



Assessment of Household Food Security through Crop Diversification in Natmauk Township, Magway Region, Myanmar

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1. Introduction

Agriculture is a risky business because it involves uncertain factors such as weather and market situations. These uncertainties influence various decisions that farmers make in a particular season. An agrarian based economy like Myanmar is dominated by small subsistence and marginal farmers. Their small operational base makes it unfeasible to enhance the incomes of these households only by raising the existing crop yields and furthermore it is difficult for the farmers to acquire inadequate resources to sustain themselves and their family and also to invest in the farm (USAID 2013, DAP 2014). Crop diversification is one of the solutions reducing variability in farm income, while it provides the farmers with the viable option to grow a variety of crops on their land. It also reduces the adverse effects of the current specialized crop systems and monoculture because it makes better use of resources; it reduces risks and uncertainty and has positive effects on soil conditions (Saraswati et al. 2011, Njeru 2013).

Myanmar is an agricultural country and the agricultural sector is the mainstay of the country's economy, contributing 23 %. The main crops cultivated in Myanmar include cereals (e.g paddy, wheat, maize, sorghum), oilseeds (e.g groundnut, sesame, sunflower, mustard), different kinds of pulses, industrial crops (e.g cotton, jute, sugarcane, rubber, coffee), kitchen crops (e.g chilly, onion, garlic) and fruits and vegetables (DAP 2013, DAP 2014). According to the Global Food Security Index 2014¹ Myanmar is ranked 86 out of 109 countries and has a score of 37.6 out of 100. Although the country produces a surplus of food in different items, many households in rural areas are suffering from chronic and acute food insecurity. The Dry Zone is a poverty-stricken area and one of the most food insecure regions of the country comprising Magway, Mandalay and lower Sagaing regions (WFP 2011). It is also characterized by a large crop diversity with three or more different crop types cultivated. The most common crops grown are pulses (pigeon pea, groundnut, sesame, chickpea, cow pea and green gram), rice and maize (DAP 2014).

As mentioned above, crop diversification provides farmers with feasible options for growing diverse crops on their land. So, the decision of the farmer to diversify is considered as an important economic decision, which has a strong impact on the farmer's income level and food security (Pope and Prescott 1980). Also there are many factors influencing the decision of farm household to diversify (Saraswati et al. 2011, Mwangi et al. 2013, Abdalla et al. 2013). These factors may include **demographic** factors such as gender, age, education and labor; **socio-economic** factors such as farm size, farming experience, interest and willingness (Ashfaq et al. 2008, Rehima et al. 2013, Sichoongwe et al. 2014), **bio-physical** factors such as rainfall, temperature and soil conditions (Weiss and Briglauer 2000, Benin et al. 2004 and Aneani et al. 2011), and **institutional** factors such as policy support, training program (Ibrahim et al. 2009, Aneani et al. 2011, Rehima et al. 2013).

Most of these studies focused on the food security in terms of their income, their livelihoods, food availability, food accessibility and food utility but did not make a relationship with crop diversification. So there are no studies that investigate the relationship between crop diversification and food security in this area. Therefore, it is needed to carry out the study, which will point out the impact on the food security status of farm households of crop diversification and it will examine the factors determining the degree of crop diversification in this area.

¹ <http://foodsecurityindex.eiu.com/Index> Accessed on 12, December 2014.

2. Material and Methods

This study was conducted in the Natmauk Township, which is situated in the Magway Region, central dry zone of the country. 95 % of total population live in rural area and rely on agriculture for their livelihoods (MAS 2014). This study was scoped to one agro-climatic zone, four villages; two villages near the Township market and two villages far from the Township market. In this study, both primary and secondary data were used. The primary data were collected through the survey with structured questionnaires to respondents in the study area. The survey was carried out in March, 2015 and collected both qualitative and quantitative data at household level in four villages. Secondary data such as demographic features, agro- ecological features, land use patterns and crops yields were collected from the “Myanmar Agriculture in Brief” book (DAP 2014) and from government reports of Township Agricultural Service, Natmauk Township. A number of structured questionnaires were prepared and tested with 10 farmers in a pilot study. After that, verification and re-structuring of surveyed questionnaires were prepared. For the selection of sample villages, the suggestions of Township Agricultural Service and field team leaders were acquired. A total of 80 farming households were selected using simple random sampling technique. From each household, the household head or a suitable respondent was interviewed. The Simpson Index of Diversification (SID) is derived directly from the Herfindahl Index (HI), which is introduced by (Herfindahl 1950) and is used to measure the level of crop diversification in this study. A censored regression models (including Tobit model) is usually estimated by the Maximum Likelihood method and is used as the model to measure the determinants of crop diversification. The food security was indirectly measured by behaviors related to consumption of foods. The methods of ‘the Household Food Insecurity Access Scale (HFIAS)’ and ‘the Household Dietary Diversity Score (HDDS)’ developed by the United States Agency of International Development (USAID) were used to measure the food security status of households in this study².

This study has following limitations. The study analyses crop diversification at farm level. This study only focuses on annual crops grown by smallholder farmers regardless of perennial crops. Furthermore only the cropping year 2013-2014 is taken into account for assessing the degree of crop diversification. As the concept of food security is very wide and has four dimensions, only food accessibility is taken into account for assessing household food security. Food availability, food stability and utilization are not considered in food security assessment. Finally, this research covers only four villages in Natmauk Township in the dry zone region. Therefore, the findings of this study might not be generalized to all small farmers in the central dry zone of Myanmar.

3. Results and Discussion

3.1 Household Food Security Assessment

Different indexes of crop diversification among sampled farmers were measured based on the Simpson Index of Diversification calculation and these indexes were categorized into five levels of crop diversification. The results are presented in figure 1. The results indicate that 22.5 % of households were adopting low diversification in crop production and 35 % of households moderately diversified their crops. High crop diversification indexes were observed among 32.5 % of the sampled farmers. There were different crop diversification levels (indexes) among sampled households due to differences in their demographic, socio-economic characteristics and institutional factors. These different levels of crop diversifications and affecting factors will be discussed briefly in coming sections.

The sampled households were categorized into four food insecurity groups: food secure, mildly food insecure, moderately food insecure and severely food insecure. Households were classified as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently. Based on the HFIAS categories, 31.25 % of the households were food secure while 35 % mildly food insecure, 25 % moderately food insecure and 8.75 % of household were suffering severe food insecurity in the study area. The study assessed the food security status of the sampled farm households by using HDDS scores. Table (1) shows the results of the household dietary diversity score and households were categorized into three groups according to the number of food groups they consumed during the last 24 hours.

² See more at http://www.fao.org/fileadmin/user_upload/eufao-fsi4dm/doc-training/hfias.pdf
<http://www.eldis.org/vfile/upload/1/document/0708/DOC19517.pdf>

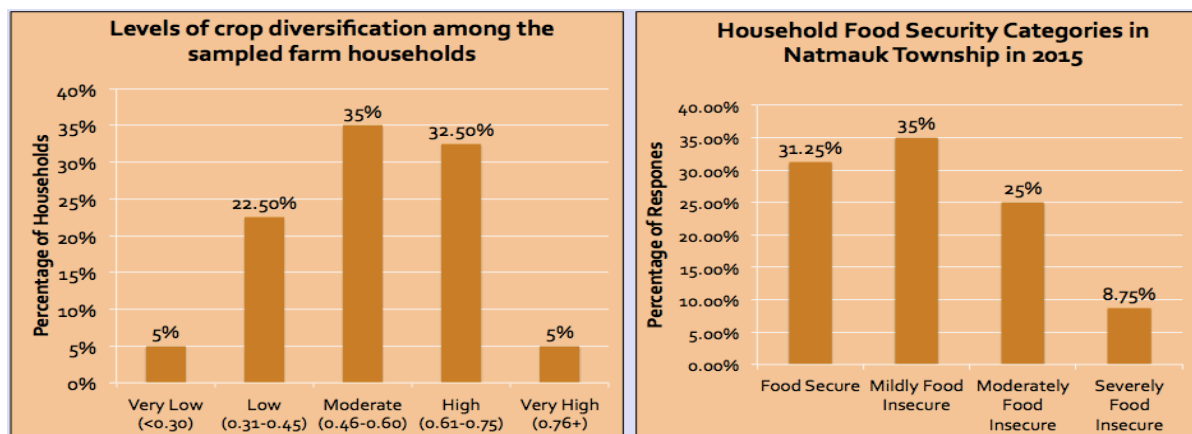


Figure 1. Levels of crop diversification and Household Food Security Categories among the sampled farm households

According to the HDDS results, more than half of the households (55 %) were found in medium dietary diversity group (consumed 4-5 food groups), followed by 31.25 % in high dietary diversity group and 13.75 % in low dietary diversity group in which households consumed 3 or less than 3 food groups.

Table 1. Distribution of households according to the HDDS score

Dietary Diversity Score	No. of food groups	No. of households	Percentage
Low Dietary Diversity	0-3 food groups	11	13.75 %
Medium Dietary Diversity	4-5 food groups	44	55 %
High Dietary Diversity	6-12 food groups	25	31.25 %

According to the results in figure 2, it was also observed that crop diversification is positively associated with greater dietary diversity of the farm households in the study area. Farmers who cultivate vegetables could easily get vegetables from their own farm and farmers who keep the crops they produce don't have to worry about not enough food. More diverse production systems might contribute to more diverse diets in the households.

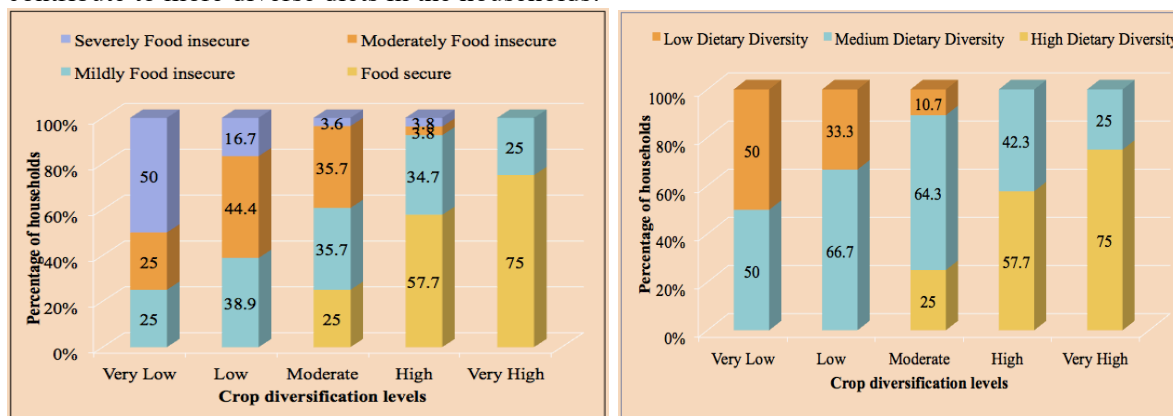


Figure 2: Distribution of household food security by crop diversification levels

Table (2) gives the overview of the Pearson's correlation coefficients for the continuous variables. The HFIAS score is negatively correlated with CDI and HDDS. Higher HFIAS score means the household is more food insecure while higher CDI means higher crop diversification and higher HDDS scores indicate better food security status of the households. HDDS score is positively correlated with CDI and negatively correlated with HFIAS. As the food security status increases, HFIAS decreases. All correlations were significant at 0.01 level and coefficients were higher than 0.05. Using correlation analysis, it was examined that the HFIAS score is negatively correlated with crop diversification and HDDS. This implies that HFIAS score decrease as food security increases increase in HDDS. From the above results, it can be concluded that food security status of farm households can be improved

through crop diversification and therefore farmers should be stimulated to more diversify the different crops in their cropping pattern.

Table 2. Pearson Correlation coefficients for the continuous variables

	Crop Diversification Index	HFIAS ^a	HDDS
Crop diversification Index	1	-0.680**	0.637**
HFIAS	-0.680**	1	-0.800**
HDDS	0.637**		1

The results of the Tobit analysis of the determinants of crop diversification among the sampled households are presented in Table (3). The sigma value and log likelihood function revealed that the model is of good fit (with $p < 0.01$). Multicollinearity was checked by variance inflation factor (VIF) and the calculated VIF values are less than 10 (the cut-off point) indicating that multicollinearity is not a problem in this study. The results from the Tobit analysis revealed that farming experience of the household head, education level of farmers, farm size, access to credit and access to irrigation are the main factors that positively and significantly affected crop diversification among the sampled farm households in Natmauk Township. This implies that increases in these variables lead to increases in crop diversification. For example, an increase in one unit of farm size increases crop diversification by 0.011. However, age of household heads, non-farm/off-farm income and distance to market were observed to have a negative and significant impact on crop diversification degrees (indexes) among the sampled farmers. This indicates that crop diversification reduced with increased age of the household heads, non-farm/off-farm income and distance to market.

INSERT TABLE. 3 HERE

4. Conclusions and Outlook

The present study was carried out to study the socioeconomic characteristics and crop diversification (indexes) among farm households, also to analyze the determining factors of crop diversification and to investigate food security status of the sampled farm households in relation to crop diversification. On average, households moderately diversified their cropping patterns (mean CDI 0.54). The determinants of crop diversification were examined by using censored Tobit regression analysis and it was observed that farming experience of household head, education level, farm size, access to credit and access to irrigation are the main factors that positively and significantly affected crop diversification among the sampled farmers. However, age of household heads, non-farm/off-farm income and distance to market were observed to have a negative and significant impact on crop diversification degrees (indexes) among the sampled farmers. According to correlation analysis, it was observed that HFIAS score is negatively correlated with HDDS and crop diversification. The findings clearly indicate that better food security is associated with crop diversification in the study area. Therefore, the study recommended that the farmers should be encouraged to improve the right selection and cultivation of different crop types on their farms, which will eventually lead to increase in crop outputs and otherwise, improve food security. The study only covered some segment from the broad and complex concepts of food security and crop diversification. Therefore, some suggestions for further research and additional exploration of the study are encouraged such as comparison the important linkage of crop diversification to food security in a region of dry zone area among different land holding size, further study assessing food security with other indicators based on these dimensions at individual or regional level, benefit-cost analysis to investigate economic sustainability of different cropping patterns in the study areas, and more sample population to make more concrete data outputs and interpret more broadly.

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Table 3: Determinants of crop diversification in the study area

Variables	T-value	Std. Error	Coefficients
Constant	5.928	0.061	0.361***
Age (years)	-2.507	0.001	-0.002**
Gender (Male = 1)	1.318	0.021	0.028
Education Level	1.962	0.012	0.024**
Experiences (years)	2.260	0.001	0.002**
Household size (persons)	0.730	0.007	0.005
Farm size (acres)	3.544	0.003	0.011***
Extension contact (number)	1.586	0.009	0.014
Non-farm income	-1.944	0.021	-0.040*
Distance to market (km)	-1.911	0.005	-0.011*
Access to credit (Yes = 1)	1.887	0.022	0.041*
Access to irrigation (Yes = 1)	2.865	0.020	0.057***
LogSigma	-2.760***		
Log-likelihood	107.339		

*** Significant at 1 % level, ** significant at 5 % level and * significant at 10 % level. The coefficients also depict the marginal effects.