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Determining factors for the application of climate change adaptation strategies among farmers in the Magwe District in the Dry Zone region of Myanmar

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Introduction

Many scientists have confirmed that climate change is occurring and it is believed that the impact of climate change will be larger in developing countries, compared to developed countries (IPCC 2007, World Bank 2012). This is because developing countries often have agricultural based economies and agricultural production highly depends on annual weather conditions and natural resources. On average about 43% of the national GDP of developing countries is generated by agriculture and related activities (Norton et al. 2010, IFAD 2010). Consequently, in the top ten of nations most prone to climate change and extreme weather events, there are 9 developing countries. Myanmar ranks second in this list (Kerft et al. 2014). Farmers in the dry zone region of Myanmar are however adapting to climate change. Adaptation to climate change is critical and could reduce the adverse impact of climate change on crop production. Farmers in most affected areas have already started to adapt by changing crop mixes, using water conservation measures, and adopting risk management techniques to lessen the consequence of the increased drought frequency (IPCC 2007, Norton et al. 2010, World Bank 2012).

Agricultural adaptation measures by farmers can for example limit yield loss. Adaptation to climate change is important for two main reasons: it can decrease exposure and vulnerability. Adaptation to climate change at the regional level can be categorized into two primary categories: indigenous adaptation and system or introduced adaptation (START 2012). The acceptance of climate change adaptation strategies is determined by numerous demographic, socioeconomic and organizational or institutional characteristics (Deressa et al. 2009, Hassan and Nhemachena 2008, Shongwe et al. 2014). Several studies have confirmed that adaptation to climate change increases food productivity (Howden et al 2007, Falco et al. 2011). However, Howden et al. (2007) argued that achieving increased adaptation action will require integration of climate change related issues with other risk factors.

Adaptation to climate change reacts to further changes in the climate in the future. Climate change adaptation is defined as "the adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC 2008). In most cases, simple and feasible adaptation such as altering varieties and planting times to avoid drought and heat stress avoid significant negative impacts on crops (Tubiello et al. 2002). Therefore, assessing the effectiveness of adaptation options, enhancing existing climate risk management, understanding likely adoption rates, and developing more resilient agricultural systems are urgently needed (Howden et al. 2007). A better understanding of climate change adaptation choices and adoption of adaptation strategies to address the increasing water scarcity over time is becoming a great concern to policy makers to comprehend the tendency of adaptation changes, and their barriers to adaptation. To limit the impact of climate change, it is therefore relevant to examine the uptake of indigenous and introduced climate change adaptation strategies in Myanmar. This study, therefore compares the actual and the past climate change adaptation strategy choices by farmers. After that, the perception about risks introduced by climate change and the practical difficulties of farming and finally the determinants of adaptation strategy choices are examined.

Material and Methods

Data was collected in 2014-2015. At the first stage, three Local Townships (Magwe, Yenanchaung, and Chauk) were selected. Within these, a total of 25 village tracts (VT) or wards were randomly selected: 11 VT from Magwe Township, 6 VT from Yenanchaung Township and 8VT from Chauk Township. At the village tract level, the respondents were randomly chosen. This sampling method is known as a multi-stage random sampling. A number of semi-structured questionnaires were prepared before conducting a focus group discussion. In the focus group discussion, several stakeholders from different administration departments, key farmers or leaders, and important persons from development agencies were invited to get insight in the regional conditions and practical overview of different adaptation methods.

Enumerators were also involved as listeners to gain understanding on the issues of climate change in the region, regional climate adaptation strategies and to familiarize with the importance of this research on climate change adaptation. Before conducting interviews with individual farmers, a pilot survey was tested with 10 farmers. The questionnaires considered socioeconomic characteristics of farmers, perception on climate risks and difficulties dealing with farming within the last 10 years. To collect the data, the questionnaires were verified and enumerators were trained for a day to familiarize with the basic concepts of sampling, interviewing, and processing data. A total of 212 farm households were interviewed.

Results and Discussion

Perception of climate change

Farmers' perceptions on the impact of climate change are presented in Figure 1. 23.1 % of the farmers agreed and 65.1% of farmers strongly agreed that water availability is decreasing and that this is a serious problem for crop production. A majority of the farmers agreed that climate change has an impact on the regional agriculture (60.8%) and on individual farming (80.2%). 50.9% of the farmers agreed and 39.6% of farmers strongly agreed that climate change affects yields. Furthermore the majority of the farmers believe that in the future their livelihoods and agricultural production will be impacted due to the changing climate. Thus in the present situation, the regional agriculture and individual farms are severely affected by increasing water scarcity, something nearly 90% of farmers agrees with, and all the farmers agree that there is a rainfall deficit. Amdu et al. (2013) indicated that unless local specific adaptation interventions are made, farming community would continue to use the existing adaptation strategies despite increasing effects of climate change in the future.

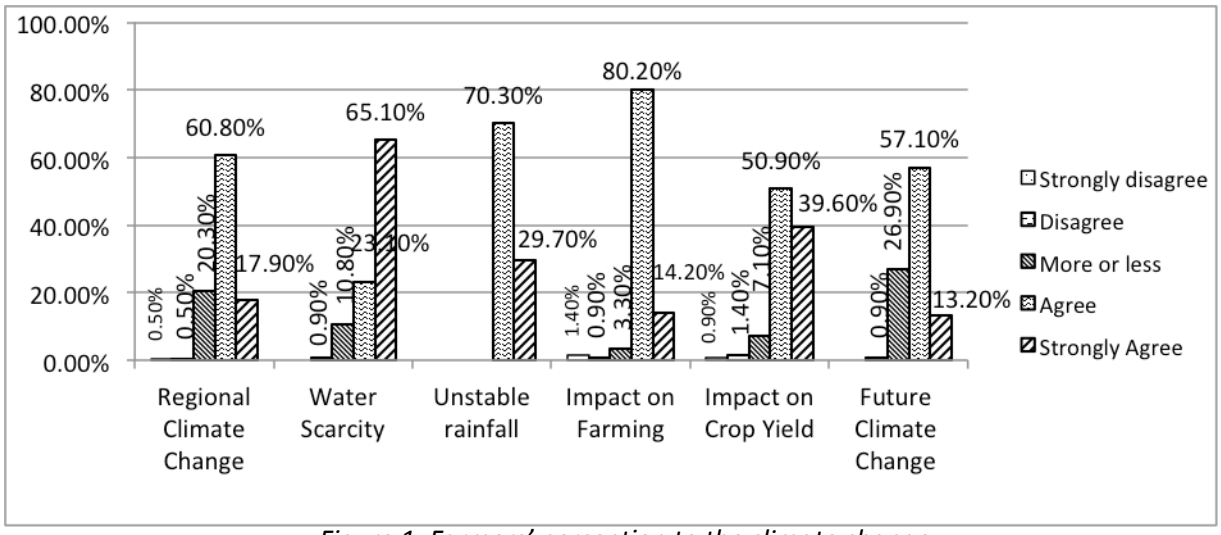

Figure 1. Farmers' perception to the climate change

Comparison of past and current climate change adaptation strategies

At the farm level, the adaptation to climate change includes many possible responses. Basically, indigenous adaptation strategies available at the farm level are adjustment of planting date (i.e., timing of sowing dates takes into account rainfall patterns), crop diversification, cultural related strategies (e.g plant protection, fumigation, cleaning bushes, etc.), soil related strategies (e.g., tillage practices, soil management practices), crop and livestock related strategies (e.g., crop varieties, livestock produced). These climate adaptation strategies were already present 10 years ago. At present, the following adaptation strategies are practiced by the sampled farmers in the region: use of improved varieties (e.g., drought resistance varieties, HYV (High Yielding Varieties), short duration varieties), advancements in soil and plant health (e.g., organic manure application, plant pest protection, mulching, weeding introduced by public organizations), recommended agricultural strategies (e.g., Good Agricultural Practices introduced by public organization), crop diversification and rotation (e.g., a mix of crops, and rotating crops year after year), adjustment of planting dates and cultivation methods (e.g., adjusting sowing dates with broadcasting methods, or different forms of seedling methods) and a combination of improved varieties and the good agricultural practices methods. The results in Figure 2 show that most farmers employ adaptation measures. However, measures taken are different amongst farmers. The adoption of climate change adaptation varies across different plots given the different plot characteristics (Deressa 2010). If we look at strategies used in the past, changing the planting date and crop diversification were applied by a large proportion of farmers 33% and 27.4 % respectively, followed by soil related adaptation methods 14.6%. However, the farmers' adaptation strategies have changed over time. In recent years the adjustment of the planting date has remained important, but this is now combined with an adjustment of the cropping system because only changing the planting date could no

longer ensure crop yield stability. The second most popular method was focusing on soil and plant health (10.8%) and crop diversification and rotation methods (9.4%). It can be noted that soil deterioration and pest infestation are becoming a challenging problem in the light of climate change. The decrease in annual precipitation and the intensity of rainfall makes it difficult to raise seedlings. Therefore, the farmers adjusted the planting dates and cultivation method. This method also includes harvesting crops ahead of water deficit condition at the end of growing season. Varying the planting and harvesting dates and shortening the length of growing season was perceived by farmers as an appropriate adaptation strategy (Hassan and Nhemachena 2008).

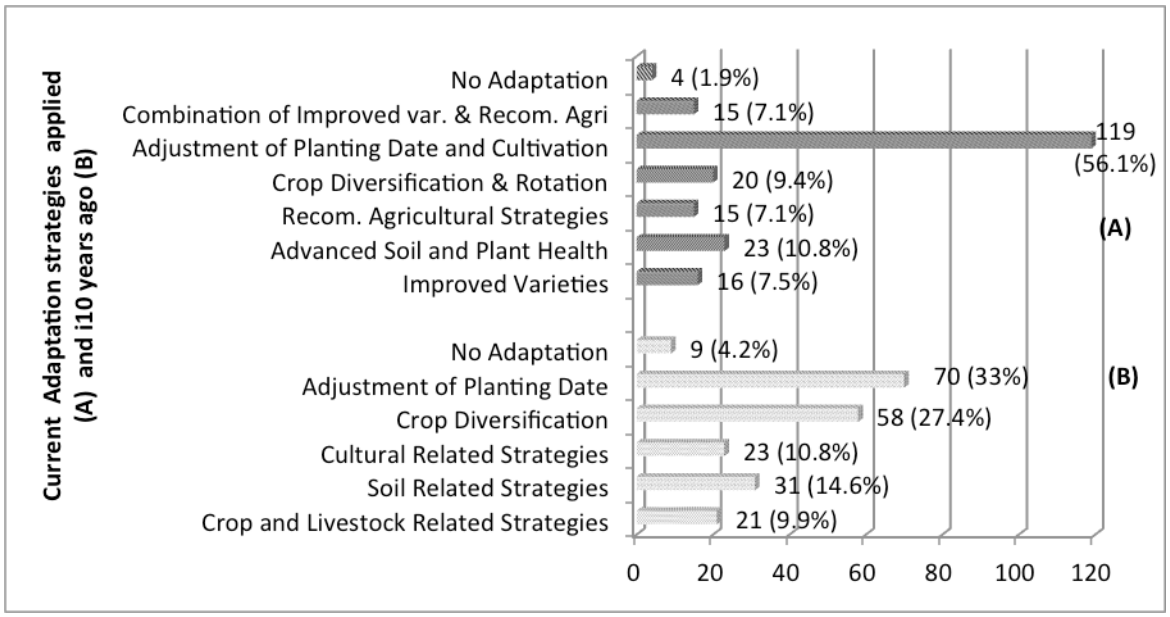

Figure 2: Comparison of past (A) and current (B) climate change adaptation strategies

Barrier to Climate Change Adaptation

A number of studies have mentioned the constraints and limitations to the climate change adaptation (Bryan et al. 2009, Deressa et al. 2009, Deressa et al. 2011, Tessema et al. 2013). In this study, the farmers' perceptions with respect to barriers to the practical application of climate change adaptation strategies were investigated. In figure 3, a number of barriers to the adoption of climate change adaptation strategies are presented.

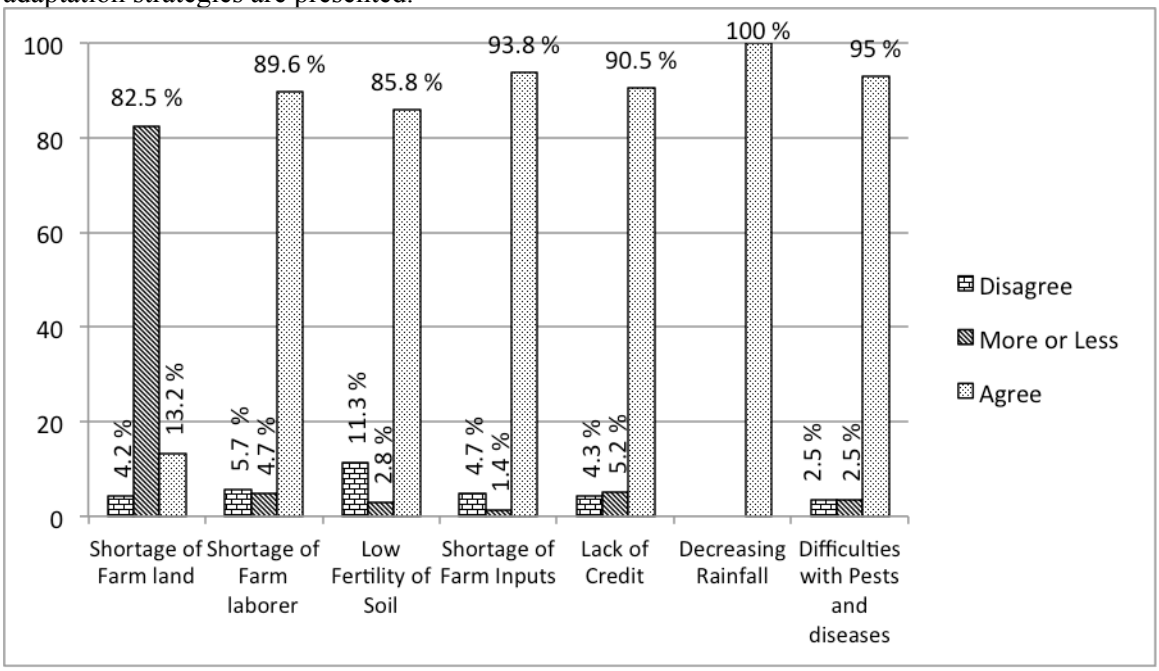

Figure 3: Barrier to climate change adaptation

During the survey, farmers perceived that these barriers hamper their adoption of adaptation measures. All farmers agreed that the intensity of rainfall is decreasing and very unstable. This makes it very

difficult to raise seedlings and cultivate crops. Overall, 95% of farmers agreed that there is a lack of farmlands and a shortage of farm laborers. In addition, the majority of the farmers are worried about the decreasing fertility of the soil and the infestation by pests and diseases. In the study, farmers believed that introducing adaptation strategies requires good care and management together with improving soil fertility and plant protection. Farmers thus perceived that these are the factors hampering their decisions to adopt introduced adaptation strategies. Moreover, farmers noticed soil quality depletion and soil erosion. Again, farmers are faced with high input costs such as fertilizers, and pesticides in the agricultural crop production. Consequently, nearly 95% of farmers reported that they do not have enough credit for farming. In some cases, farmers reported that they were paid less and not received in time, where the farmers normally need credit in busy periods such as before the start of monsoon season and at the harvesting times. Therefore, the majority of farmers mentioned that their planned adaptation strategies are altered and sometimes impeded with these barriers.

Conclusions and Policy Recommendation

The research was performed in Magwe district in the dry zone region of Myanmar where 212 farm households from Three Township were randomly chosen for the study. In the past, the majority of farmers used to apply traditional adaptation strategies and methods to counter the impact of climate change on agriculture. Several focus group discussions highlighted the impact of climate change on regional agricultural crop production. The majority of the farmers agreed that there is an impact of climate change on farming, and yields. Also, the majority of the farmers practices climate change adaptation strategies as their agricultural crop production will be impacted by possible climate change in the future. The majority of the farmers adjusted the planting and system method (56.1%). Only 1.9% of farmers did not employ any adaptation strategy. Moreover, the probabilities of farmers' choice of adaptation methods are clearly identified and the study revealed that the indigenous adaptation methods are gradually overturned and popular knowledge is somehow replaced. Currently, farmers are turned to adopt introduced-adaptation strategies. Finally the study identified the barriers to climate change adaptation such as, shortage of farmland, shortage of farm inputs, shortage of farm laborers and lack of credits. These are important limits to adopt introduced adaptation methods. A better access to seeds from the regular sources is necessary for the farmers. The study suggests that regional government and public or private organizations should encourage to timely supply purified and high yielding seeds for the farmers and should implement policy implications to enhance adaptation measures and reduce barriers to climate change adaptation.

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