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Socioeconomic Factors Affecting Adoption of Use of Organic Manure as Climate Smart Agriculture Technology in Malawi

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Abstract: ***There is increased number of organizations bringing awareness on climate smart agriculture (CSA) technologies to farmers. In Malawi, the increased numbers are due to impacts farmers are facing as a result of climate change hence making adoption of (CSA) technology being the best alternative to mitigate the impacts. The study aimed at identifying socio-economic variables that affect farmer's decision to adopt use of organic manure as(CSA) technology. Data was collected using a semi-structured questionnaire through personal interview which targeted 120 households which were randomly selected composed of 30% (n=37) males and 69% (n=83) females. Data was analyzed using SPSS and STATA. The results showed that education, household size and income were significant at 0.05 level of significance. Since education, total annual income and size of the household were said to influence use of organic manure then they deserve particular attention in developing plans and implementation of this CSA technology.***

Keywords: Climate smart agriculture technologies, adoption, socioeconomic factors

1. Introduction

In recent decades productivity in agriculture sector has been high and impressing hence playing a crucial role in food security, development and management of natural resources. The story in recent years (2000-2014) is different due to the problem of climate change which is reducing agriculture productivity among most farmers (Place *et al.,* 2004). This development negatively contribute in achieving of Millennium Development Goals (MGDs) for instance goal 1: *Eradicate Poverty and Hunger* and goal 7: *Ensure Environmental Sustainability*. According to the United Nations Framework Convention on Climate Change (UNFCCC) article 2 where their ultimate goal is at stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, then full adoption of climate smart agriculture technologies can help to achieve the goal.

Climate-Smart Agriculture (CSA) is defined by the Food and Agriculture Organization of the UN (FAO) (2013), as the farming practices that sustainably increase agricultural productivity and income, adapt and build resilience to climate change which includes increasing adaptive capacity in the short-term, where there is more uncertainty over climate extremes; and the one that in the medium-long term, as permanent changes in climate patterns become more apparent (Cooper et al., 2013) and reduce and/or remove GHG emissions while supporting the achievement of food-security and development goals.

Climate smart agriculture technologies including agroforestry, use of organic manure and conservation agriculture have emerged as a sustainable land management practices. According to Lehmann et al. (*1998*) CSA technologies have potential in addressing loss of soil fertility and land degradation. Thangata et al. (*2007*) found that many smallholder farmers are in a state of poverty and cannot afford to purchase industrial inputs to improve yields therefore CSA technologies play an important role to improve yields. Climate-smart agriculture include proven practical techniques like; mulching, intercropping, conservation agriculture, crop rotation, integrated crop-livestock management, agroforestry, improved grazing, and improved water management. These technologies involve innovative practices such as better weather forecasting, more resilient food crops and risk insurance. FAO (2013) found out that the adoption of these CSA technologies, can lead to climate change adaptation and mitigation benefits, as well increased and more stable yields, thereby increasing food security. However, the adoption of such technologies remains generally low, particularly in sub-Saharan Africa (SSA) with the most commonly cited constraint to increased adoption being the lack of robust property rights and an associated lack of land tenure security.

The main climate smart techniques that have been promoted to improve and sustain agricultural productivity in Malawi are use of organic manure, agroforestry and conservation agriculture (FAO 2013).The study focused on use of organic manure among many CSA technologies.

2. Objectives and Method

This study was initiated with the aim of analyzing the socio-economic factors affecting adoption of use of organic manure as a climate smart agriculture technology among farmers in Malawi.Data from household questionnaire was analyzed using Statistical Package for Social Scientists (SPSS) version 20.0 and STATA version 16. Descriptive statistics that included the use of frequency distributions, percentages, logit model probability values and marginal effects was used to tabulate the adoption status against various socio-economic factors. Logistic regression model was used to identify and interpret main socio-economic factors affecting adoption of use of organic manure. The model was specified such that "adoption" was used as the

dummy dependent variable which was regressed on a set of socio-economic characteristics of the household.

3. Review of Literature

Soil productivity has declined in many areas of Sub-Saharan Africa (SSA) (FAO, 2011a). The productivity of the soils can be enhanced by application of composite or green manure (Breland, 1995).Green manures, also referred to as fertility building crops, may be broadly defined as crops grown for the benefit of the soil. Use of organic manure as a soil improvement strategy has been used in traditional agriculture for thousands of years but conventional farming systems largely rejected them as the use of fertilizers and pesticides became more common (Shepherd et al., 2002).

Use of organic manure reduces emissions and raise productivity of agricultural sector(Kilcher, 2007). For example, the anaerobic digestion of manure stored as a liquid or slurry can lower methane emissions and produce useful energy, while the composting solid manures can lower emissions and produce useful organic amendments for soils.Khor (2008), reported that the benefits of the use of organic manure regarding climate change includes; reduced emissions, high stabilization of soil organic matter, increased soil water retention capacity and also organic systems are highly adaptive to climate change due to application of traditional skills and farmers' knowledge, soil fertility-building techniques and a high degree of diversity.

Feder 1985 defined adoption of a new technology as "the degree of use of a new technology in long-run equilibrium when the farmer has full information about the new technology and its potential". According to Langyintuo (2001), adoption of new agricultural technology has long been recognized as one of the key factors in increasing productivity in the agricultural sector. However, adoption of use of organic manure and other new technologies among poor farmers has been reported to be affected by lack of knowledge, access to markets, certification, agricultural inputs and lack of organization(Kilcher, 2007). Furruh et al. (2007) and Menale et al. (2009) found out that age of the farmer had a negative influence in adoption of organic manure as a climate smart agriculture technology.However, age had been reported to have a positive correlation with use of manure to improve soil fertility among farmers (Odendo et al., 2009). Education level of the householdhead was reported to have positive effect on adoption of use of organic manure as a climate smart agriculture technology because its adoption requires understanding land preparation procedures for land(Odendo et al., 2009).

It is observed that adoption of use of organic manure as a climate smart agriculture technology is affected by various factors including age, education status, household size, income, altitude, and extension contact with the farmers (Franzel, 1999).

4. Finding and Discussions

Adoption of CSA technology may be different in different districts due to variations in availability of resources. Use of organic manure registered high adoption levels in Ntcheu (41%), followed by Dedza (34.9) and then Dedza (24.1). The results of the logistic regression model shows that adoption of use of organic manure by farmers was influenced by total annual income, education level and household size of the household head (Table 1).

Table 1: Factors affecting adoption of use of organic manure

Dependent Variable: Adoption of Use of Organic Manure				
Independent variable	dy/dx	Std. Error	Z-value	P-value
Sex of respondent	-0.0618753	0.09343	-0.66	0.508
Age of respondent	-0.0032635	0.00285	-1.15	0.252
Household Size	0.0644473	0.02288	2.28	0.005**
Size of Land	0.0088086	0.03859	0.23	0.819
Education level	0.090997	0.03987	2.28	0.022**
Total annual income	0.2256114	0.04371	5.16	0.000***
Number of obs = 120		Prob> chi2 =	0.0000	
Wald X^2 statistic =	46.52			
Pseudo R2 =	0.3122			
Log likelihood = -51.238121				

***, *** Significant at 5% and 1% Confidence level respectively*

Household size, education level and total annual income of the household head had a positive and significant influence on the adoption of the use of organic manure. Basing on the study, it was shown that probability of adoption of use of organic manure increased with each addition member of the household by 6 percent. This may be the case as use of organic manure requires enough labour for making and transporting the manure to the gardens hence households having large family size likely to adopt this technology. The results are not consistent with findings by Baudronet al.(*2007*) who argued that due to the paucity of family labor, more farmers will likely turn to technologies that save labor like reduced tillage systems if they are accessible and affordable, meaning that more farmers that adopted CSA technologies have less labor supply but this is not the case with use of organic manure.

The probability of adoption increased with each addition school year of formal education completed by the head of the household by 9 percent. The results agreed with the findings by Kanyama-Phiriet al. (*1994*), who said education has an essential aspect in technology adoption because it changes farmers` perception on culture, social and tradition hindrances to adoption hence the higher the education level attained the lower hindrances to adoption. The results also corroborate with those of Ajayi et al. (*2003*) who observed that education level of the farmer influences adoption of new agricultural technologies. Another positive and significant determinant of the adoption of use of organic manure was total annual income of the household head. This means that an increase in household"s income would increase the probability of adopting use of organic manure by at least 23 percent, holding other factors constant. The results agreed with Batzet al.(*1999*) who observed that farmers with higher income are more likely to adopt new agricultural technologies compared with those with a low income.

5. Conclusion and Suggestion

The use of organic manure has decreased over the past 5 years due to introduction of other climate smart agriculture technologies like conservation agriculture and agroforestry. However, it is still prevalent in most parts of Malawi regardless of the low adoption levels that are attributed due to household size, education level and total annual income of the household head. Increasing adoption of the use organic manure as climate smart agriculture technologies will require partnership and collaboration among government and non-governmental organizations to improve the education levels, income and labor availability through agriculture mechanization to meet the labor demanded by this CSA technology.

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