method. Other methods of storage used by the sampled population were; in a wooden crate with wood shavings, in a pit with sand, in a pit with soil, and in a pit with banana leaves at the bottom.

5.4 Crop sale

Households' earnings from crop sales were calculated for crop year 2009/2010. First, the proceeds were calculated in Malawian kwacha and then converted to US dollars using the average conversion rate during the survey period. Farmers were also asked several other questions regarding crop sales, the results of which are presented in this section.

From the 2009/2010 crop year, pigeon peas, Irish potatoes and bananas turned out to be the most sold crops, sold by more than half of the farmers who planted them during that crop year (Figure 5.19). Overall, about 30% of the farmers who planted sweetpotato sold some of the produce. Sorghum was sold by the fewest farmers in the study area. Analysis by district shows that all farmers who produced Irish potatoes in Phalombe district sold the produce. The second highest proportion of farmers who made sales from their produce was banana farmers in Dedza (73%), and bean farmers in Phalombe came third.

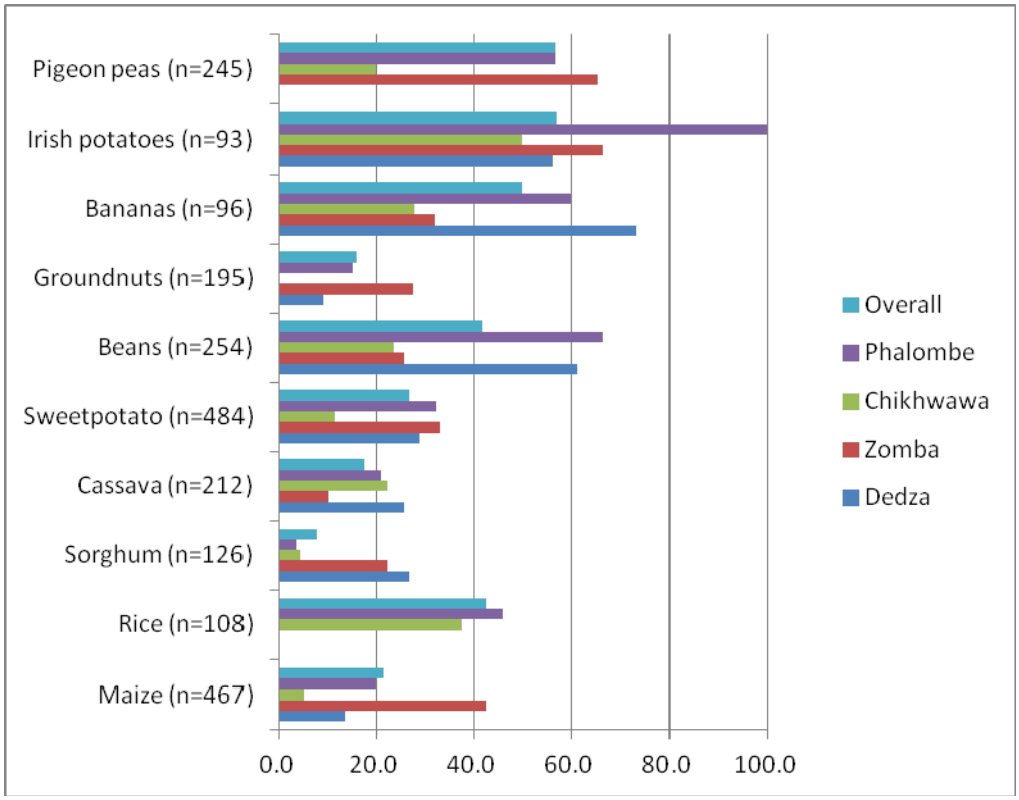

Figure 5.19: Percentage of households that sold different food crops among those who produced the crop

On average, about 30% of the farmers who produced sweetpotato during the 2009/2010 crop year sold the crop (Figure 5.20). On the other hand, OFSP sales were much lower (about 10%). Cassava sales were, however, lower than sweetpotato sales in general. The highest proportion of households that sold sweetpotato was recorded in Zomba and Phalombe, followed by Dedza. OFSP sales were highest in the Dedza district, and the lowest proportion of households that sold sweetpotato, OFSP and cassava was recorded in Chikhwawa.

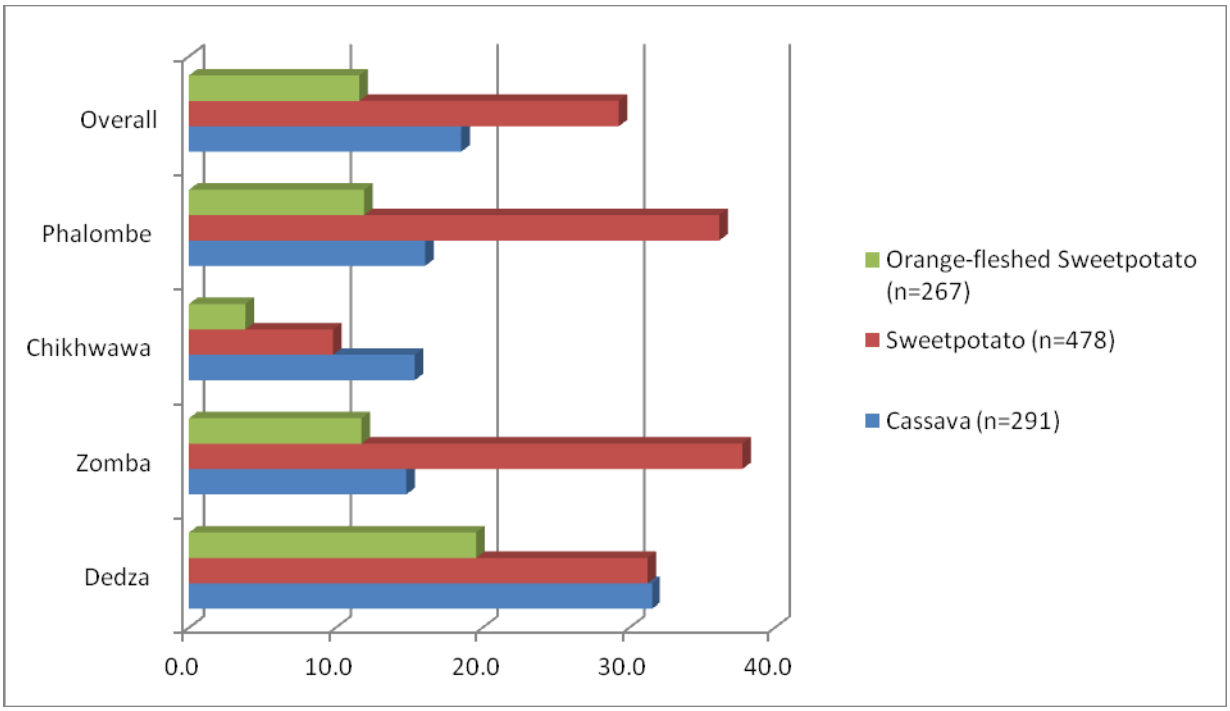

Figure 5.20: Proportion of households that sold sweetpotato and cassava by district

Besides determining the proportion of farmers that made sales from their farm produce, it was important to know the crops that fetched a high income for the family. Overall, tobacco fetched the highest income for the households that produced the crop during the 2009/2010 crop year, fetching an average amount of about US$ 240 per household (Figure 5.21). Okra came second, then tomatoes and cotton.

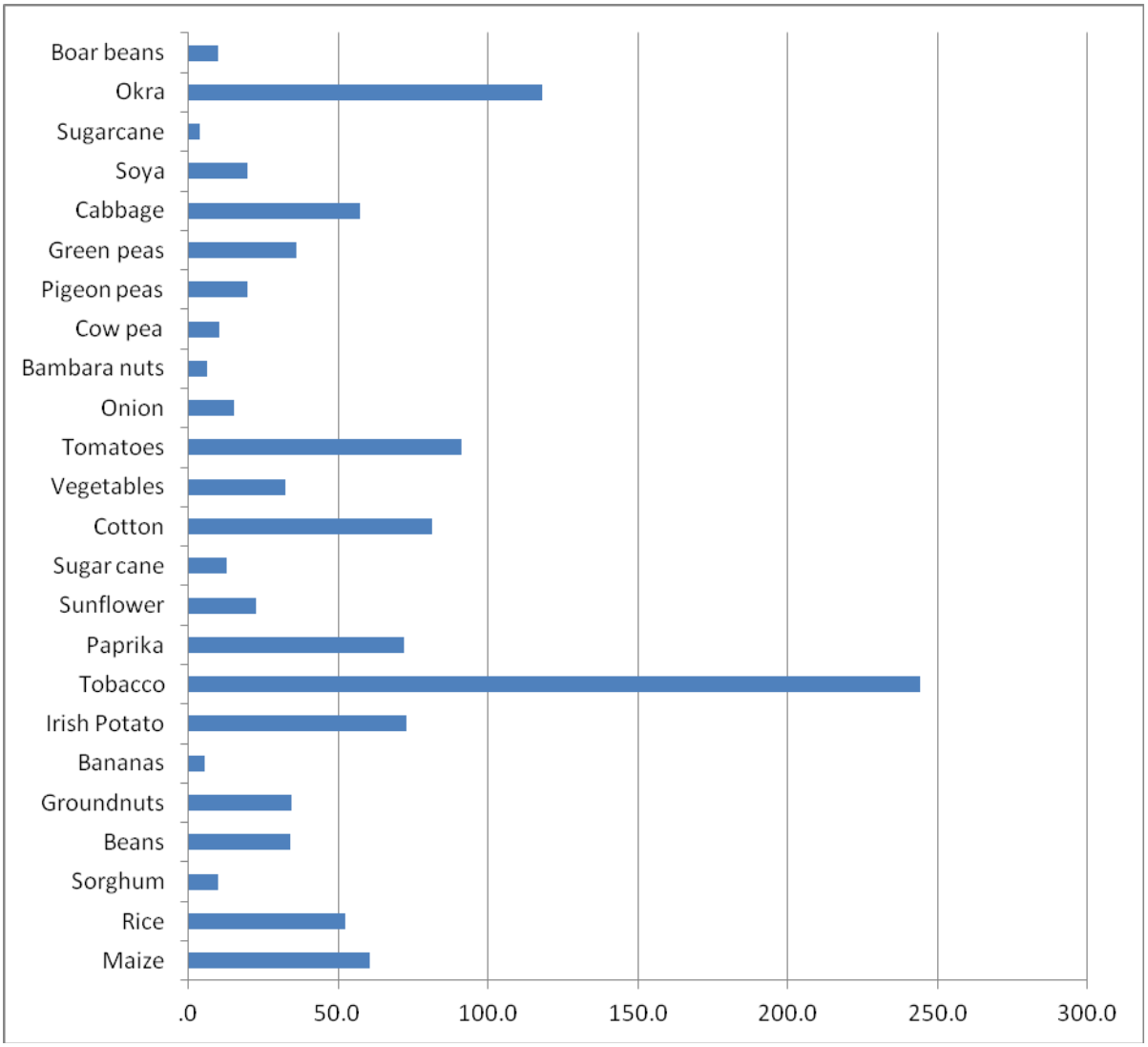

Figure 5.21: Money received from different crops in US dollars

1 MwK= US $ 0.00655

Analyzing sweetpotato, OFSP, and cassava sales by district shows that households in Dedza received the highest revenue from sales of sweetpotato (US$ 1200) and cassava compared to households in the other three districts (Figure 5.22). Those in Chikhwawa district received the least revenue from sales of cassava, sweetpotato and OFSP. Revenue received from the sale of OFSP in the four districts however, was much lower, less than US$ 200 per household that produced OFSP. One of the objectives of the project '*Rooting out hunger in Malawi with OFSP*' is to increase the production OFSP so that farmers have surplus for sale to increase their income. If farmers can produce more of the OFSP, it will boost their income and at the same time increase consumption of vitamin A in the area.

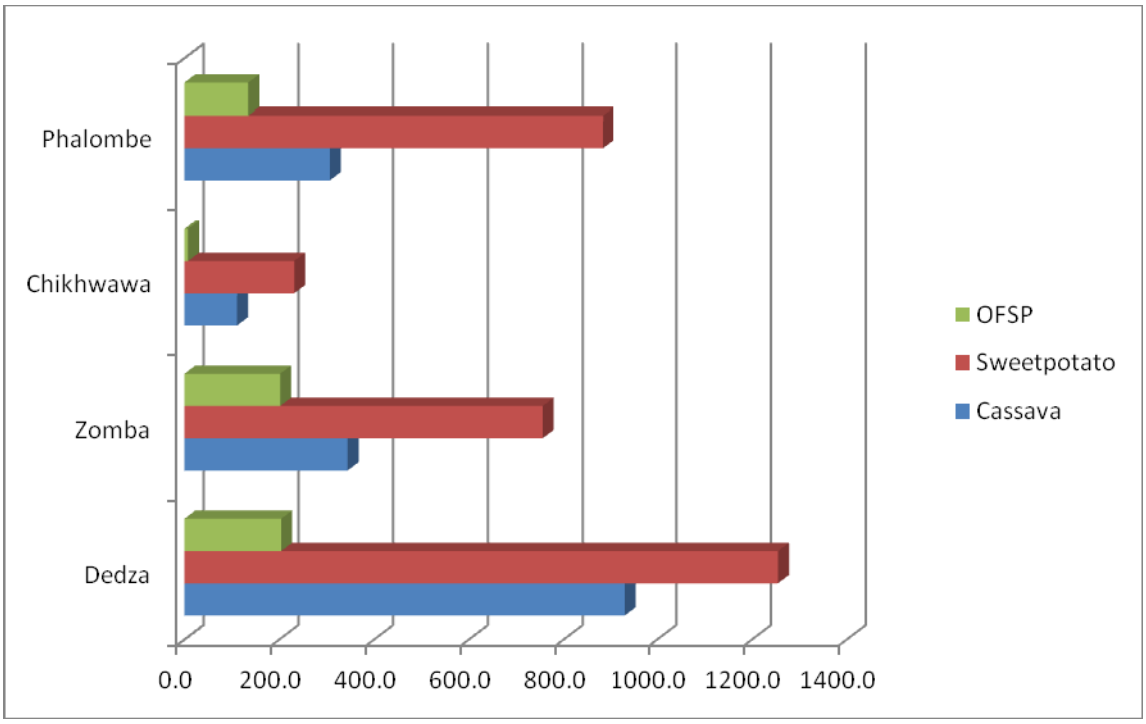

Figure 5.22: Average sales from different crops (in US$) among households that produced them by district

The majority of households that sold cassava, sweetpotato, and OFSP were from households headed by men (72%) compared to those headed by women (Table 5.14). More than 80% of men-headed households sold cassava, 71% sweetpotato, and more than half sold OFSP. Among women-headed households, the highest percentage of households that sold these three crops (sweetpotato, cassava, and OFSP) was seen from households headed by women with a resident man. The smallest proportion of households that made sales was seen from households headed by women without the support of a man, and those with the support of a non-resident man.

Table 5.14: Gender of head of household for households that sold sweetpotato and cassava

	Man	Woman HH with the support of a non-resident man	Woman HH with resident man	Woman without the support of a man
Cassava (n=54)	83.33	5.56	7.41	3.70
Sweetpotato (n=140)	71.43	6.43	15.71	6.43
OFSP 9(n=31)	54.84	0.00	32.26	12.90
Overall (n=225)	72.00	5.33	16.00	6.67

From these results, we learn that high proportions of households with men (either headed by men or headed by women but supported by a resident man) sell their crop produce as compared to those headed by women without any support of a man or supported by a non-resident man. Women are always keen on food security and always want to make sure that their household

members have food to eat. Therefore, when they have control over their farm produce, they will rarely sell.

Most of the crop produce sold was sold at the local market (Figure 5.23). More than half of the farmers who made crop sales during the cropping year under study sold their crops through this channel. Farm gate sale was the second most used channel of crop sale across the four districts. Government board/ADMARC, auction floors and big town market were the least used channel of crop sale. More detailed channels of crop sale are displayed in Appendix D, showing all crops sold and where the produce was sold.

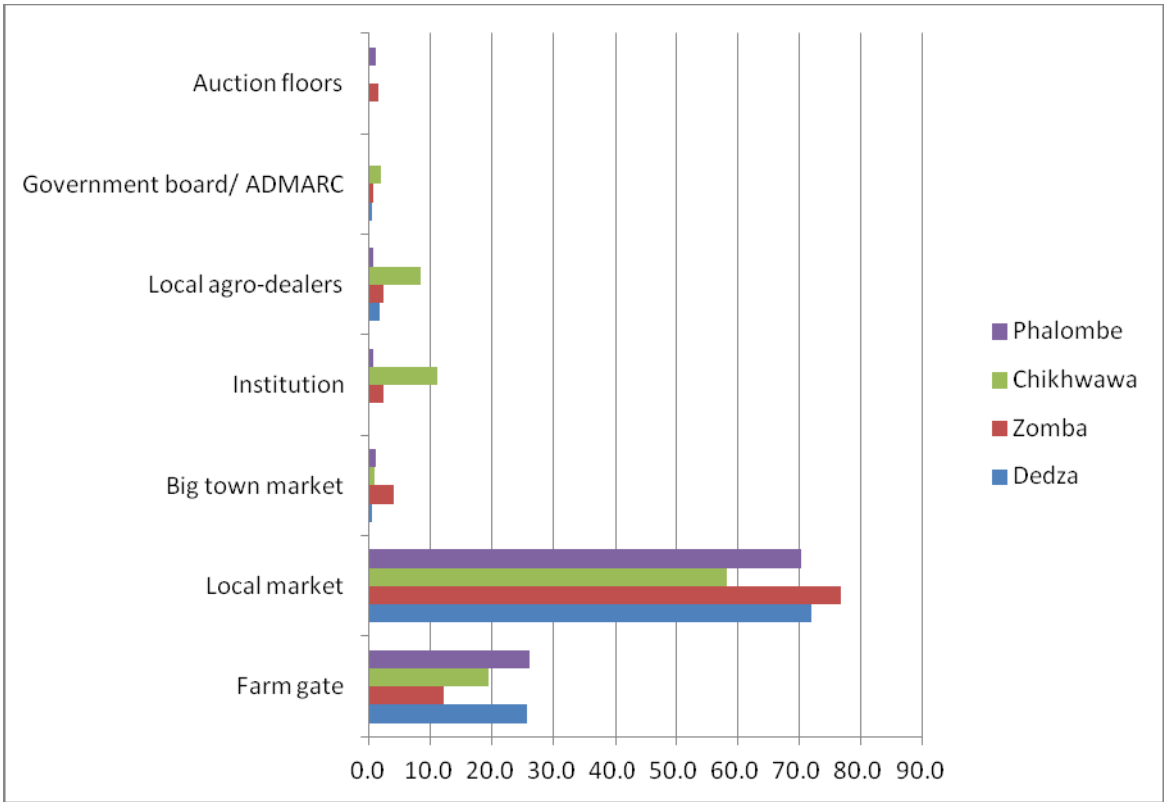

Figure 5.23: Most used channel of crop sales in percentages

Between local market and farm gate, local market was the most used channel of sweetpotato and OFSP sale, but was closely followed by farm gate (Figure 5.24). For cassava, however, most of the produce was sold at the farm gate (70%) and only 30% was sold at the local market.

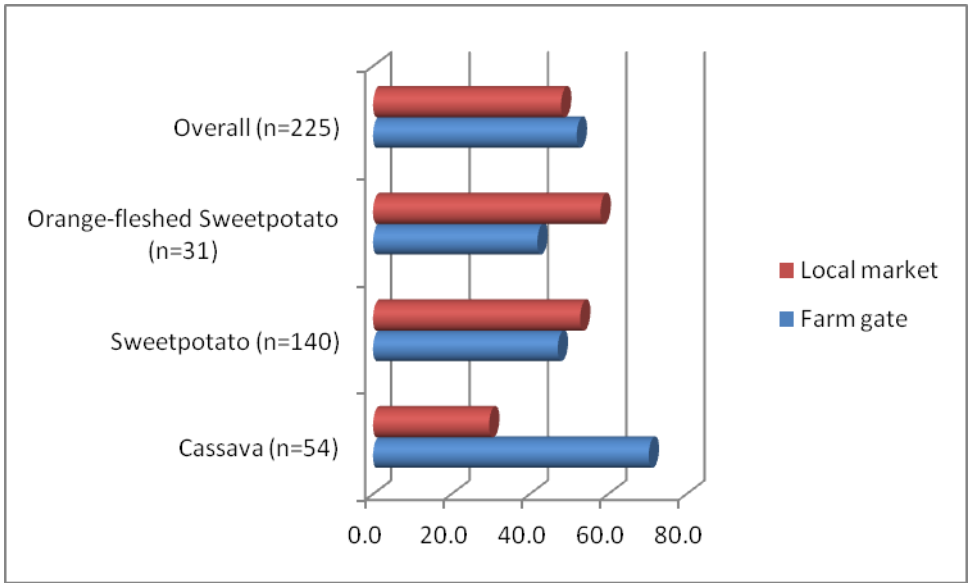

Figure 5.24: Main channels of sale by crop (in percentages)

Results displayed in this chart are consistent with prior results arrived at in this report where cassavas collected the lowest revenue for the households that sold them when compared to sweetpotato and OFSP sales. Most of the cassava sales were made at the farm gate and high possibilities are that they were bought by local traders, who are the main buyers of crop produce sold during the referenced crop year as shown in Figure 5.25 below. As a result, the local traders, who could also be middlemen, buy the crop produce from farmers at a much lower price, so that they can sell to other traders at a higher price. For farmers to make profit from the sale of their crop, they need to cut down on the number of middlemen in the market chain.

As previously mentioned, local traders dominated the purchase of crop produce from farmers in the study area during the 2009/2010 cropping year (Figure 5.25). More than half of the farmers (59%) who sold their farm produce during that year sold to local traders. Consumers at the local market were the second most important buyers of farm produce (28%); the farmers came third (6.2%). NGOs (1.3%) and auction floors (1.8%) purchased the least from farmers in the study area during that year.

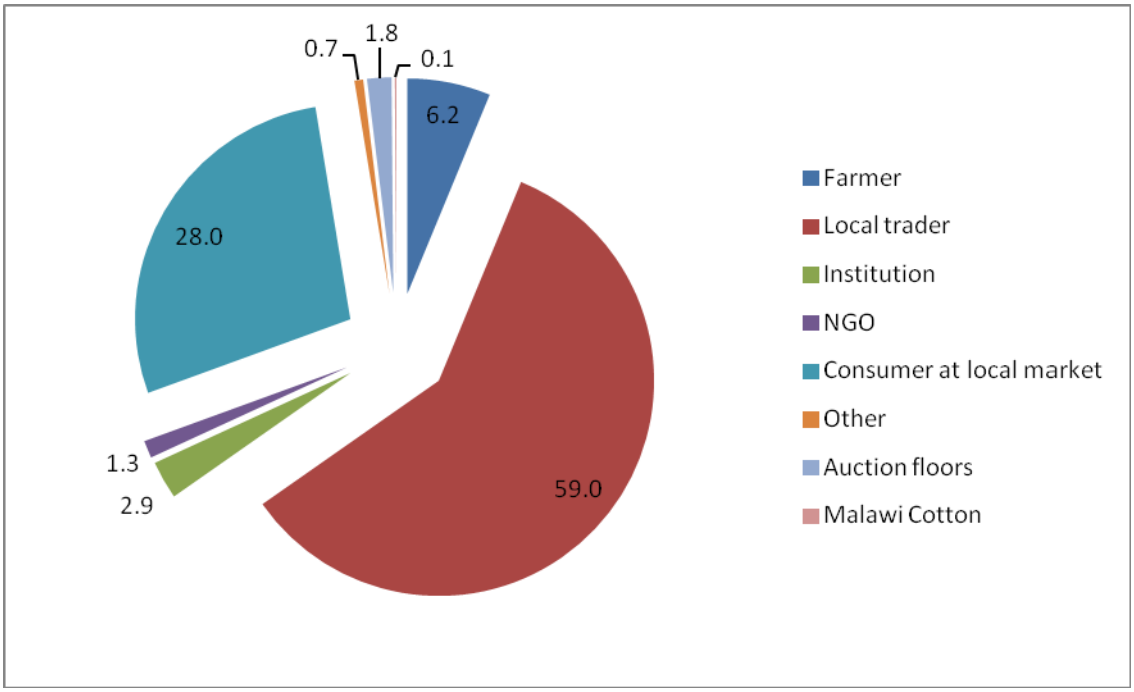

Figure 5.25: Overall main buyer of sweetpotato, OFSP and cassava

Farmers who sold crop produce during the 2009/2010 crop year gave different reasons for selling their farm produce. Selling crops to purchase other household items, however, dominated the reasons given (Figure 5.26). Buying fertilizer was the second reason, and buying food items came third. Other reasons given are shown in Figure 5.26.

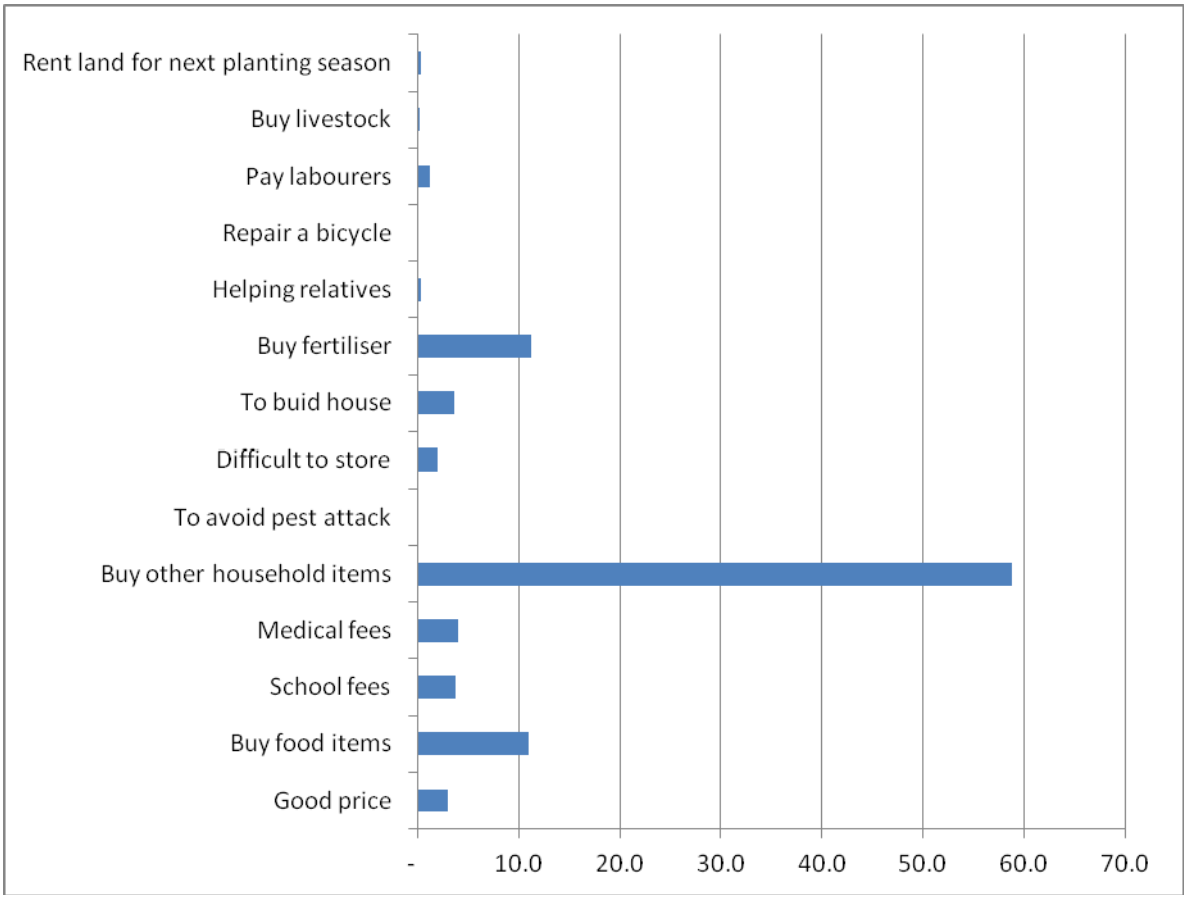

Figure 5.26: Overall reasons for selling crops in percentage

When farmers were asked reasons for selling OFSP, sweetpotato, and cassava, reasons given were consistent with those given for all crops in Figure 5.27 above. Still, the most predominant reason for selling the three crops was to buy other household items (Figure 5.27). This was consistent across the four districts. Buying food was the second most common reason given, closely followed by buying fertilizer.

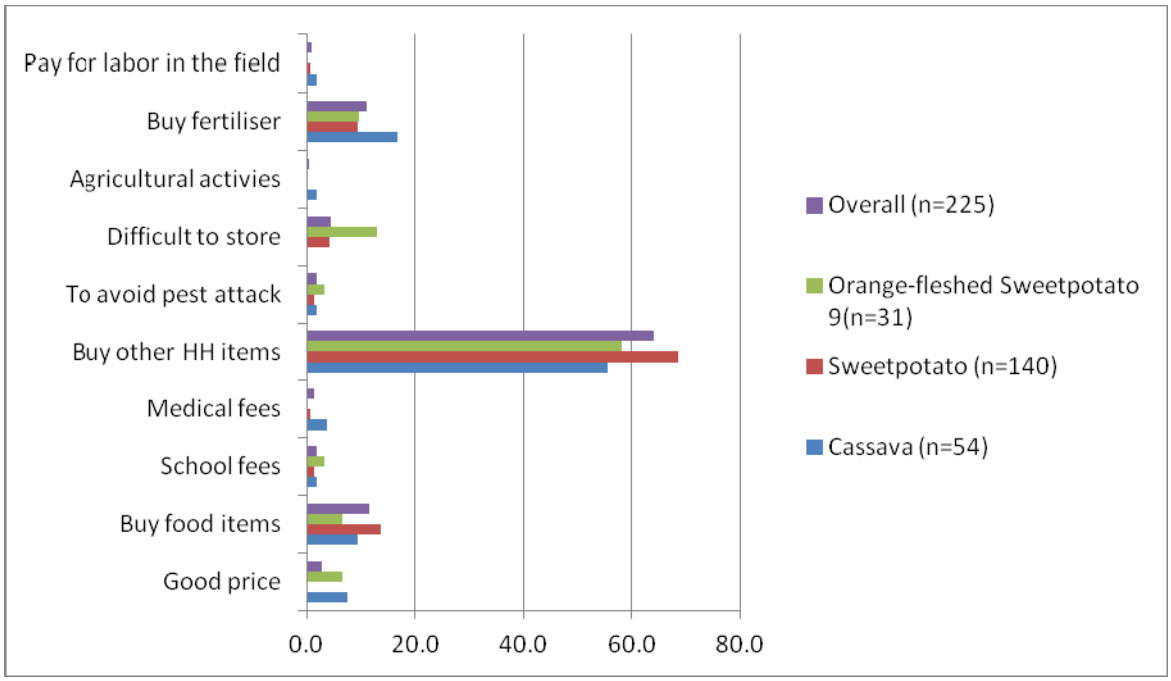

Figure 5.27: Main reason for selling different crops (in percentages)

In most of households that sold sweetpotato, OFSP, and cassava, both husband and wife made selling decisions of when and how much of the produce to sell (Figure 5.28). This was consistent across the four districts of study In instances where husband and wife made the selling decisions separately, however, husbands dominated over their wives in Phalombe, Chikhwawa and Zomba. In Dedza, a higher proportion of women made decisions on when to sell the farm produce and how much to sell. The high proportion of men making decisions on the sale of farm produce over women is consistent with prior results in this study, where a high proportion of households that sold farm produce were reported among male headed households compared to those headed by women.

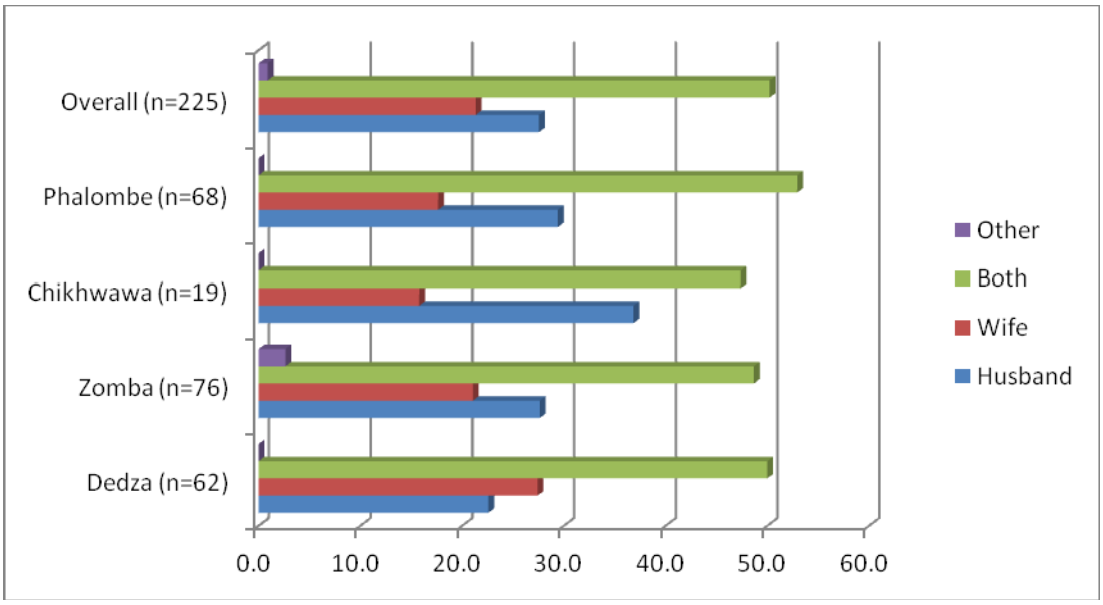

Figure 5.28: Main decision-maker of when and how much of the crop to sell by district (in percentages)

As shown in Figure 5.29, the highest proportion of proceeds from sales of farm produce was received by women (42.4%) compared to that received by men (31.0%). This could be explained by the matrilineal system in Malawi, where cultivation rights are inherited by the wives. Only 26.6% of the proceeds were received by both women and men.

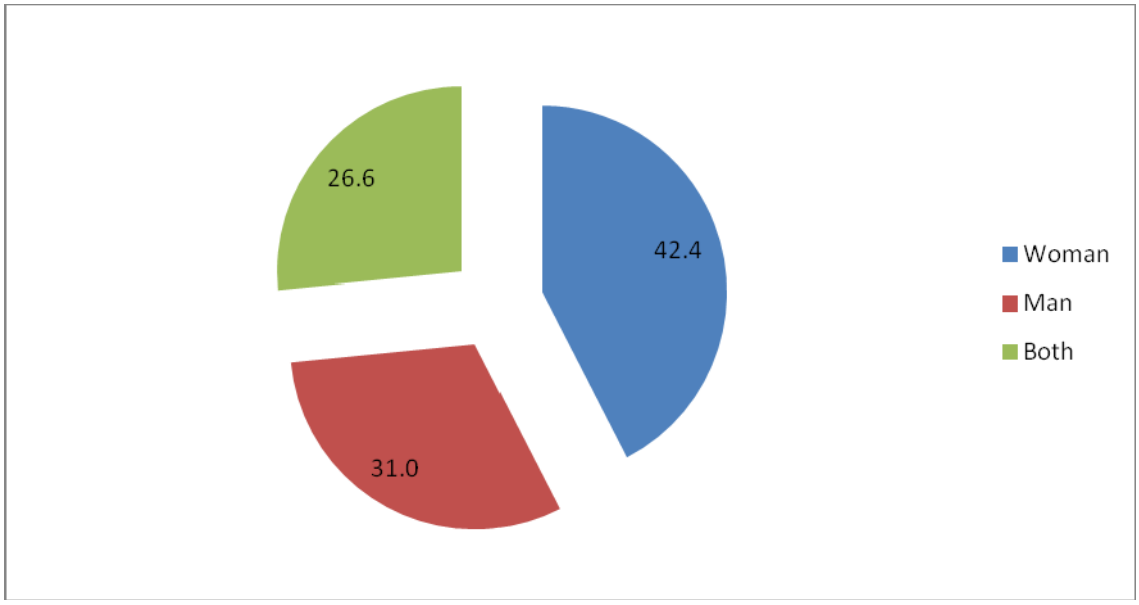

Figure 5.29: Gender of person who received money from overall crop sales

5.5 Credit access

Promoting an efficient, sustainable, and widely accessible rural financing system remains a major development challenge in sub-Saharan African countries. With about 73% of Africa's population living in the rural areas and experiencing a high incidence of poverty, access to credit is crucial in achieving pro-poor growth and poverty reduction goals. This, however, becomes a challenge due to the high costs of delivering services to small, widely dispersed customers who often lack suitable collateral (Onumah, 2002). Insufficient working capital and low liquidity limits farmers' ability to purchase productivity-enhancing inputs such as improved seeds, fertilizers, and pesticides.

In this study, farmers were first asked whether they applied for credit, to find out the proportion that had realized the need for credit. Overall, about half of the respondents had previously applied for credit (Table 5.15). The highest proportion of those who had applied for credit was in the Chikhwawa district (55.4%), and the lowest in the Dedza district (37.3%).

Table 5.15: Credit access analyzed by districts

	Dedza (n=118)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=484)
Those who applied for credit (%)	37.3	51.2	55.4	52.0	49.0
Those who received credit among those who applied (%)	72.7	83.1	77.4	90.9	81.9

More than three quarters of the farmers who applied for credit actually received it. Overall, 81.9% of the farmers who had applied for credit reported that they had been granted the credit. The highest percentage of respondents who applied and received credit was recorded in Phalombe (90.9%), followed by Zomba (83.1%), then Chikhwawa (77.4%), and lastly Dedza (72.7%). These results show that if farmers look for credit, quite a high number attain the credit applied for.

Further analysis was done to find out whether there was a difference in the proportion of households that applied for credit based on the type of household head. About 73% of the farmers who applied for credit came from male-headed households (Figure 5.30). Female- headed households with support from a resident man made up 14.8% of the farmers who applied for credit; 7.2% from female-headed households without the support of a man; and only 5.1% of farmers from female-headed households with the support of a non-resident man sourced for credit.

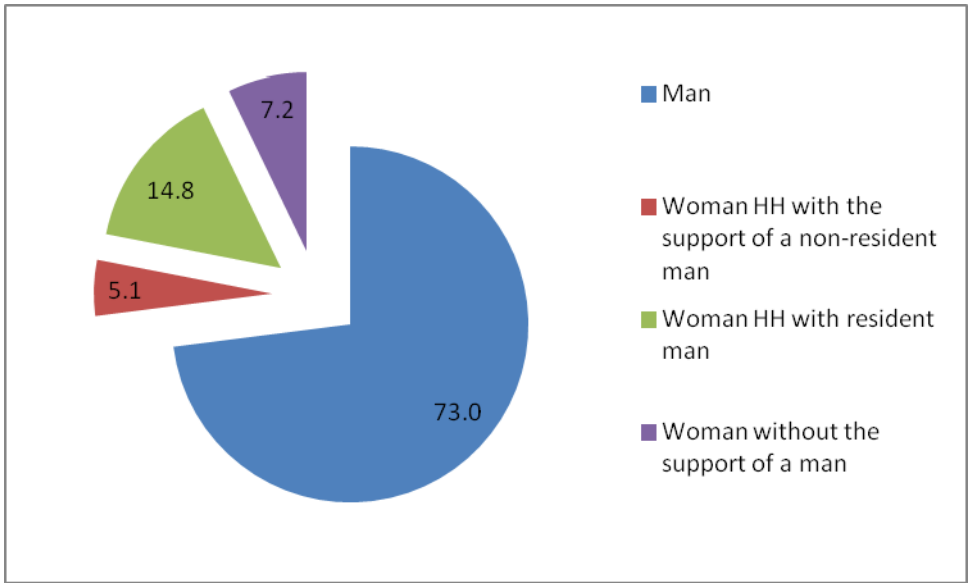

Figure 5.30: Proportion of households that applied for credit by status of household head

The four predominant sources of credit identified in the four districts of study were: friends, microfinance organizations, relatives, and savings and credit groups (Figure 5.31). Friends were the main source of credit for farmers in the Chikhwawa (37.5%) and Zomba (32.1%) districts. In Dedza district, microfinance organizations were the main source of credit (37.5%), whereas in Phalombe, the majority of the farmers received their credit from savings and credit groups (28.3%). Other sources of credit that were used by a few of the farmers in the study area are; commercial banks (only used by respondents in Zomba district), FAO (only used by farmers in Zomba and Dedza) and Malawi rural finance company and "WALA-Bank ya mmudzi" which financed farmers in Chikhwawa only.

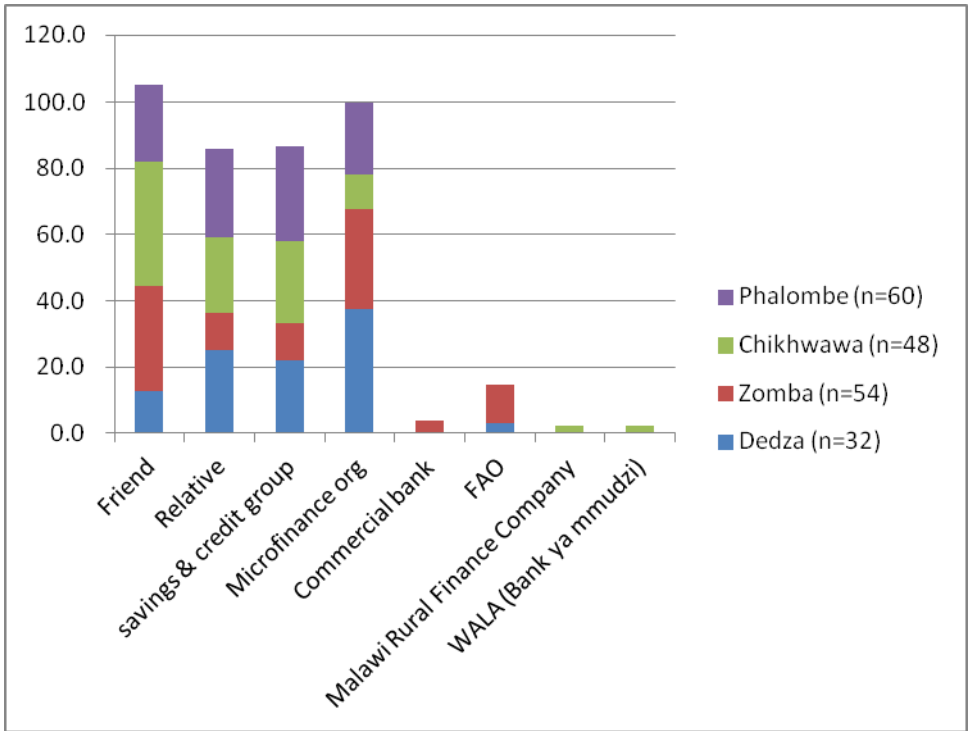

Figure 5.31: Sources of credit by district

6. VITAMIN A KNOWLEDGE, FARMERS' PRACTICES, ATTITUDE AND PERCEPTION ON SWEETPOTATO

6.1 Attitude and perceptions towards sweetpotato

Consumers' attitude and /or perception towards a product can affect its consumption. Farmers, who are also consumers of the agricultural produce, can decide to consume or not to consume a specific type of food depending on the perceptions they have towards that food (Shepherd & Sparks, 1994). At the same time, this can highly affect its adoption at the production level.

To understand farmers' attitude and perceptions on sweetpotato in this study, respondents were asked several questions regarding sweetpotato. The majority of the farmers (84.5%) strongly agreed that sweetpotato leaves are good for human consumption (Table 6.1). The high positive perception among farmers in Malawi shows that households in Malawi can consume (or could be consuming) sweetpotato leaves, which are one of the sources of vitamin A. About 78.9% of the farmers strongly disagreed with the statement that sweetpotato is food for women and children. Only 2.5% agreed and 6.8% strongly agreed with this statement. This shows that people are changing the previous perception they had about sweetpotato, namely that sweetpotato is a woman's crop and it is food for women and children only. No wonder that 87.0% of the

respondents strongly disagreed with the statement that men cannot grow sweetpotato and be considered men.

Table 6.1: Attitude and perception towards sweetpotato and OFSP

	Strongly agree	Agree	Do not know/ No opinion	Disagree	Strongly disagree
Sweetpotato leaves are good for human consumption	84.5	8.9	1.4	3.1	2.1
SP is a food for women and children only	6.8	2.5	2.7	9.1	78.9
OFSP are healthier than ones that are WFSP	58.7	6.6	27.5	4.3	2.9
SP is the most reliable food crop for our family during times of food shortage	80.0	15.7	0.8	2.1	1.4
Even when we have plenty of maize/ cassava/ rice we still like to have SP in our diet	69.4	24.4	0.2	4.1	1.9
You can't grow SP and be considered a man	5.2	0.6	2.1	5.2	87.0
You can't eat too much SP because you will get stomach problems	29.1	10.7	11.0	11.8	37.4

More than half of the respondents understood that OFSP was more nutritious than white fleshed sweetpotato (WFSP). Only 7.2% thought that WFSP was more nutritious than OFSP. About 27.5%, however, did not know which type of sweetpotato was more nutritious than the other. On the other hand, about a third of the respondents (29.1%) agreed that one cannot eat too much sweetpotato because they will get stomach problems. This shows that there is a need for training in sweetpotato consumption and, specifically, in the nutrition benefits of OFSP so that people can change this perception.

6.2 Farmers' practice regarding sweetpotato

Understanding the daily practice of households regarding sweetpotato will help in knowing whether sweetpotato is important to farmers or not. More so, it will bring out any knowledge gap regarding sweetpotatoes, and show where training needs to be done.

From all households in the four districts of study, 87.8% reported that whenever an important person visited them, they served them a meal with sweetpotato. In addition, 28.5% indicated that if they became richer, they would eat more sweetpotato, 34.9% would eat the same, and 36.6% would eat less (Table 6.2). Across districts, more respondents in Dedza and Zomba would eat more sweetpotato than in Chikhwawa and Phalombe. The highest percentage of respondents in Dedza however, would eat less if they became richer (46.6%).

Table 6.2: Proportion of farmers that would eat more or less sweetpotato if they became richer

	Dedza (n=118)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=484)
Percentage of respondents that would eat less	46.6	21.3	46.4	33.9	36.6
Percentage of respondents that would eat more	37.3	32.3	24.1	20.5	28.5
Percentage of respondents that would eat the same	16.1	46.5	29.5	45.7	34.9

The proportion of farmers who would eat less sweetpotato if they became richer (36.6%) is the highest among the three categories of consumption behavior in the study area. This shows that there is a likelihood that sweetpotato is associated with poverty, and only poor consumers will consume sweetpotato, and the richer the farmers become, the less sweetpotato they consume. This further emphasizes need for information dissemination regarding sweetpotato consumption and the nutrition benefits of OFSP, which is not linked to poverty in any way.

In all, 87.6% of the overall interviewed households reported that they ate something before mid-morning. Of these households, porridge was the most consumed (46.2%), followed by sweetpotato (35.0%) and then tea (11.2%) as showed in Table 6.3. Consumption of sweetpotato in the morning was highest in Chikhwawa (50.0%) and lowest in Zomba (16.7%). Other foods consumed were rice, cassava, Irish potato and mandazi.

Table 6.3: Type of food consumed by households during mid-morning

	Dedza (n=93)	Zomba (n=108)	Chikhwawa (n=102)	Phalombe (n=108)	Overall (n=411)
Rice	1.1	0.9	0.0	8.3	2.7
Cassava	0.0	4.6	0.0	2.8	1.9
Sweetpotato	37.6	16.7	50.0	37.0	35.0
Irish Potato	10.8	0.0	0.0	0.0	2.4
Porridge	41.9	56.5	42.2	43.5	46.2
Tea/Coloured Tea	8.6	20.4	6.9	8.3	11.2
Mandazi	0.0	0.9	1.0	0.0	0.5

Most of the respondents (91.9%) were aware that sweetpotato is healthier to eat in the morning than bread (Table 6.4). These results were consistent across the districts of study, even though the highest proportion of respondents with this knowledge was recorded in Zomba (97.6%), followed by Phalombe (96.1%), Dedza (89.0%) and Chikhwawa (83.9%). When sweetpotatoes are in production, households in the study area reported that they consume sweetpotato six days in a week, on average.

Table 6.4: What is healthier to eat in the morning, bread or sweetpotato?

	Dedza (n=118)	Zomba (n=127)	Chikhwawa (n=112)	Phalombe (n=127)	Overall (n=484)
Bread	11.0	2.4	16.1	3.9	8.1
Sweetpotato	89.0	97.6	83.9	96.1	91.9

6.3 Vitamin A knowledge

As earlier mentioned in this report, VAD is a serious health concern in Malawi. Knowledge of vitamin A and vitamin A rich foods among the household members, and subsequently consuming vitamin A rich crops, would play a vital role in reducing VAD in the country.

In this study, women and men were asked their awareness of vitamin A to find out whether there was difference in awareness by gender. Over half of the men (57.2%), however, were not available to respond to this question, whereas only 1.9% of the women were unavailable to respond. From the women and men who responded to this question, vitamin A awareness was found to be slightly higher in women (89.3%) than in men (87.0%) as shown in Figure 6.1.

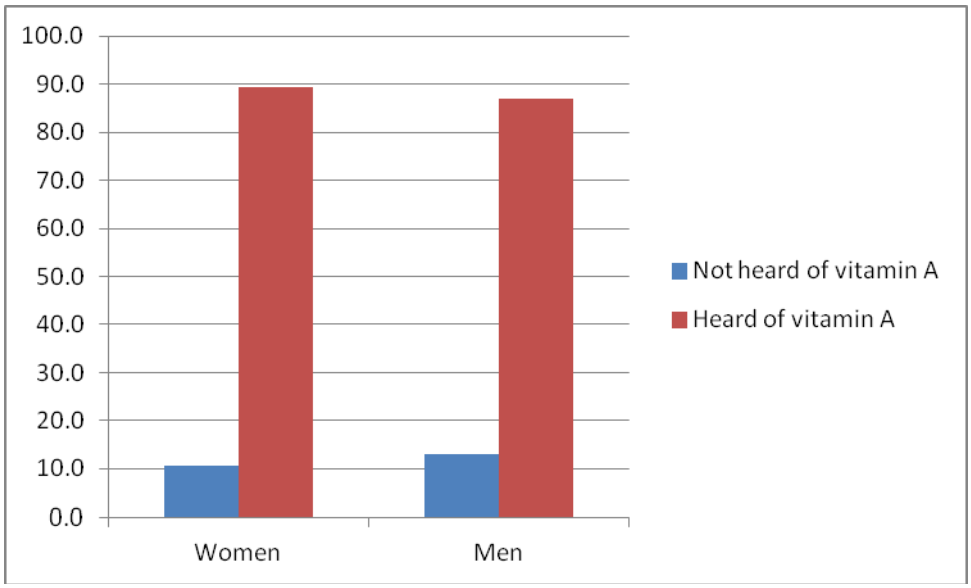

Figure 6.1: Vitamin A awareness among men and women

To find out whether farmers in the study area had any vitamin A knowledge, both men and women who had indicated that they were aware of vitamin A were asked the importance of vitamin A to the human body. Vitamin A knowledge among men was higher than in women (Table 6.5). Among the women, 55% indicated that vitamin A protects the body, 12.7% improves vision,

5.4% enhances health, 3.5% increases body immunity, and 15.1% did not know any importance of vitamin A. From the men's responses, 61.7% responded that it protects the body, 10.0% improves vision, 3.9% enhances health, 1.1% increases body immunity and 12.2% did not know any importance.

Table 6.5: Importance of vitamin A to human body among those who have previously heard of vitamin A

Importance of vitamin A	Women responses (n=424)	Men responses (n=180)
Do not know	15.1	12.2
Protect the body/Skin	55.0	61.7
Build the body	0.2	1.1
Strengthen the bones	0.5	0.6
Improves vision	12.7	10.0
Gives energy	4.2	5.6
Increases body immunity	3.5	1.1
Increases blood	1.2	0.6
Helps to grow	0.2	1.1
Enhances health	5.4	3.9
Provides nutrients	1.4	1.1
Nourishes the body	0.5	1.1

Health units came out as the most important source of vitamin A information. More than 70% of the women and 30% of men who had knowledge of vitamin A had obtained the information from health units (Figure 6.2). Radio programs in the local language were the second most important source of vitamin A information, followed by schools and health extension officers and volunteers. Workshops and religion leaders were the least sourced places.

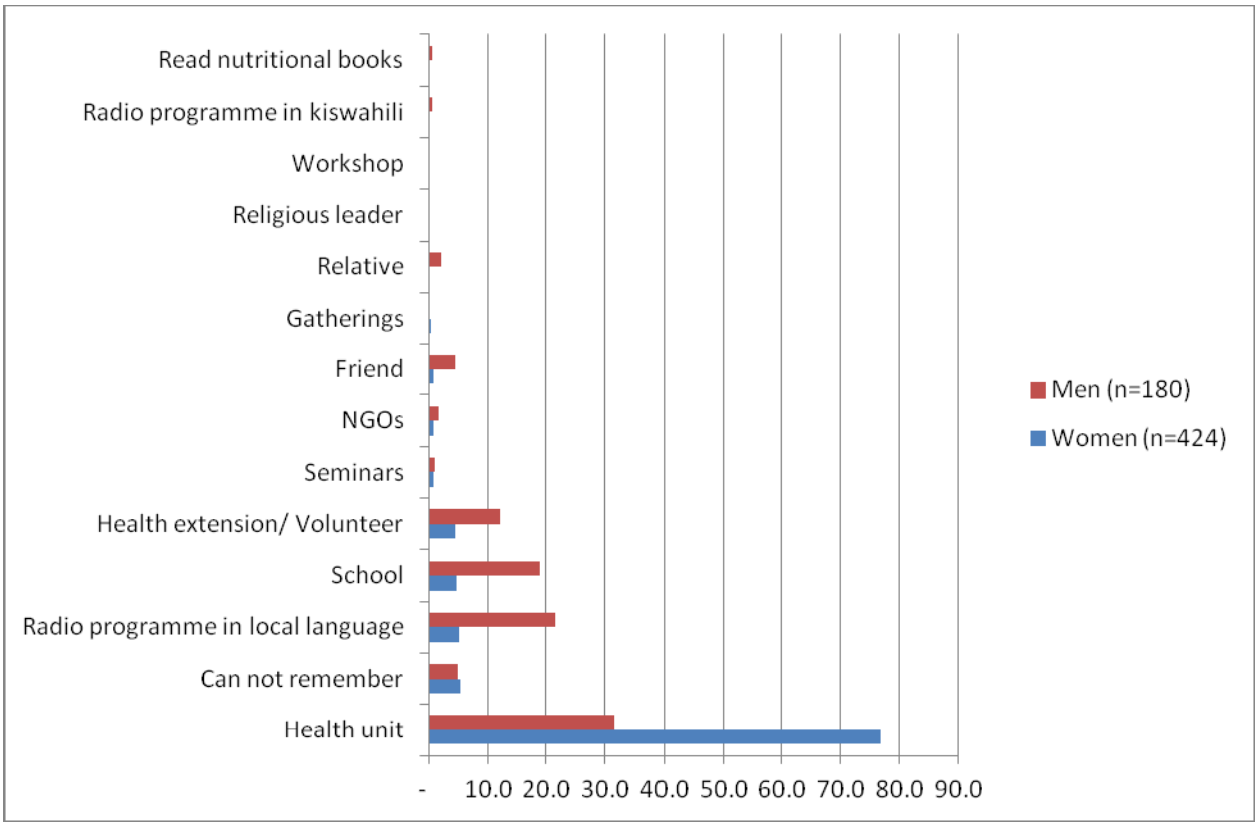

Figure 6.2: Main sources of vitamin A information

These results will be of importance in the project during the dissemination of information on vitamin A and OFSP. The right channels' dissemination of information to farmers can be used to ensure that information reaches the people. For instance, health units, which are the main source of vitamin A information, can be used in the project to disseminate more vitamin A information and OFSP information.

7. CONSUMPTION AND FOOD SECURITY

7.1 Dietary diversity

Dietary diversity is a qualitative measurement of food consumption that can be used to evaluate a household's access to a variety of foods (households' dietary diversity score-HDDS) and also act as a proxy for nutrient adequacy for individual diet (individual dietary diversity score-IDDS) (Swidale & Bilinsky, 2006). A simple count of foods consumed over a reference period (mostly over a 24-hour period) is made. A high score is associated with increased nutrient adequacy of the diet. A score below four reflects poor dietary diversity and is unacceptable, a score of four or five is medium dietary diversity, while a score of six and above reflects adequate nutrient intake (Kennedy, Ballard & Dop, 2011). The measure also shows the economic ability of a household to

consume a variety of foods. Studies have shown that a high dietary diversity score is associated with a high socio-economic status and household food security (Hoddinott & Yohannes. Y., 2002).

In the case of Malawi, food items collected during this study were grouped into 12 different categories of food products to identify those food groups that can contribute the most to the diet of the Malawian in terms of quality and quantities of nutrients consumed. As earlier noted in this report, the majority of the respondents were women (spouse of household head), who are the people responsible for preparing food for the household. They were asked whether the household members, and subsequently the reference child, consumed items from the following 12 food groups in the day preceding administration of the questionnaire: starchy staples such as maize, cassava and sweetpotato, biofortified starchy staples such as OFSP, orange maize and iron rich beans, legumes or nuts, dairy products, organ meat, eggs, other meat such as fish, beef or poultry, dark green leafy vegetables, vegetables that are orange inside, any fruits that are orange inside, any other kind of fruits or vegetables, any source of fat.

In this study, HDDS was calculated based on food proposed by FAO (Kennedy*, et al*., 2011). Since some food groups were already combined during data collection, however, 10 food group categories were used instead of 12. The 10 food group categories used are: grain roots and tubers, dark green leafy vegetables, other plantbased vitamin A rich foods, other fruits and vegetables, organ meat, meat and fish, eggs, legumes nuts and seeds, oils and fats, and dairy products. To calculate this score, certain food groups collected in the questionnaire were aggregated.

On the other hand, IDDS was calculated based on seven food groups proposed by the World Health Organization (WHO, 2007). These food groups are: Grains roots and tubers; legumes and nuts; dairy products; flesh foods; eggs; vitamin A rich fruits and vegetables; and other fruits and vegetables. The different groups of foods consumed by children in the current study were aggregated to form the required seven groups. A minimum dietary diversity (MDD) of four is required for children aged six to 23 months. Children with IDDS below four (0-3) are considered to have low dietary diversity, while those with IDDS greater than or equal to four are considered to have a high dietary diversity. Consumption of foods from at least four food groups on the previous day would mean that in most populations the child had a high likelihood of consuming at least one animal-source food and at least one fruit or vegetable that day, in addition to a staple food (grain, root or tuber).

7.1.1 Household dietary diversity

Households in all the districts were heavily dependent on starchy staples, which generally have no vitamin A (Figure 7.1). A relatively high percentage of households from all the four districts of study consumed dark green vegetables. Dedza had the highest proportion of these households (79.7%), while Chikhwawa had the lowest proportion (51.8%). Other foods consumed by more than a third of the households in the four districts are; fat, fruits that are orange inside, fish, meat, beef or pork, and legumes-/ nuts. Consumption of vegetables that are orange inside, eggs, organ meat, dairy product and biofortified starchy staples was very low in all the districts.

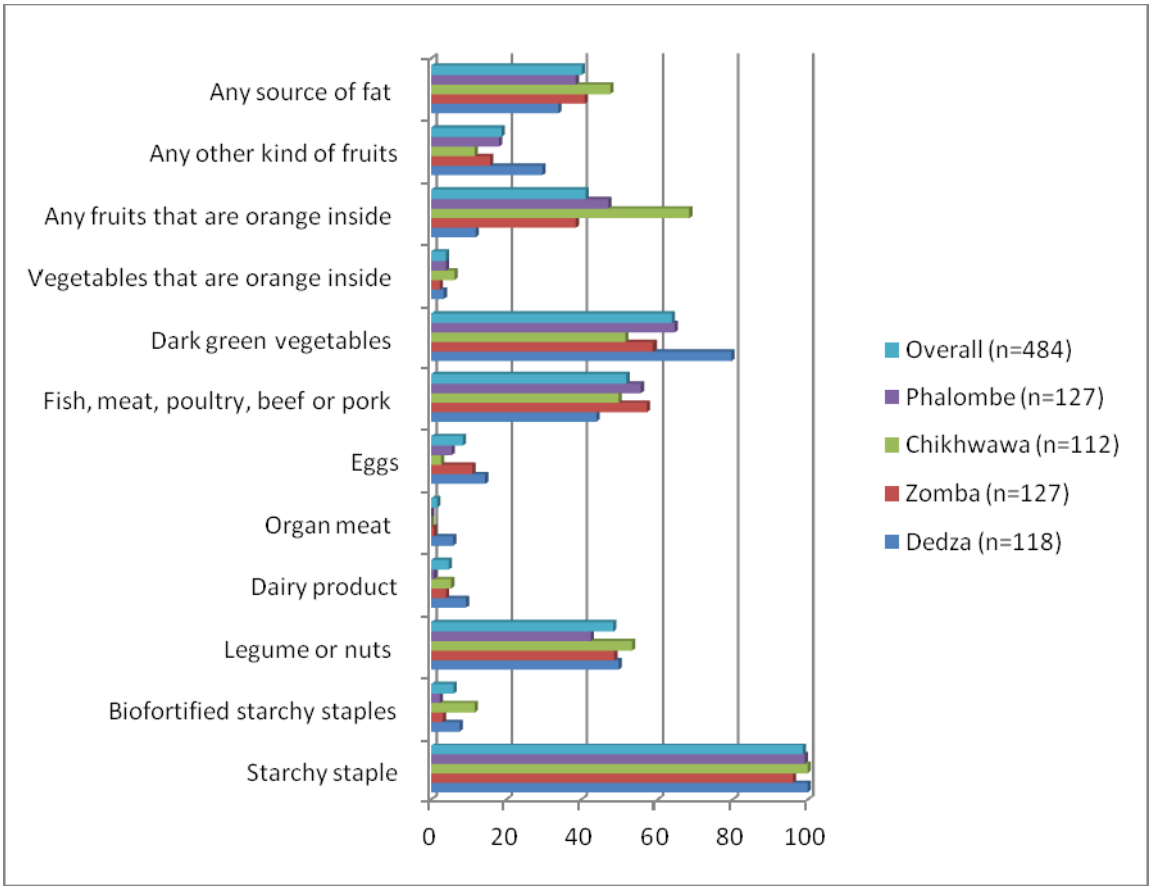

Figure 7.1: Proportion of households that consumed different foods in the last 24 hours

To find sources of vitamin A for households that consumed vitamin A rich foods in the past 24 hours, vitamin A rich foods were aggregated depending on their source: either animal or plant. About 84.3% of the respondents in the study area consumed vitamin A rich foods from either plant or animal source (Figure 7.2). The majority of the households, however, consumed vitamin A rich foods from plant source (80%) compared to those who consumed from animal source (13.4%).

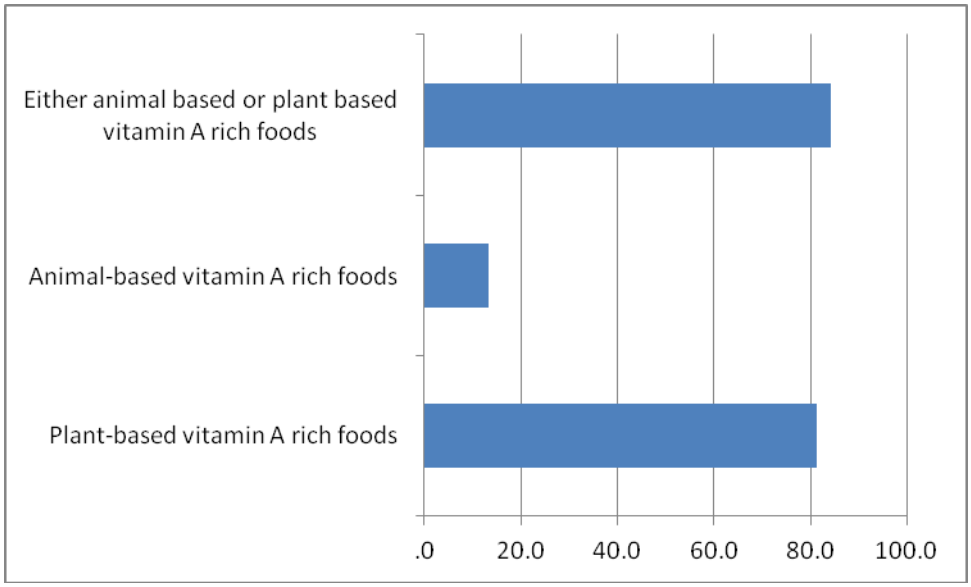

Figure 7.2: Proportion of households that consumed vitamin A rich foods from different sources

Average HDDS from the four districts was below four (3.8), showing low dietary diversity among the households in the area of study (Figure 7.3). Chikhwawa households clearly had the highest dietary diversity among all the districts, with a score of four, which reflects medium dietary diversity for the households in that district. Households in the other three districts (Dedza, Zomba and Phalombe), had HDDS lower than four, which reflects low dietary diversity. In Dedza households had a HDDS of 3.9, Zomba 3.8 and Phalombe 3.7.

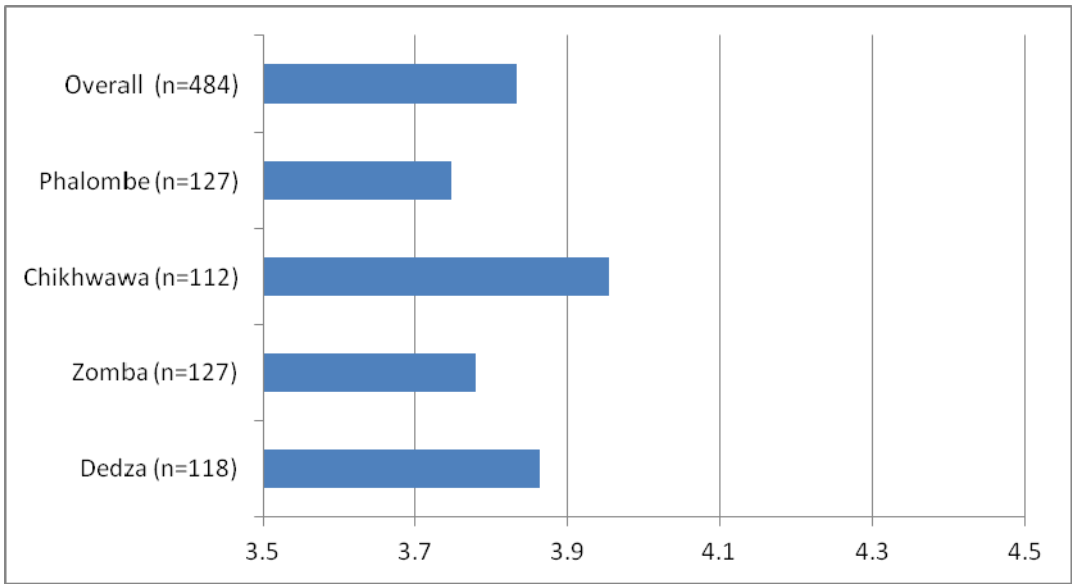

Figure 7.3: HDDS by district

Further analysis was done to find out the exact proportion of households that had low, medium and high dietary diversity across the four districts of study. Almost half of the households in the study area had low dietary diversity, and less than 20% had high dietary diversity (Figure 7.4),

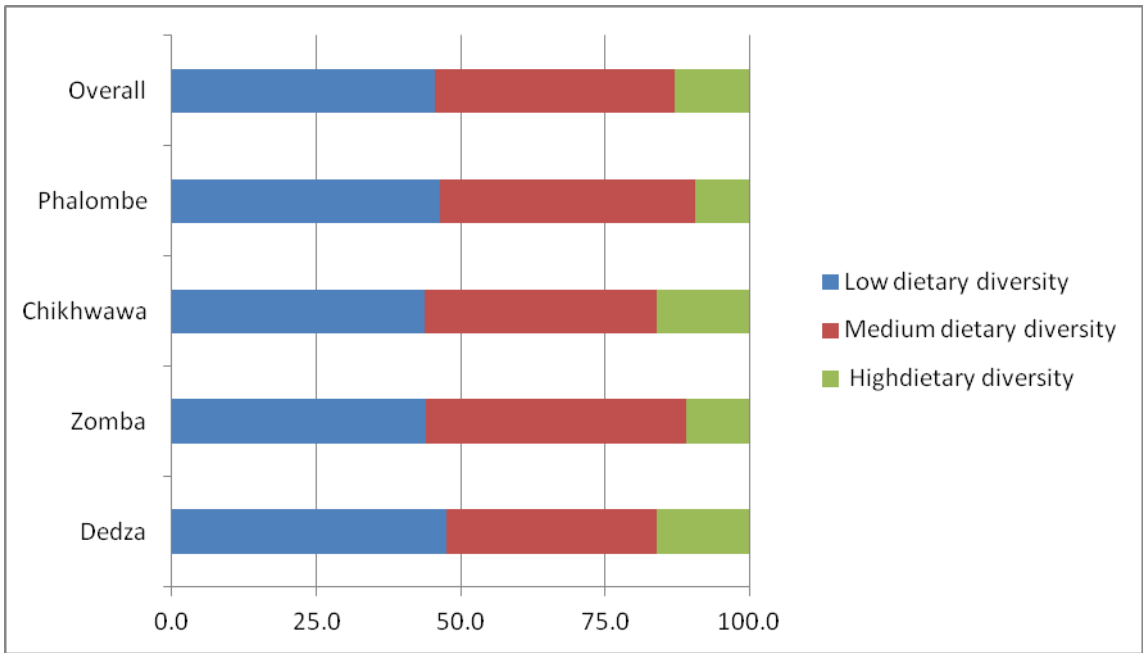

Figure 7.4: Proportion of households with low, medium or high dietary diversity by district

Chikhwawa and Dedza districts had the highest proportion of households with high dietary diversity (16%) compared to the other two districts, but the proportion of households with low dietary diversity was lower in Chikhwawa (44%) than in Dedza (48%).

Analysis was done to find out whether HDD varied according to differences in headship of the households. The HDDS varied from 3.4 to 4.0 depending on the type of household head as shown in Figure 7.5. Households headed by a woman with the support of a non-resident man had more diverse diets (HDDS of 4.0) than other households, reflecting medium nutrients intake. Households headed by men had HDDS of 3.9, while those headed by women without any male support had the lowest HDDS (3.4).

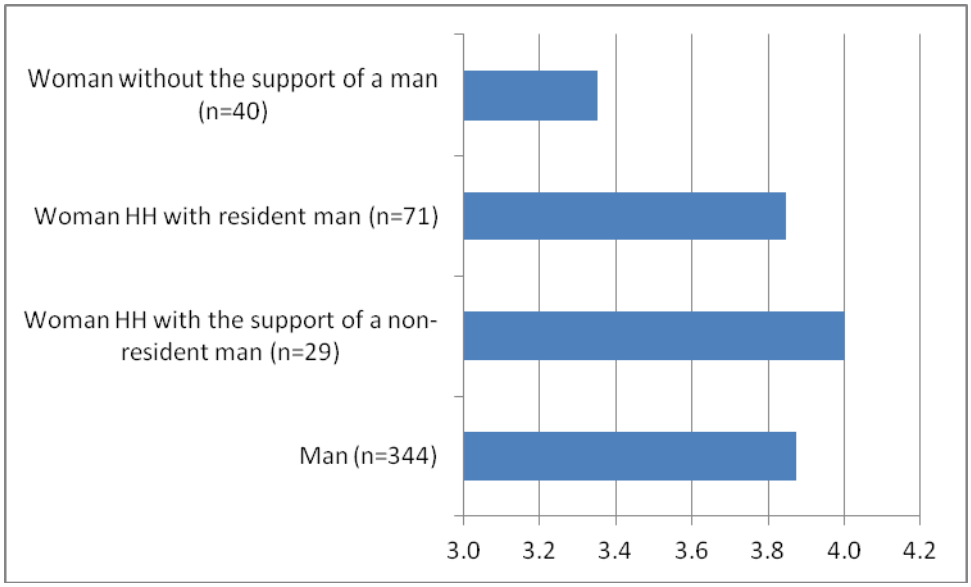

Figure 7.5: HDDS by household head type

From these results, it can be argued that households headed by women with the support of a non-resident man have a higher socio-economic status than other households. This could be true since, in most of these households, men supporting the households work far from home hence bringing more resources to the household. On the other hand, households without any support of a man can be argued to have the lowest socio-economic status.

7.1.2 Individual dietary diversity (IDD)

Dietary diversity among the reference children was consistent with that of the households. As was the case in the HDD, children in all the four districts are highly dependent on starchy staples. Overall, more than 80% of the children had fed on starchy staples in the last 24 hours (Figure 7.6). More than half of the reference children in the area of study had consumed dark green vegetables with the exception of Chikhwawa district which had less than 50% of the children consuming this type of food. Foods such as vegetables that are orange inside, eggs, organ meat, dairy products, and biofortified starchy staples were consumed by fewer than 10% of the children from the four districts of study.

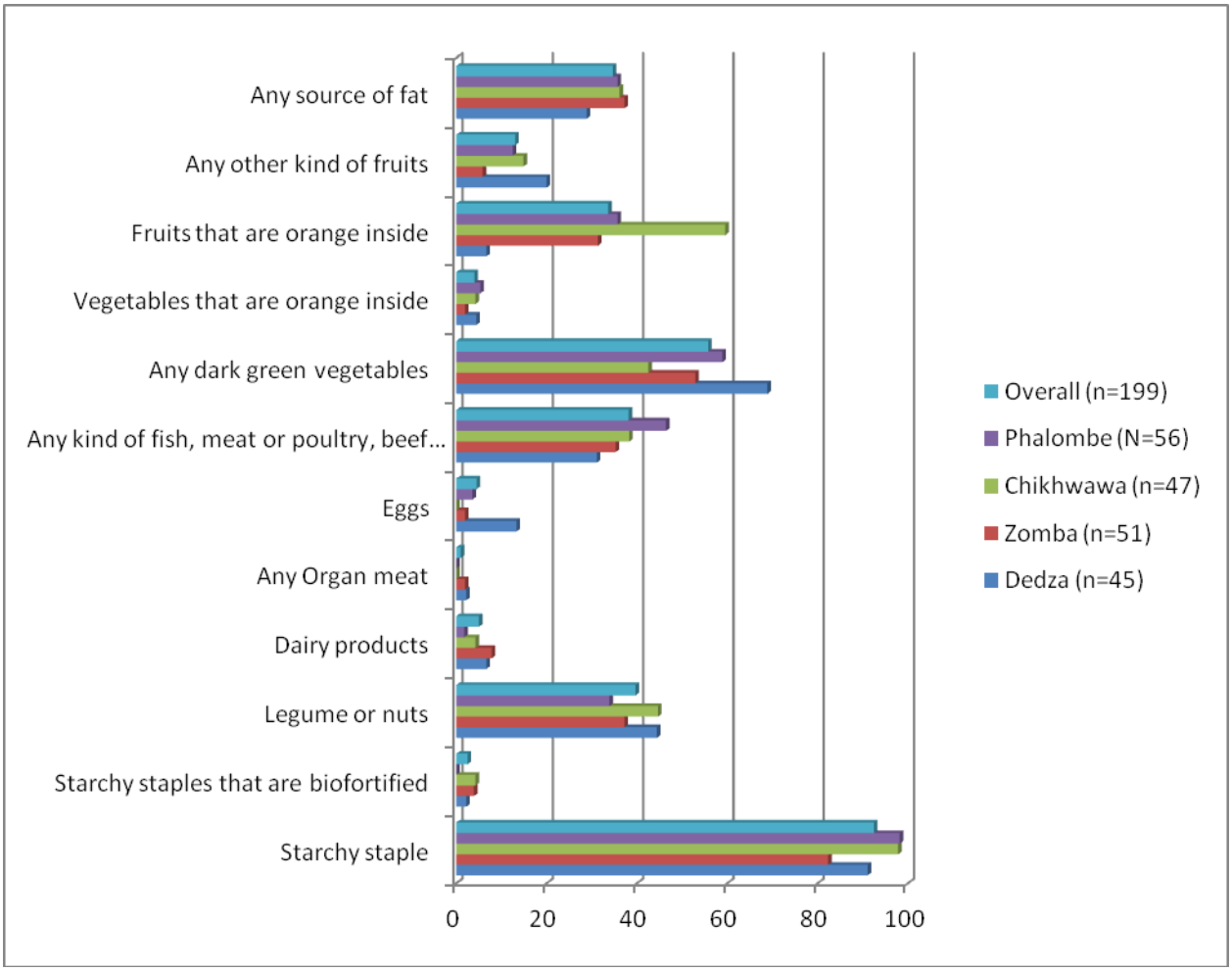

Figure 7.6: Consumption of different foods by children aged 6-24 months in the last 24 hours

When respondents were asked what types of foods the reference child had consumed in the last seven days, 19.5% had consumed OFSP at least on one day, but only 3.3% had consumed OFSP for more than three days (Appendix E). Dark green vegetables and ripe mangoes are noted as the two vitamin A rich foods that are most eaten by children in the study area. About 39.4% of the children in the study area had consumed dark green vegetables and 21.2% consumed ripe mangoes more than three days in seven days. Of importance to note, however, is that both these crops are seasonal and therefore, consumption could go down if the study was undertaken at a different period when they are not in season.

To clearly understand the nutritional quality of the reference children in the study area, IDDS was calculated and used as a proxy measurement of the nutritional quality of the children's diet. IDDS was consistent with the HDDS. All children in the study area had an IDDS of less than four, which shows low dietary diversity (Figure 7.7). The case in HDDS was similar, where households in Chikhwawa had the highest dietary diversity among households in the four districts, as was the

case in IDDS. Chikhwawa children had the highest dietary diversity with an IDDS of 3.1, even though the IDDS still reflected low dietary diversity. These children were closely followed by those in the Phalombe district. Children in the Zomba district had the least nutritional diversity, with an IDDS of 2.6.

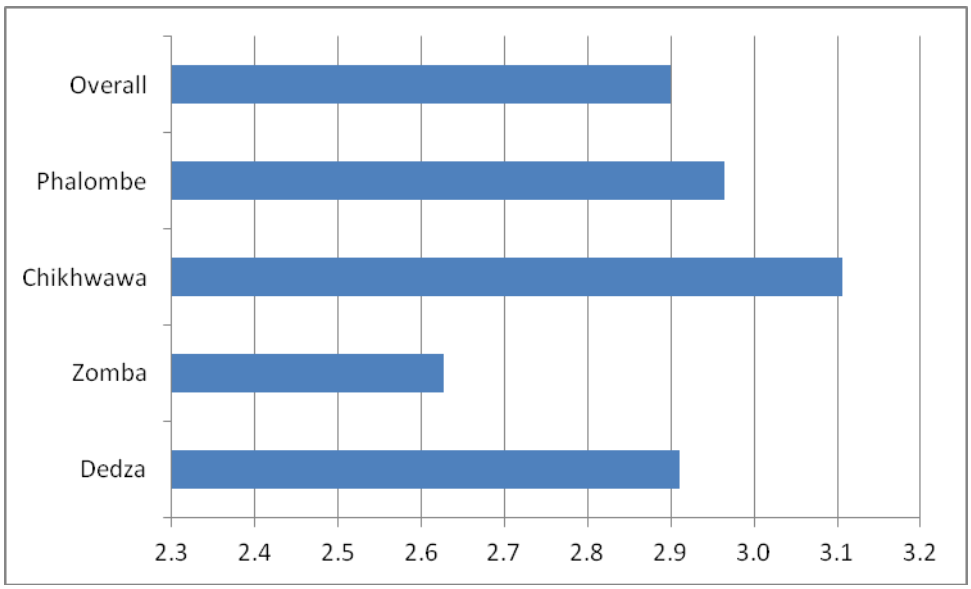

Figure 7.7: IDDS by district

Studies in different age groups have shown that an increase in IDDS is positively correlated with increased mean micronutrient density adequacy of complementary foods (FANTA 2006). Therefore, children in the Chikhwawa district can be said to have higher micronutrient adequacy than those in the Zomba district, even though it is still not high enough.

Further, analysis was done to find out the proportion of children with low or high dietary diversity by district. Overall, more than 60% of the children in the study area were reported to have low dietary diversity (Figure 7.8). This proportion of children falls below the required minimum dietary diversity, and the trend was consistent across districts, with Chikhwawa having a slightly lower proportion of children in this category compared to other districts. Overall, only about a third of the children were reported to have the required MDD.

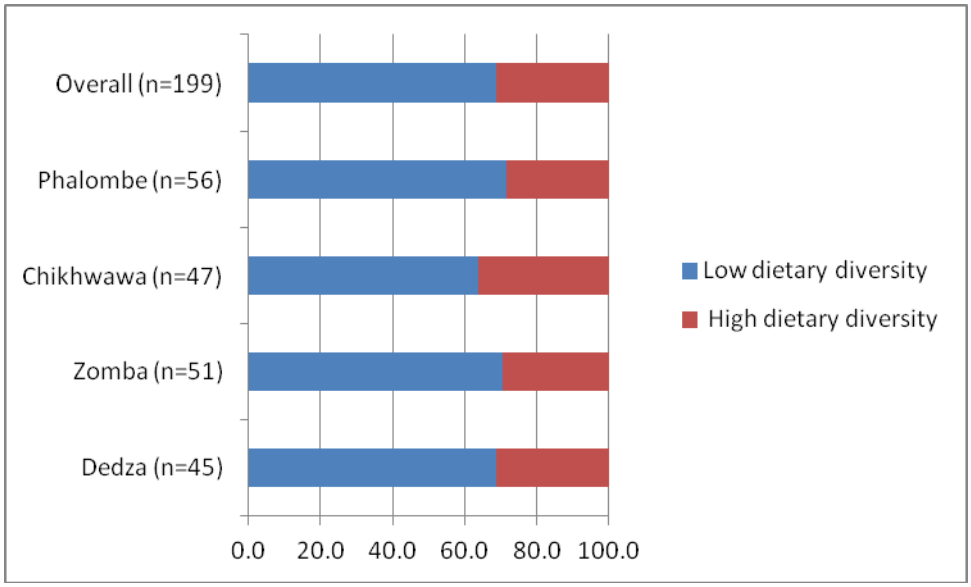

Figure 7.8: Proportion of children with low or high dietary diversity by district

7.3 Food security, shocks and coping mechanism

Food security is a complex sustainable development issue, not only linked to health through malnutrition, but also linked to sustainable economic development and the environment. A nation is said to be food secure when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life (World Food Summit, 1996). This however, has been a problem not only for developing countries but also for developed countries. In Malawi, past studies have shown that a large proportion of the population is chronically food insecure, and droughts and other adverse natural events would cause widespread hunger or famine in the absence of safety net support (Ellis, *et. al*., 2003).

In this study, farmers were asked questions regarding the availability and consumption of food in the past 12 months to find out food security status over the calendar year. Further, several negative shocks were read out to them and they were asked whether they had experienced any of those shocks in the past three years prior to the study (2007 to 2009). Respondents were then asked to mention methods household members used to cope with the food insecurity situation. These results are given in this section.

Since food security exists when people have access to sufficient, safe and good quality foods, it was important to find out the level of food access in the study area. To do so, a Food Consumption Score (FCS) was calculated based on seven groups of foods as elaborated by the World Food Program (WFP) (WFP, 2010). Data collected on household food consumption based on a 7-day

recall period were used to calculate this score. A household that consumed each of the food groups every day for the last seven days is expected to have a maximum FCS of 112. Households can however, have FCS between zero and 112. A three-level food consumption threshold recommended by WFP was used in this report: FCS of zero to 21 = poor food consumption; FCS of 21.5 to 35 = borderline food consumption; and FCS greater than 35 = acceptable food consumption.

7.3.2 Food insufficiency over the calendar year and in the past three years

Consumption of sweetpotato was highest in July. During this month, more than two thirds of the households (66.9%) reported that they had consumed sweetpotato at least twice a week (Table 7.1). Other months when more than a third of the households reported consumption of sweetpotato at least twice a week were from May to September, which is the period after harvest of sweetpotato. This, therefore, explains the increasing consumption of sweetpotato which begins in April (20.2%) and increases all the way to 66.9% in July, and then starts to decrease. November to March, the main rainy season, was noted as a period of low consumption of sweetpotato. This is the period when sweetpotato is in the farms, hence months of low sweetpotato consumption. The high consumption of sweetpotato after harvest shows that it is an important food crop in their food basket. Any improvement in their productivity will play a critical role in improving Malawian's food security. Furthermore, the results bring out a need to train farmers in sweetpotato root conservation, so that higher consumption can take place during months of low rains and during dry seasons. What is more, farmers can be encouraged to plant sweetpotato in the wetlands so that they do not wholly depend on rains for their production of sweetpotato.

Table 7.1: Different indicators of food insecurity

	Jan	Feb	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
HH consumed SP at least twice a week in % (n=484)	3.9	3.1	6.8	20.2	35.3	62.6	66.9	55.2	39.0	26.4	13.2	6.8
HH consumed less than two meals a day in % (n=484)	43.2	49.6	11.0	1.9	1.2	1.4	1.2	2.9	7.0	14.0	18.0	25.4
HH received relief food in % (n=484)	7.2	8.7	2.3	0.4	0.2	0.2	0.4	0.4	0.6	3.7	1.7	2.3

To further understand the extent of food insecurity in the study area, respondents were asked how many months they consumed less than two meals a day from their own resources. February was noted as the month of highest food insufficiency among households in the study area. About half of the households consumed less than two meals in a day during the month of February as shown

in Table 7.1 above. January came second (43.2%), December was third (25.4%) and November fourth (18.0%). Furthermore, the highest percentage of households received relief food during these months, 7.2% in January and 8.7% in February.

Analysis of months that households consumed less than two meals a day by district showed that food insufficiency was high, although very seasonal (Figure 7.9). As previously noted, January and February were months of highest food insufficiency. Households in Chikhwawa had the highest food insufficiency during this period, with 67% of the households consuming less than two meals a day during January and 57% in February. Households in other districts were also facing food insufficiency problem, although fewer households than in Chikhwawa were affected. There is not much diversity in the trend of food insufficiency among households in the four districts of study across the year. Households in all districts recorded a high food insufficiency during the rainy season (November to March), although this declined to very few households (less than 2% across the districts) after harvest (April).

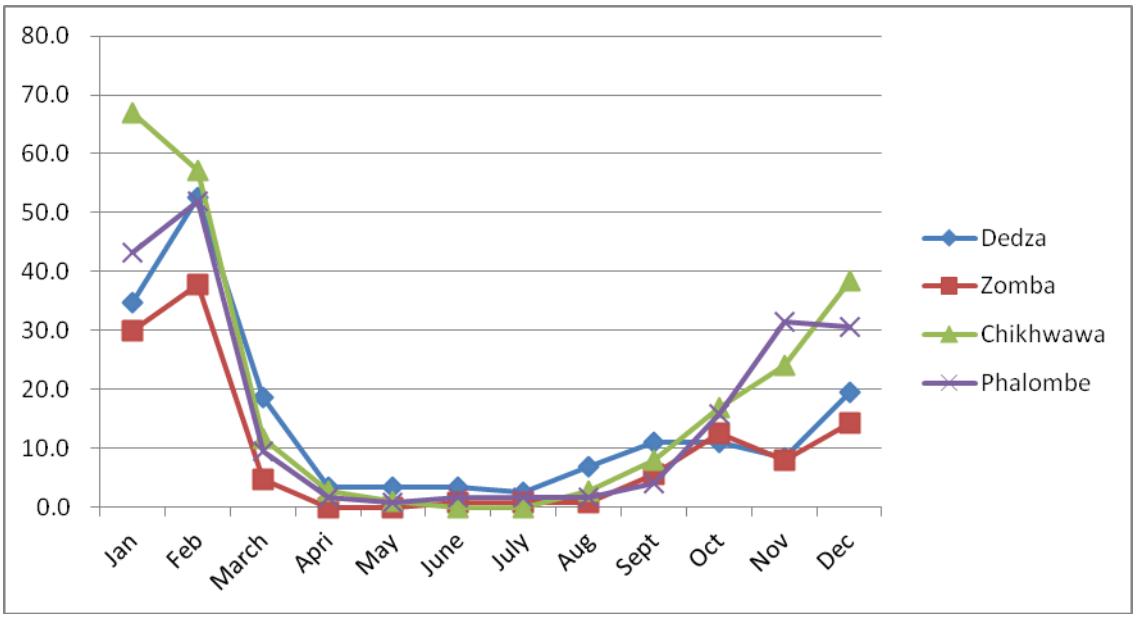

Figure 7.9: Proportion of households that consumed less than two meals a day by district (n=484)

To understand the past food security situation in the study area, respondents were asked whether they had previously experienced difficult situations for the household such that they had been forced to sell their assets to enhance purchase of food. More than a third of the households (34.5%) indicated that they had experienced such a situation and they had been forced to dispose of some of the household's assets so that they could buy food. The majority of the households in

the area of study sold livestock, while household goods were reported as the second most sold assets (Figure 7.7). Livestock sale was highest in Chikhwawa (80%) followed by households in Phalombe (40%), then Dedza (38%), and finally Zomba (25%). On the other hand, sale of household goods was highest in Zomba (38%), followed by Dedza (31%) then Phalombe (23%) and lastly Chikhwawa (10%).

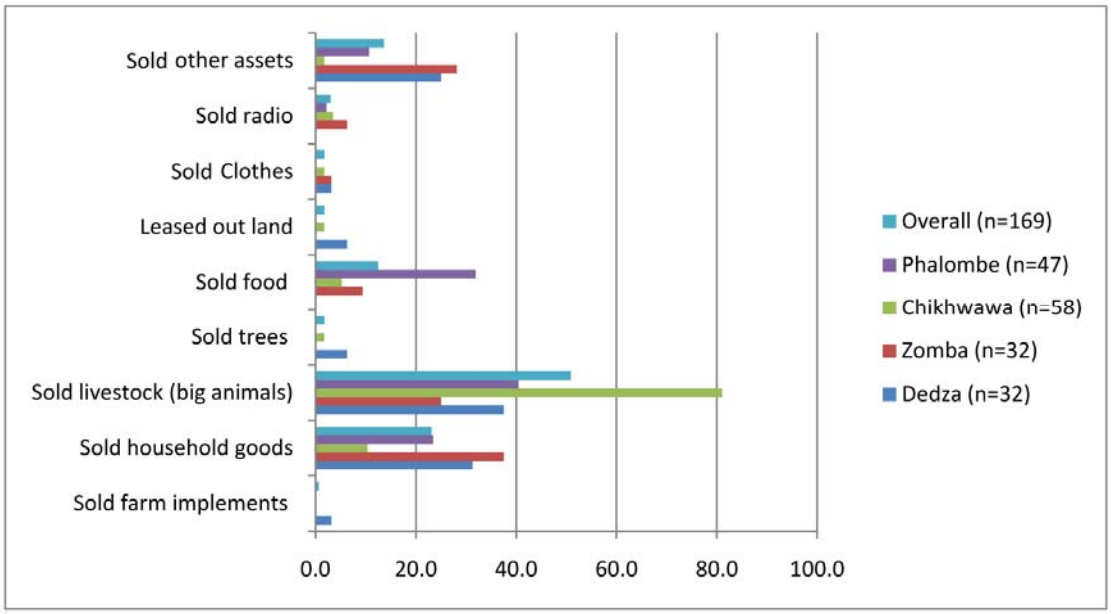

Figure 7.10: Percentage of households that sold different properties in the last 3 years due to food insecurity

An overall analysis of food consumption thresholds showed that about a third of the households in the four districts of study were below the acceptable food consumption (Figure 7.11). This is an indication of food insecurity in the area. About 20% of the households were within the borderline food consumption, while 8% were within the poor food consumption. This trend was consistent across the four districts.

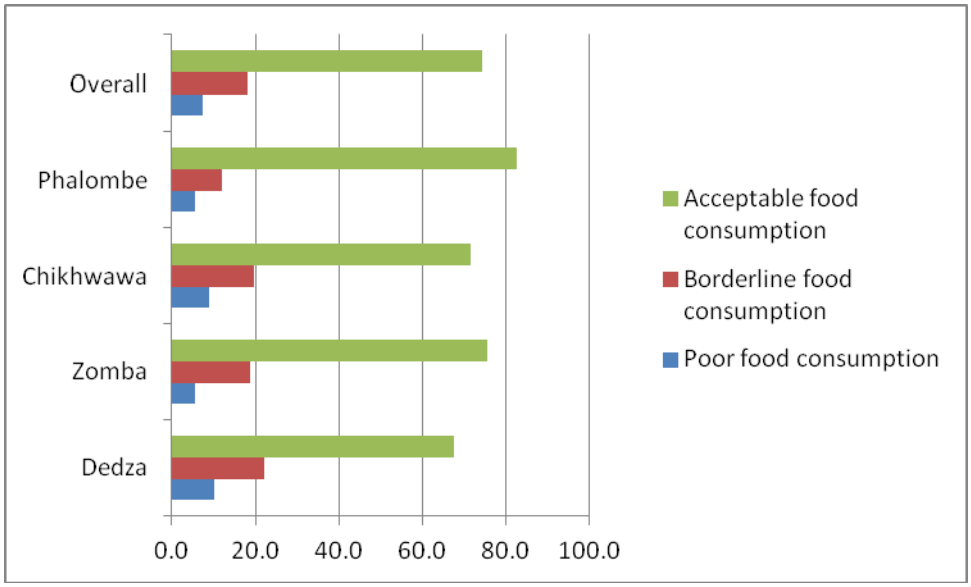

Figure 7.11: Proportion of households within the three different food consumption thresholds

It is important to note that this study was undertaken after the harvest period. If another study is undertaken during a different period, for instance from November to April (hunger period), the results will vary.

7.3.3 Shocks

During periods of food insufficiency, households can experience unexpected harsh events which can affect their economic status and subsequently make them change their livelihood. In this study, respondents were asked whether they had experienced such events in the past three years preceding the survey (2007 to 2009). Major loss of crops due to drought or flood came out as the most widely experienced shock, as reported by about three quarters of the households (Figure 7.12). This was followed by death of extended family member2, loss of livestock and major loss of crops due to pest, diseases, or other reasons. Other shocks experienced by the sampled households are shown in Figure 7.12.

[2] There was no follow up question to ascertain causes of deaths of these extended family members.

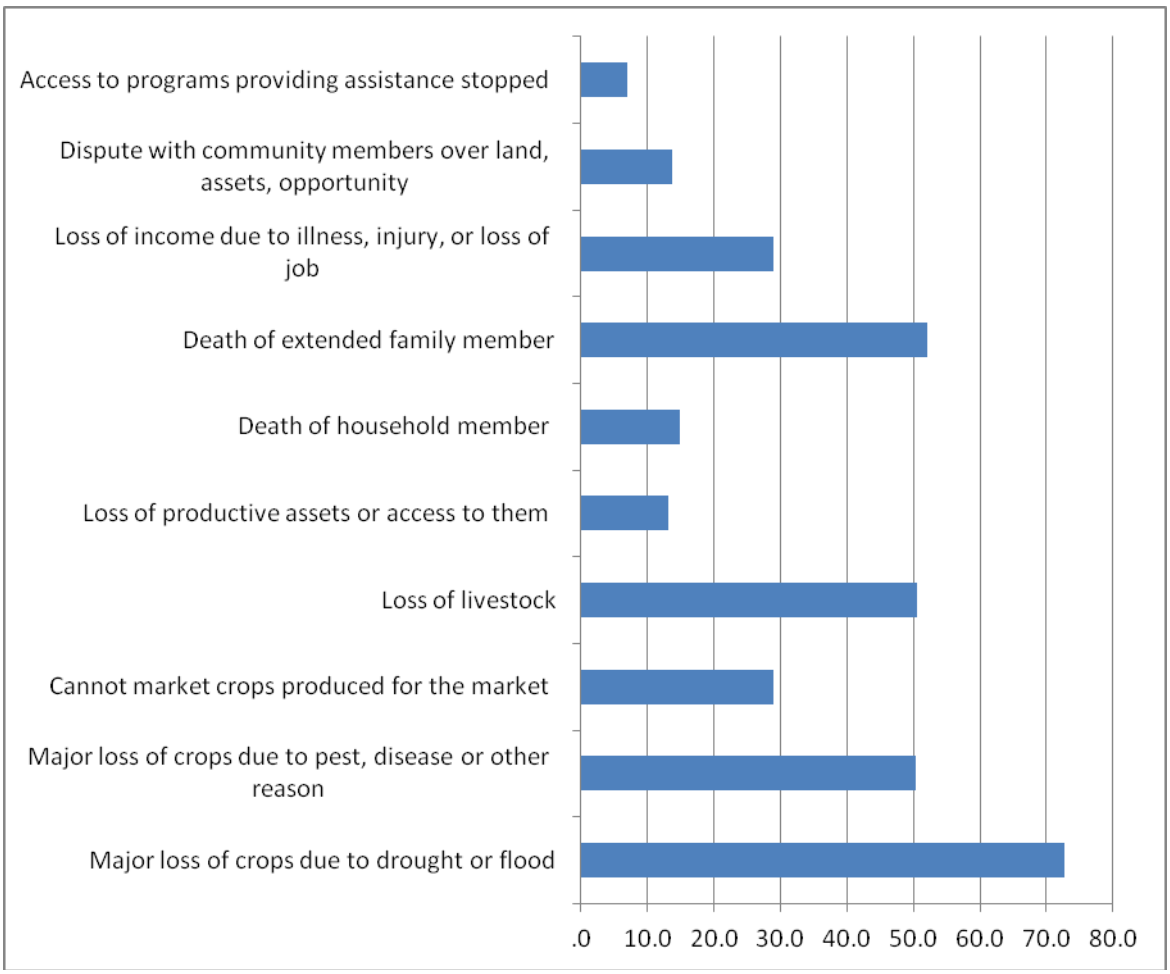

Figure 7.12: Shocks experienced in the past three years

The high proportion of households that reported loss of their crops due to drought or floods shows that there have been food security problems here in Malawi. As previously mentioned, sweetpotato, which is a drought resistant crop, could help in addressing the food security problem. If farmers are trained in seed multiplication to ensure that clean planting material is used, this would play a great role in addressing the food security problem.

7.3.4 Coping mechanisms

The majority of small-scale agricultural producers in developing countries wholly depend on rainfall for their crop production. With the current climatic changes and unpredictability of rainfall, many of the developing countries have been hit by the food insecurity problem. As a result, consumers use several strategies to cope with the problem.

In this study, households were asked to mention strategies they used to cope with the food insecurity problem during periods of prolonged food scarcity. Several types of strategies featured in their responses, ranging from mechanisms relating to psychological effects on farmers-; for

instance, engaging in degrading jobs-; to mechanisms that affected their food quality-, for instance, eating meals that are less preferred, consuming wild foods, consuming toxic foods and seed stocks. Moreover, households gave responses that gave an indication that their food quantity was also affected. This was during instances where members of the household skipped some meals in a day, or ate smaller quantities of food so that food could be enough for all, or when children were allowed to eat more than adults.

The mechanism most used by households in the study area was engaging in casual jobs. Over three quarters of all the respondents in all the four districts used this mechanism (Figure 7.13). Types of coping mechanisms used by households were consistent across the districts. Skipping some meals in a day was reported as the second most used mechanism by households in all districts. Skipping a meal came third and consuming immature crop was the fourth. Receiving remittances and withdrawing children from school to work were the two most uncommon coping strategies among all households. Other strategies used by households to cope with the food scarcity problem are shown in Figure 7.13.

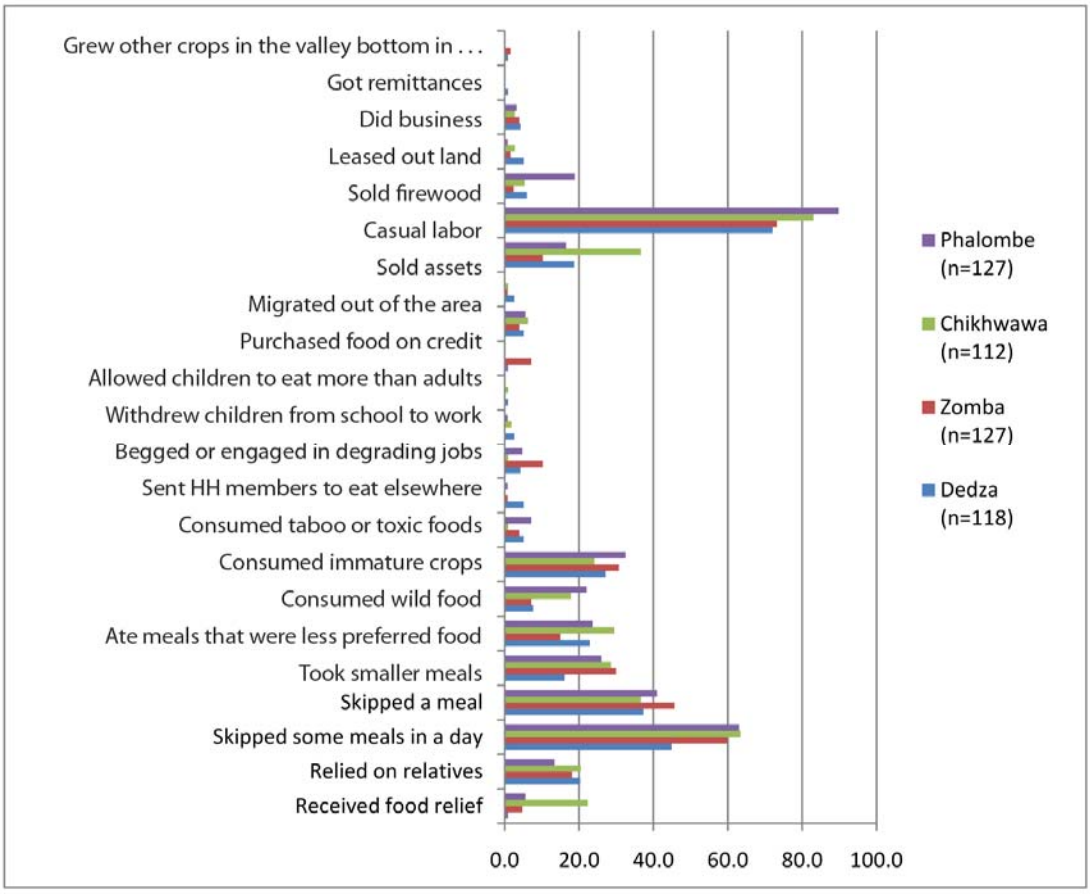

Figure 7.13: Coping mechanisms used by households during prolonged periods of food scarcity

Strategies used by households in the study area to cope with the food scarcity problem show that during those periods, both the quality and quantity of food consumed by these households are affected, hence food insecurity. Therefore, the need to incorporate a crop like sweetpotato that can withstand drought and be available throughout the year becomes vital.

8. CONCLUSION

Sweetpotato is an important food crop to people in the Dedza, Zomba, Phalombe and Chikhwawa districts. Results of this study reveal that 9% of households' total landholding was under sweetpotato, and 3% under OFSP. Since the majority of sweetpotato farmers produced sweetpotato as a pure stand, farmers can be encouraged to intercrop sweetpotato with other crops to increase its production. This is due to the fact that 97% of the total landholding was already under crop production; hence minimal land was available for crop production expansion.

Further, this study found that 68% of the households produced sweetpotato as a food crop, 30% both as a cash crop and food crop, and only 2% produced sweetpotato wholly as a cash crop. Overall, 86% of the farmers who produced sweetpotato had not been given any training in sweetpotato production and management. No wonder that more than half of the farmers could not identify a sweetpotato plant infected by sweetpotato virus. The project '*Rooting out Hunger in Malawi with Nutritious OFSP*' will disseminate information to farmers on sweetpotato production and management to ensure that they are well equipped with knowledge on sweetpotato production. This will eventually increase the productivity of sweetpotato, and farmers will be able to produce enough sweetpotato for household consumption and for sale, thereby increasing their income.

This study finds that farmer-to-farmer exchange of sweetpotato planting materials was the predominant seed dissemination system. From the four districts of study, an average of 63.5% of the households used sweetpotato planting material from their own farms and an aggregate total of 26% from neighbors and relatives. Further, the study reveals fellow farmers as a source of new sweetpotato varieties. The main challenge, however, remains obtaining clean planting material. About 78% of the respondents reported that their sweetpotato farms had previously been infested by sweetpotato weevils. The project aims at training vine multipliers in the production of clean planting material, so that farmers will have access to planting material at the right time.

Further, this study reveals the importance of socio capital in sweetpotato production. About 66% of group members received a new crop variety through the group. Group members also benefited

in other different ways which enhanced their farming activities. For instance, a quarter of the farmers received inputs, training, and seed from the groups. Furthermore, sweetpotato productivity is reported to be higher among group members (7491.9kgs/ha) than non-members (5803.8kgs/ha). This, therefore, shows that if farmers work in groups, they can access new technologies, and reduce their production and marketing costs due to economies of scale. Also, knowing that sweetpotato planting material moves from farmer to farmer, if clean material is provided to farmer groups and farmers are trained in good sweetpotato production and management systems, then farmers will maintain clean seed which will improve their sweetpotato productivity.

June and July were noted as months of high production of sweetpotato in the study area. Sweetpotato harvests in the other months of the year were minimal, and no harvests were realized in January and December. This shows the need for root conservation to ensure consumption of sweetpotato throughout the year, thereby alleviating food insecurity. In this study, 94% of the households stored roots whole and fresh, and 67% of these households stored roots in the house. Training is needed in root conservation methods, and the project '*Rooting out Hunger in Malawi with Nutritious OFSP'* will play an important role in training the farmers on this.

The local market was the main channel of sale of sweetpotato and OFSP, and local traders were the main buyers. Almost 60% of the households indicated that they sold sweetpotato to buy other household items. Moreover, both husband and wife decided when and how much sweetpotato to sell. This study reveals that men are getting involved in sweetpotato production activities. This is a good thing, since they will then support the women in OFSP production. Improving marketing chains for OFSP, which is one of the objectives of the aforementioned project, will improve incomes received from the sale of this crop, hence improving households' overall income.

This study finds that people have a positive attitude and perception towards OFSP and sweetpotato generally. For instance, 85% of the respondents strongly agreed that sweetpotato leaves are good for human consumption, 59% strongly agreed that OFSP is more nutritious than WFSP, and 79% strongly disagreed that sweetpotato is food for women and children only. This shows that the promotion of OFSP by the said project is likely to be a welcomed idea since the majority of the farmers already acknowledge its benefits.

On the other hand, however, more than a third of the respondents in the four districts would eat less sweetpotato if they became richer. This may be an indication that the consumption of sweetpotato is associated with being poor. Changing the perception that people have on

sweetpotato and OFSP generally, which is one of the objectives of the aforementioned project, will be important to ensure that more OFSP is consumed, thereby alleviating VAD.

Results of this study also showed that more than 80% of both women and men respondents are aware of vitamin A. Health units, radio programs in the local language and school were the three main sources of vitamin A information for these respondents. This will be important for the project when selecting channels through which to disseminate vitamin A and OFSP information.

Increased consumption of OFSP will enhance a diversified food basket for the people in Malawi. Furthermore, more than 90% of both household members and children highly depend on starchy staples which do not have vitamin A. About 80% of households consumed plant-based vitamin A rich foods in the last 24 hours; mainly dark green leafy vegetables and fruits that are orange inside. It is important to note that these two groups of foods are highly seasonal and crops under dark green leafy vegetables are highly dependent on rains. Therefore, increased production of vitamin A rich drought-resistant crops like OFSP will increase vitamin A intake among the population hence alleviating VAD.

Further, this study found that about half of the households had low dietary diversity, and only 13% had high dietary diversity. Likewise, more than 60% of children had low dietary diversity. Households headed by women with the support of a non-resident man had the highest dietary diversity compared to other households. This could be as a result of higher resources in these households since the majority of the men supporting women heading households are working away from home.

January and February were reported as the months of highest food insufficiency. The highest proportion of households also received relief food during these two months. Moreover, about a third of the households in the four districts of study were below the acceptable food consumption levels. This could be an indicator of food insecurity in the study area. Access to clean planting material at the right time would increase production of OFSP, and consequently increase its consumption. With proper root conservation, then, households can consume OFSP round the year, thereby alleviating food insecurity.

9. APPENDICES

Appendix A: Households visited by region, district, EPA and villages

Region	District		EPA	Villages		Region	District			EPA	
Central	Dedza	118	Bembeke	Kauye	3	Central	Dedza		Kanyama	Kauye	1
				Kapulula	4					Ndembo	8
				Kamgulitse	4					Nzoola	7
				Kankhwani II	3					Mzungu	9
				Kapenuka	4					Nangamtani	4
				Buya	5					Chikuse	6
				Chitsonga	1					Kanyenda	8
				Kamtande	2					Nyama	8
				Nzoola	2					Matenje	6
				Matenje	1					Chiunda	2
				Alibelito	8					Msosa	1
				Chimpalika	3						**60**
				Mgwele	11						
				Juwa	3	South	Phalombe	127	Naminjiwa	Kadewere	9
				Yohane	4					Nalingula I	5
					58					Nalingula II	10
South	Zomba	127	Thondwe	Mwandama	5					M'phale	12
				Nyozani	3					Likaka	12
				M'mambo	6					Njumwa	6
				Kamalo	5						**54**
				Kutambala	11						
				Chiunda	8				Waruma	Chibwana	4
				Malajira	10					Mangoza	8
				Matchado	13					Phunduma	14
				Makawa	8					Lomoliwa	6
				M'beti	8					Mtengo	10
				Mwitingule	8					Subili	6
				Msosa	10					Chilombo	10
				Majawa	11					Kazombo	10
				Matache	9					Phwechiwa	5
				Maulama	12						**73**
					127						
	Chikhwawa	112	Mbewe	Zyuda I	10	South	Chikhwawa		Mitole	Liwonde	7
				Mangulenje	6					Kandeu	5
				Mphapha	4					Fombe I	7

				Mandimu	10					Namila	8
				Mvula	8					Chadula	5
				Masamba	4					Mwalija	4
					42						**36**
			Livunzu	Malata	3						
				Mengerezi	6						
				Phali	3						
				Mtambo	1						
				Aluferi	5						
				Mandere	5						
				Jana	11						
					34						

Appendix B: The two most preferred sweetpotato varieties

	Most preferred variety	2nd most preferred variety
Kenya	29.3	11.9
Nsanje	6.4	11.7
Sakananthaka	5.0	4.4
ADMARC	4.5	1.7
Semusa	0.2	0.0
Mugamba	1.0	1.5
Zondeni	4.3	4.8
John	4.3	5.0
Sanza/ Nyasi mmaso	0.2	1.9
Kamchiputu	1.2	3.3
Babache	4.1	5.6
Ngapaalendo/Nkapalendo/kapalendo/Kampalendo/kampaalendo/sadyaalendo	4.3	3.5
Chidyawa	0.2	0.2
Kachilambe	0.4	1.3
Yofiira (OFSP)	1.0	1.0
Kalonga	0.2	0.2
Gundamtuzu	0.2	0.0
White	0.4	0.8
Red skin	0.2	1.3
Kenya (YFSP)/Forty one (41)	1.7	1.0
Kenya (WFSP)	0.2	1.0
Kamchiputu (WFSP)	0.2	0.0
Mulenga/Mlenga	0.8	1.3
Research (yellow skin and white flesh)	0.4	0.2
Research	1.0	1.5
Mfumu	0.6	0.4
Chikhutu /(kachikhutu)	0.6	1.9
Kolinda/Folinda	2.7	3.3
CADECOM	2.3	1.5
Maria	1.0	0.0
Carrot	0.8	1.3
China	1.4	1.0
Agriculture/Boma	1.2	0.2
Karonga	1.7	0.8
Lifebuoy	0.2	0.0
Mandanda	0.2	0.6
Kawilira	0.2	0.2
Chinese	3.7	2.1
Salela	0.2	0.0

ADMARC (WFSP)	0.2	0.0
Phalalamwana	0.2	0.2
Kakhome (local variety)	1.2	0.6
Kaulesi	0.4	0.4
Lingoni	0.6	0.4
Hybrid (white flesh, white skin)	0.2	1.5
Sena/Nsena	0.6	0.6
Local	1.4	2.3
Namasipuni	0.2	0.0
Namasipuni (OFSP)	0.2	0.0
Kachewere	1.0	0.4
Yellow flesh, white skin	0.8	0.4
Yellow skin (OFSP)	0.2	0.0
Red skin, white flesh	0.6	0.0
Chigololokumpanda	0.2	0.2
Have forgotten the name	2.7	9.4
Kam'chigoba	0.0	0.2
Mfumu (Red skin, white flesh)	0.0	0.4
Cocoa (white skin, purple flesh)	0.0	0.2
Zimbabwe (Red skin, white flesh)	0.0	0.4
Kanaufa	0.0	0.2
Chiringa	0.0	0.2
Sakaika	0.0	0.2
Red skin, orange flesh	0.0	0.2
Reddish flesh	0.0	0.4
Yellow skin (OFSP)	0.0	0.6
Red skin, white flesh	0.0	1.5
Namagonontho	0.0	0.2
White goom	0.0	0.2
Total	100.0	100.0
	n=484	n=479

Appendix C: Gender roles in sweetpotato production activities

	Ploughing	Ridging	Bed preparation	Preparing mounds	Cutting vines	Carrying vines to the plot	Planting vines	Weeding	Harvesting	Bagging	Transporting to the market	Selling in market	Deciding how the funds will be
Women	14.3	12.8	2.5	1.9	31.2	39.5	20.7	15.5	19.6	17.4	15.7	20.5	12.2
Women & children	3.7	3.3	0.4	0.4	1.7	3.9	3.5	3.9	4.1	3.1	0.6	0.6	0.4
Men	22.5	20.5	6.2	5.2	29.5	13.2	25.0	5.6	7.2	11.0	10.5	12.6	15.9
Men with all children	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Women & men equally	48.1	48.8	7.9	4.3	31.0	32.9	41.9	58.3	51.9	43.6	11.0	11.6	19.2
Women, men and children	7.2	6.6	1.0	1.0	4.3	6.4	6.6	12.6	13.2	9.7	2.3	0.8	0.2
Women with girls	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.2	0.2	0.0	0.2	0.0
Women with boys	1.0	0.6	0.4	0.4	0.2	0.4	0.6	1.4	1.4	1.0	0.0	0.0	0.0
Men with girls	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0
Men with boys	0.8	0.8	0.0	0.0	0.0	0.0	0.2	0.4	0.2	0.6	0.0	0.0	0.0
Children	0.2	0.0	0.0	0.0	0.0	0.8	0.0	0.2	0.2	0.4	0.0	0.2	0.0
Girls	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.0	0.2	0.0
Boys	0.6	0.2	0.0	0.0	0.6	1.4	0.4	0.2	0.4	0.8	0.0	0.0	0.0
Farmgate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.4	1.2
Do not undertake the activity	0.8	6.2	81.6	86.8	1.2	0.8	0.8	1.2	1.2	12.0	58.3	51.9	50.8

N=484

Appendix D: Channels of crop sale by crop

	Channels of crop sale						
Crop	**Farm gate**	**Local market**	**Big town market**	**Institution**	**Local agro-dealers**	**Government board/ ADMARC**	**Auction floors**
Maize (n=115)	23.5	73.0	0.0	2.6	0.9	0.0	0.0
Rice (n=49)	30.6	69.4	0.0	0.0	0.0	0.0	0.0
Sorghum (n=9)	22.2	77.8	0.0	0.0	0.0	0.0	0.0
Cassava (n=2)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sweetpotato (n=2)	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Beans (n=120)	15.8	80.8	0.0	0.0	2.5	0.8	0.0
Groundnuts (n=29)	20.7	75.9	0.0	0.0	3.4	0.0	0.0
Bananas (n=41)	48.8	51.2	0.0	0.0	0.0	0.0	0.0
Irish Potato (n=55)	32.7	65.5	1.8	0.0	0.0	0.0	0.0
Tobacco (n=27)	18.5	7.4	37.0	7.4	3.7	3.7	22.2
Paprika (n=1)	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Sunflower (n=1)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Sugar cane(n=15)	60.0	33.3	6.7	0.0	0.0	0.0	0.0
Cotton (n=41)	7.3	39.0	2.4	29.3	17.1	4.9	0.0
Vegetables (n=13)	7.7	92.3	0.0	0.0	0.0	0.0	0.0
Tomatoes (n=69)	11.6	85.5	0.0	0.0	2.9	0.0	0.0
Onion (n=2)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Bambara nuts (n=3)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cow pea (n=1)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Pigeon peas (n=148)	12.8	82.4	0.7	1.4	2.7	0.0	0.0
Green peas(n=2)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Cabbage (n=5)	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Soya (n=11)	9.1	72.7	0.0	0.0	9.1	9.1	0.0
Okra (n=5)	50.0	50.0	0.0	0.0	0.0	0.0	0.0
Boar beans (n=2)	20.0	80.0	0.0	0.0	0.0	0.0	0.0

* Percentages are row percentages

Appendix E: Proportion of children that consumed different foods over the past 7 days

Type of food	0	1	2	3	4	5	6	7	At least 1 day	> than 3 days
Cassava , maize or rice (fresh or flour)	7.1	2.3	2.1	2.7	1.0	1.9	0.6	82.4	92.9	85.9
Stiff porridge of sorghum/ millet/ maize	19.3	8.9	10.2	10.2	6.8	2.3	0.6	41.7	80.7	51.5
Rice	66.6	12.4	12.9	3.9	2.1	0.2	0.2	1.7	33.4	4.1
WFSP	69.7	10.8	6.2	6.4	2.3	0.6	0.2	3.7	30.3	6.8
OFSP	80.5	7.9	5.8	2.5	1.2	0.2	0.2	1.7	19.5	3.3
YFSP	80.9	8.3	4.6	2.7	1.5	0.6		1.5	19.1	3.5
Dark green leaves	13.9	10.2	15.1	21.4	8.3	3.3	1.9	25.9	86.1	39.4
Pigeon pea leaves	97.1	1.0	1.5	0.4	0.0	0.0	0.0	0.0	2.9	0.0
Sweetpotato leaves	81.3	11.0	5.0	1.5	0.8	0.0	0.0	0.4	18.7	1.2
Pumpkin leaves	30.9	19.5	21.4	15.4	4.6	1.7	0.8	5.8	69.1	12.9
Cassava leaves	83.8	11.6	3.3	0.4	0.6	0.2	0.0	0.0	16.2	0.8
Egg with yolk	70.3	16.4	9.1	2.9	0.6	0.2	0.2	0.2	29.7	1.2
Carrots	98.8	0.8	0.2	0.2	0.0	0.0	0.0	0.0	1.2	0.0
Pumpkins	98.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
Pumpkin or cucumber seeds	99.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0
Ripe papaya	60.6	16.4	10.8	5.6	1.9	0.6	0.2	3.9	39.4	6.6
Ripe mango	53.9	9.1	11.0	4.8	2.3	0.8	0.4	17.6	46.1	21.2
Cow's / goat's / powdered / condensed milk	86.9	2.7	2.9	3.3	1.0	0.0	0.0	3.1	13.1	4.1
Small fish FRESH (with intact liver)	86.9	7.5	3.9	1.0	0.4	0.0	0.0	0.2	13.1	0.6
Small fish DRIED (with intact liver)	19.9	15.4	26.8	19.5	10.4	1.7	0.6	5.8	80.1	18.5
Groundnut or cashew nut	42.5	19.9	19.5	9.3	1.9	1.2		5.6	57.5	8.7
Prawn / crab	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chicken	76.6	13.9	6.4	2.1	0.6	0.2		0.2	23.4	1.0
Liver- from any animal	93.8	4.6	1.5	0.0	0.0	0.0	0.2	0.0	6.2	0.2
Meat from cow / pig / sheep / rabbit/ rat	69.5	14.7	9.5	4.1	1.5	0.2	0.0	0.4	30.5	2.1
Butter	97.3	1.2	0.8	0.2	0.0	0.0	0.0	0.4	2.7	0.4
All kinds of beans	28.2	29.9	22.4	12.4	2.9	1.2	0.2	2.7	71.8	7.1
Wheat / biscuits / cookies	49.4	13.7	12.2	8.9	5.0	1.2	0.4	9.1	50.6	15.8
Cod liver oil	98.1	0.4	0.6	0.2	0.4	0.0	0.0	0.2	1.9	0.6
Food fried in oil or with oil	32.6	12.9	15.8	12.7	9.1	2.3	0.4	14.3	67.4	26.1
Coconut milk	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vitamin A fortified margarine or oil	73.4	5.2	6.2	3.5	3.1	1.0	0.0	7.5	26.6	11.6
Cerelac (fortified packaged cereal)	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Percentages are row percentages; n=482

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