Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.4, No.10, 2014

Exploring Some Social Dimensions to the Practice and Sustainability of Traditional Conservation Agriculture in Semi-Arid Ghana

Yaw Agyeman Boafo[1*] Godfred Seidu Jasaw[1], Frederick Dayour[2]
1- United Nations University, Institute for the Advanced Study of Sustainability (UNU-IAS), 53-70, Jingumae 5-chome, Shibuya-ku, Tokyo 150-8925, Japan
2- University for Development Studies, Wa Campus, Wa, Ghana
*yaboafo@yahoo.co.uk/boafo@isp.unu.edu

This research is financed by the Japan International Cooperation Agency (JICA) and Japan Science and Technology Agency (JST) under the Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach (CECAR Africa) Project (FY2011-FY2016)

Abstract

This paper identifies and examines the social factors driving the continuous use of traditional farming techniques hereforth referred to as traditional conservation agriculture by smallholder farmers in two Districts; Tolon in Northern and Wa West in Upper West Regions of Ghana. The influence of the identified social drivers was tested against field-based evidence in purposively selected case study communities in the Tolon and Wa West Districts. The study employs a multi-stage sampling approach to select two categories of farmers (those known to be dominantly employing traditional farming techniques and (ii) those who employ less or no traditional farming techniques in their farms) for this survey. Using a structured questionnaire, a total of 80 farmers were sampled and interviewed. Focus group discussions with the two categories of farmers and farm visits were undertaken to triangulate and validate individual responses. Data from the two study districts were analyzed using descriptive statistical techniques (frequency, percentages and bar charts) in Statistical Product and Service Solutions (SPSS). Results gathered revealed a discernible and significant relationship between the continual practice of traditional conservation agriculture and social factors including gender, age, education, household size and income. Other factors including farm size, labour costs, low capital requirements, declining soil fertility, low yield due to increasing climatic variability and dearth of external institutional support emerged as key drivers influencing the practice and sustainability of traditional conservation agriculture. This study calls for the re-examination of the efforts to transfer formal conservation agriculture practices to local communities by adopting a synergistic approach.

Keywords: Traditional Conservation Agriculture, Northern Ghana, Smallholder Farmers, Gender, Sustainability

1.0 Introduction

As climate-induced extreme events, such as floods, drought, desertification and increasing temperatures continue to enervate livelihood strategies of people across the globe, it has become urgent to devise innovative, resilience enhancing and practical ways to deal with these events and their associated impacts. In most developing countries, particularly in Africa, drought and desertification have been identified as two of the biggest challenges facing sustainable development, especially in the agricultural sector, making it the most vulnerable continent (United Nations Environment Programme [UNEP], 1995; Intergovernmental Panel on Climate Change [IPCC], 2007; Food and Agriculture Organization [FAO], 2008). Africa's vulnerability is attributed greatly to its geographical setting as over 70% of its population relies on rain-fed agriculture (IPCC, 2007).

In Ghana, agriculture remains the most important economic activity, engaged in by about 60% of its population (Ghana Statistical Service [GSS], 2013a). It is known to contribute to about 21.3%% of its annual Gross Domestic Product (Government of Ghana [GOG], 2013), Jasaw et al, (2014). The growth and sustainability of the agriculture sector for many years now is constrained by social and environmental factors including poor transportation, pest and disease invasions, infertile soils, irregular and unreliable rainfall, incidence of perennial floods and droughts among others (Armah et al., 2011). Although, these constraints vary geographically and regionally, the recognized trend is a general worsening in their state and patterns, aggravating food insecurity situation (Okai, 1997). In the semi-arid northern Ghana composed mainly of three administrative regions; Northern, Upper West and Upper East, where over 70% of inhabitants are engaged in rainfed agriculture, rainfall has become more erratic, resulting in prolonged drought periods (Armah et al. 2011; GSS, 2013b). Consequently, the dominant vegetation (grasslands) suffers annual bushfires that deplete the biomass

and exposes the soils to erosion and loss of soil nutrients (Yahaya and Amoah, 2013). Additionally, biodiversity and ecosystems services that hitherto ensured that man lived in harmony with nature are being lost at an alarming rate.

In this context, several intervention measures by the Government of Ghana with support from its development partners have been and are still being implemented in the area of food security and environmental sustainability throughout the country. Notable examples relate to afforestation projects; the introduction of high yielding, drought or flood tolerant crops especially maize, rice and soya beans) as well as fertilizer subsidy programmes aimed primarily at supplementing the soil nutrient deficit for many of the hybrid crop/seed varieties. These interceding strategies have often been initiated by the Ministry of Food and Agriculture (MOFA), the Environmental Protection Agency (EPA) and its related agencies as well as several Non-Governmental Organisations (NGOs). However, the high incidence of poverty in these regions (highest in the country, (GSS, 2013a) often renders the adoptability and sustainability of modern agriculture technologies ineffective. One such technology that been successfully implemented in many South America countries and has been transferred to Ghana over the years is Conservation Agriculture (CA). CA is widely acknowledged as a resource-saving agricultural crop production technique; a more sustainable and economic alternative to the conventional approach to crop production (Knowler & Bradshaw., 2007). The FAO defines Conservation Agriculture as a system of crop production based on the three principles of minimum soil disturbance, continuous soil cover and crop rotation. The objectives of conservation farming are to increase crop production, at the same time protecting and enhancing land resources on which production depends. It integrates ecological principles with modern agricultural technologies (FAO, 2008). In recent years, conservation agriculture has become more institutionalised[1] and is being promoted in developing countries as a way of stimulating the sustainability of agriculture sector especially, amongst rural farmers. In the midst of agricultural land degradation and its accompanying constraints, especially in developing countries, conservation agriculture (CA) is believed to provide a window of hope for improving global food security (Friedrich et al., 2009).

1.1 Conservation Agriculture in Ghana: Old Wine in New Bottle?

In spite of the work of international organizations including the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Agriculture Research for Development (CIRAD) and FAO towards ensuring the active involvement of African farmers in CA, some researchers still doubt its practicability and potential, especially amongst poor small holder farmers (Kassam et al. 2009). Reference is made to the fact that the three agronomic principles behind institutional conservation agriculture means that its practice and adoptability amongst smallholder farmers in Africa is virtually impossible (Erenstein, 2003). Gowing and Palmer (2008) buttresses these arguments on the grounds that CA will typically require farmers to use herbicides, weedicides and other forms of inorganic fertilizers if the full benefits are to be achieved and in most cases smallholder farmers do not have the economic wherewithal to acquire these. This brings into question the adoptability of scientifically backed CA practices amongst traditional farmers who in most conditions are poor and illiterate (Benneh, 2011).

In Ghana, institutionalized conservation agriculture (ICA) is known to have spread rapidly over the last two decades with support from international agencies, such as German Development Cooperation (GIZ), Sasakawa Global 2000 amongst others. From a handful of farmers growing a single crop in 1996, 350,000 farmers in 2002 were reported to be growing diverse crops from legumes, roots, vegetables and trees (FAO, 2008) using the CA approach. Recent efforts involve the introduction of *Mucuna pruriens* (velvet beans) as land conservation strategies in selected farming communities in Ghana by the Ministry for Food and Agriculture with support from other stakeholder institutions. Jasaw et al. (2014) assessment of farmers' adoption of *Mucuna pruriens* in selected communities in the Wa West and Nadowli Districts of Upper West Region reveals a high farmer's satisfaction and desire to adopt new technology provided adequate information through extension services is available to such farmers.

Notwithstanding the often positive appraisal of the principles behind conservation agriculture, a critical review of the system reveals that most indigenous farming communities across the world have practiced conservation agriculture for many millennia. This makes the CA as is being institutionalised not new. Prior to the introduction of farm implements like ploughs, farmers engaged in crop rotation and fallowing of land while using the hand-held hoe for land preparation, which are all key principles of CA. In this regard, conservation agriculture as is being currently packaged cannot be said to be a totally new approach to sustainable and economically efficient crop production. It is along this line of analysis that this study examine existing traditional

[1] *Under formal institutional support, in this case donor agencies from foreign countries in alliance with the Ministry for Food and Agriculture, Environmental Protection Agency and others.*

farming techniques in rural households of semi-arid Ghana. As an example. "*proka"* slash and mulch system which is widely practiced amongst many farming communities in Ghana has been practiced for hundreds of years. The *proka* system, widely practiced in agroforestry and annual cropping is noted to conserve biodiversity whiles enhancing soil fertility (Quansah et al., 2004). In that sense conservation agriculture is nothing new can be referred to as 'old wine in new bottle'. Traditional farming techniques, however, face a number of challenges in recent years. Notable is the negative perceptions that formal stakeholders have, regarding traditional local knowledge systems and practices and their refusal to understand the reasons behind them needs.

This study singles out traditional crop farming practices (Traditional Conservation Agriculture-TCA) being undertaken by rural farmers in two Districts (Wa West and Tolon) in semi-arid Northern Ghana for evaluation. Using socio-demographic factors as driving forces behind change, the study tested how continual users of practical indigenous conservation agricultural technologies such as intercropping, mulching and non-tillage of lands, faired against farmers who no longer place emphasis on traditional farming techniques. The field survey focused on smallholder farmers in two communities; Bankpama in the Wa West District of the Upper West Region and Kpalgun in the Tolon District of Northern Region. In this comparative study, the paper argues that TCA should be seen as an integral part of existing agricultural practices of rural farming communities in Northern Ghana. Further analysis was carried out to find out the underlying reasons behind the continuous use of TCA in the he study villages.

2.0 Research Location and Methods

2.1 Location

The study was undertaken in two districts; Wa West in the Upper West Region and Tolon in Northern Region of Ghana. In Ghana, districts represents the second-level administrative subdivision below the level of region. Wa West is located between latitude 9°W and 32°W and longitude 40°N and 45°N whiles Tolon is located between 10°N and 20°N and longitude 10°W and 50°W. Within each district, a village was purposely selected as case study site (Bankpama in Wa West and Kpalgun in Tolon). Figure 1 is a map of northern Ghana providing a visual illustration of the location of the study districts. The reason behind the selection of these sites (districts and villages) is due to their common socio-economic livelihoods and agroecosystem features. The study areas are also part of the adopted sites for the ongoing research on climate and ecosystem changes in northern Ghana titled "*Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach* (CECAR Africa)".

Tolon and Wa West Districts are within the guinea savannah ecological zones. Geologically, the areas are underlain by precambrian, granitic and metamorphic rocks with comparatively less exposure to weathering but very ideal for water harvesting with its well-developed fracture systems (Dickson & Benneh, 1988). Two distinct seasons; wet and dry regulate livelihood conditions and activities in the area. The area experiences a unimodal rainfall regime lasting for a maximum of four months. Annual rainfall in the area varies from 800mm to 1100mm. Mean annual temperatures range between 24°C-26° C. Vegetation is composed of grass with scattered drought resistant trees. As with most grasslands, the dominant trees here include Shea (*Vitellaria paradoxa*), dawadawa (*Parkia biglobosa*), Kapok (*Ceiba pentandra*) and Baobab (*Adansonia dipitata*). The Black and White Volta and their ephemerals are the main rivers draining the Wa West and Tolon districts respectively.

Figure 1: Map of Northern Ghana showing the study districts (marked in yellow)

Deforestation due mainly to human activities, such as bush burning, poor farming practices, overgrazing by livestock and charcoal production is rife in both study districts. Mixed agriculture involving crop production and animal rearing is the dominant livelihood activities in the area with almost 70% of inhabitants engaged in it (GSS, 2013). Crop rotation, small scale irrigation, ploughing and soil fertilisation are common agronomical practices amongst farmers. Table 1 shows some of the features of the agriculture system in the study areas. Figure 1 provides a visual illustration of the location of the study districts in Northern Ghana.

Table 1: Characteristic of farming systems in the study areas

Agriculture Characteristics	Study Area (District and village))	
	Wa West (Bankpama)	Tolon (Kpalgun)
Main crops cultivated	Yam, groundnut, okra, cowpea, maize, sorghum, millet, rice	Maize, millet, groundnut, pepper tobacco, rice, millet, tomatoes,
Average area of compound farms(ha per household)	2.2	1.8
Bush farms(hectare per household)	2.7	2.8
Lowland/Rice valleys (hectare per HH)	0.45	0.32

2.2 Methods: Data Collection Approach and Analysis

The study employed primary and secondary data. Field survey for primary data was undertaken between August and September, 2013 (traditional period of harvesting of early crops for farmers). Secondary data was sourced mainly from published and unpublished sources. Unpublished sources included interviews with regional directorates of the Ministry of Food and Agriculture (MOFA), the EPA and the Agriculture Extension Officers in the study sites. Primary data was collected via face to face administration of questionnaires, key informant interviews, focus group discussions and participant observations. An in-depth survey of farmers in the selected villages in the two districts was initially conducted to understand key socio-demographic and economic dynamics at household level. The initial informal surveys enabled us compose a working questionnaire for detailed survey at the farm level. The surveys involved a comparison between two equal-sized sub-groups of farmers based on the differences in farming practices.

Drawing on a multi-stage sampling approach, the study sampled a total of 80 farmers from two study villages; Bankpama and Kpalgun in the Wa West and Tolon districts respectively. Thus, in each study village, the two categories of identified of farmers; (i) those known to be dominantly practicing in traditional conservation agriculture (TCA) related practices and (ii) those who no longer employ traditional conservation agriculture (TCA) related technologies in their farms, were purposively selected and interviewed. Each group was composed of 20 respondents. The identification of the different categories of farmers was undertaken after a detail and exhaustive observation and discussions with the support of agriculture extension officers and lead farmers who also served as key informants throughout the research process. Face-to-face Interviews with farmers were conducted at their farm sites, thus allowing the research to have a first-hand observation of the nature of the farms and the CA practices. Additionally, two sets of focus group discussions composed of both sub-groups were conducted in each study village. The discussions sought to elicit farmer perception and experience of traditional CA practices, reasons for continual practice of traditional farming techniques, challenges being faced. The data collected were coded and computed into Microsoft Excel and Statistical Product and Service Solutions (SPSS) as nominal or ordinal data. The results were presented using descriptive statistics including cross tabulations tables, frequencies and bar charts.

3. Results and Discussion

Results for further discussion included the socio-economic characteristic of farmers and the linkages with the practice of traditional farming, gender roles in traditional farming and factors driving the continuous practice and non-practice of TCA as well as the practical challenges influencing the sustainability of traditional agriculture.

3.1 Linkages between Farmer's Socio-demographic Characteristics and the Practice of Traditional Conservation Agriculture

Table 2 shows the results of linkages between practices of TCA and socio-demographic characteristics of farmers. Generally, women were the majority in those still practising traditional farming techniques whiles men formed the majority of farmers not utilising traditional farming techniques. In the Wa West (Bankpama), women accounted for 55 % (11) of the total respondents with men making up the remaining 45% (9). In Tolon (Kpalgun), women represented 60% (14) and men being 40% (6). The study also tested for a possible relationship between age and the practice of TCA. The results show a positive correlation in both study villages. In Bankpama, results showed that the majority of farmers still practicing TCA fell in the 51-60 (20%) and >60 (40%) categories. Farmers no longer practicing TCA in Bankpama were dominated by people in the categories 21-30 (25%), 31-40 (15%) and 41-50 (30%). A similar result emerged for farmers in Kpalgun with a majority of TCA practitioners being in the 51-60 (20%) and >60 (30%) range. In terms of the general age of respondents, the ages were evenly distributed amongst the five categories (Table 2). A critical assessment of the results however, reveals a linear relationship between the ages of respondents as older farmers are still practising TCA as compared to relatively younger farmers. This, in many ways is concomitant with a study by Mazvimavi and Twomlow (2009) whose study found a positive correlation between age and farmer's adoption of conservation agriculture from selected Districts in Zimbabwe. Even with institutional CA technology in Ghana such as Mucuna pruriens adoption, Jasaw et al. (2014) found a positive correlation between age and adoption. This study cannot, however, provide empirical evidence to this effect as other reasons, such as income levels, family size could have an influence as well rather than age alone.

The educational status of farmers was also deemed relevant to the adoption of new and modern farming practices in any locality. The level of education was hypothesized not to have any relationship with farmer's continual use of indigenous conservation agriculture. This is in recognition of the fact that the districts fall into the least literate regions of Ghana (GSS, 2013b). Moreover, TCA does not in any way require any technical knowledge to practice. In all, fifty six percent (56%) of farmers in the survey had no form of formal education and this reflected in both categories of farmers who participated in this study. Table 2 provides further details on

the responses. Regarding the role of household size on the adoption and continual practice of TCA, the results showed no correlation between the size of households and the use of TCA farming methods in the Wa West and Tolon districts. In terms of the sizes of households, the results reveal an even distribution amongst all the categories. Household sizes from 1-5 make up ten percent of the total respondents; 6-10 category accounted for 35%, 11-15 (25%) and >15 (30%).

Table 2 Farmers socio-demographic profile and the practice of TCA

Demographic Characteristic	Practice of TCA in study sites				
	Wa West (Bankpama)		Tolon (Kpalgun)		Total (n=80)
	Practising TCA (n=20)	Not Practising TCA(n=20)	Practising TCA(n=20)	Not Practising TCA(n=20)	
Gender					
Male	9 (45%)	15 (75%)	6 (30%)	11 (55%)	41 (51%)
Female	11 (55%)	5 (25%)	14 (60%)	9 (45%)	39 (49%)
Total	20 (100%)	20 (100%)	20 (100%)	20 (100%)	80 (100%)
Age					
20-30	0 (0%)	5 (25%)	1 (5%)	3 (15%)	9 (11%)
31-40	3 (15%)	3 (15%)	4 (20%)	5 (25%)	15 (19%)
41-50	5 (25%)	6 (30%)	5 (25%)	4 (20%)	20 (25%)
51-60	4 (20%)	3 (15%)	4 (20%)	8 (40%)	19 (24%)
>60	8 (40%)	3 (15%)	6 (30%)	0 (0%)	17 (21%)
Total	20 (100%)	20 (100%)	20 (100%)	20 (100%)	80 (100%)
Education					
No Education	10 (50%)	13 (65%)	12 (60%)	10 (50%)	45 (56%)
Primary	3 (15%)	2 (10%)	4 (20%)	5 (25%)	14 (18%)
JHS	5 (25%)	5 (25%)	2 (10%)	3 (15%)	15 (19%)
SHS	2 (10%)	0 (0%)	2 (10%)	2 (10%)	6 (8%)
Total	20 (100%)	20 (100%)	20 (100%)	20 (100%)	80 (100%)
Household size					
1-5	3 (15%)	3 (15%)	2 (10%)	0 (0%)	8 (10%)
6-10	9 (45%)	6 (30%)	6 (30%)	7 (35%)	28 (35%)
11-15	4 (20%)	5 (25%)	8 (40%)	3 (15%)	20 (25%)
>15	6 (30%)	4 (20%)	4 (20%)	10 (50%)	24 (30%)
Total	20 (100%)	20 (100%)	20 (100%)	20 (100%)	80 (100%)
Annual Household Income (GHS)*					
100-500	12 (60%)	9 (45%)	8 (40%)	10 (50%)	39 (49%)
600-1000	6 (30%)	7 (35%)	5 (25%)	4 (20%)	22 (28%)
1100-1500	1 (5%)	2 (10%)	5 (25%)	6 (30%)	14 (18%)
>1600	1 (5%)	2 (10%)	2 (10%)	0 (0%)	5 (6%)
Total	20 (100%)	20 (100%)	20(100%)	20 (100%)	80 (100%)

Using income as a driver of adoption of new technology, the study aggregated annual household income as earnings from all activities (agriculture and non-agriculture, being undertaken by farmers), including migrant remittances. Data for income distribution among the four categories of farmers (Table 2) indicate that the majority of the study population were poor, thus falling in the GHS 100-500 category of mean annual income, which at current (August, 2013) Dollar-Ghana Cedis exchange rate (GHS 1=UDS 0.43812) is far below the average annual income for rural households in Ghana in the Ghana Living Standards Survey (GLSS) 5 in 2008 (GHC1 cedis= USD 0.98) (GSS, 2008). At the district level, the same trend emerged for both categories of farmers in this survey. In Wa West 60% (practicing TCA) and 45% (not practicing TCA) of farmers were in the GHS 100-500 category whiles Tolon, recorded 40% (practicing TCA) and 50% (not practicing TCA) in the GHS 100-500 category. Only 6% of the total respondents had annual income higher than GHS 1600 at October, 2013. The study did not find any relationship between the level of income and the practice of traditional conservation agriculture, although it was assumed that farmers with relatively higher income could hire labour, engage in mechanized farming and are less likely to continually practice TCA.

3.2 Gendered Roles in Practice of Traditional Conservation Agriculture

As with many other communities in Ghana, gender roles in crop production and management practices (manual weeding, planting, threshing, soil conservation, application of fertilizer and weedicides, storage and marketing of farm produce) in the study districts are clearly defined but some are complementary. An interesting

result that calls for further inquiry is the dominant role of women in traditional conservation agriculture in the study localities (Table 2). There are probably two interlinked explanations for this trend. One possible explanation for this could be due to the fact that most women farmers are still engaged in handheld or manual farming which involves using hoes, cutlasses and other basic implements to prepare and weed their farms. Relatedly, women, compared to men have also been identified to be economically weaker and hence have no direct access to animal or motorised traction and tilling of land if their farms are self-owned. The defined role of women in this area could also be a contributing factor to the practice or otherwise of TCA (Odame et al., 2002). Secondly, a linkage could be established between the size of farms cultivated by farmers engaged in TCA and those not engaged in TCA. In the study districts, men household heads tend to be offered larger parcels of land than women and have the economic power to cultivate larger areas. It is assumed that men have more responsibility than women. Women can only have access to land that is offered to her by the husband or chief and this tends to be small in size as it is perceived that women do not have the ability to cultivate large land areas. During farm visits, it was detected that women TCA practitioners had smaller farms compared to their men who were not practising TCA.

3.3 Interlinkages between Crop and Livestock Production and the Practice of Traditional Conservation Agriculture

3.3.1 Crop Cultivation

In the study sites, farmers grow diverse crops at different times of the year (wet and dry seasons). However, the main crops cultivated include maize, sorghum, rice, pepper, tomatoes, millet, yam, cowpea, cotton and tobacco (Table 3). All households (100%) in this survey indicated that they cultivate maize. This result does not come as a surprise as maize is known to be the most planted food crop in Ghana. According to MOFA, about 992,000 hectares of land was used for the cultivation of maize in Ghana in 2010 out of the total of 3,396,000 hectares of land utilized for selected food crops (MOFA/SRID, 2010). Groundnuts are the next most cultivated crop in both districts. In Wa West, 70% of farmers practicing indigenous conservation agriculture cultivate maize, with another three-quarters (75%) of those not employing TCA cultivating it. In Tolon, 100% of farmers employing TCA cultivate groundnuts during farming season with 95% of non TCA farmers also cultivating groundnuts.

Table 3: Crops cultivated in the two study districts

Main crops grown	Wa West (Bankpama)		Tolon (Kpalgun)		Total (n=80)
	Practicing TCA (n=20)	Not Practicing TCA (n=20)	Practicing TCA (n=20)	Not Practicing TCA (n=20)	
Maize	20 (100%)	20 (100%)	20 (95%)	20 (90%)	80 (100%)
Sorghum	5 (25%)	7 (35%)	3 (15%)	4 (20%)	19 (24%)
Rice	3 (15%)	4 (20%)	15 (75%)	17 (85%)	39 (49%)
Pepper	4 (20%)	6 (30%)	4 (20%)	6 (30%)	20 (25%)
Cotton	3 (15%)	4 (20%)	8 (40%)	9 (45%)	24 (30%)
Millet	5 (25%)	3 (15%)	6 (30%)	5 (25%)	19 (24%)
Groundnut	14 (70%)	15 (75%)	20 (100%)	19 (95%)	68 (85%)
Yam	9 (45%)	11 (55%)	16 (80%)	13 (65%)	49 (61%)
Tomatoes	8 (40%)	5 (25%)	4 (20%)	8 (40%)	25 (31%)
Tobacco	0 (0%)	1 (5%)	5 (25%)	7 (35%)	13 (16%)
Cowpea	3 (15%)	1 (5%)	4 (20%)	3 (15%)	11 (14%)

Groundnuts and maize are grown for household consumption and cash in both sites. Groundnut and cowpea were cited as important crops as it is known to enrich soil nutrients as well as serving as cover to protect soils from erosion. Amongst all the crops under cultivation, millet is known to be the least susceptible to climate-based fluctuations in seasonal yields with sorghum and maize following closely. Rice and cotton have much wider variation in productivity yearly. Growing of vegetables in gardens close to compounds and irrigated plots in the dry season has emerged as an important livelihood diversification strategy for many farmers, especially during the long drought periods. In all this, what remains paramount is the contribution of these food and cash crops to household food security. Figure 2 are photographs showing typical traditional farms in the study sites.

Figure 2. A typical traditional farm showing different crops and farm management techniques

3.3.2 Animal Rearing (Livestock and Poultry)

Livestocks and poultry are integral component of the farming practices of farmers in the Tolon and Wa West Districts. To farmers, animals are a source of wealth as well as input to land preparation and crop cultivation. Dung from cattle and other livestock are important organic fertilizer for, especially traditional farmers. In the study villages, household food security is largely dependent on livestock rather than crops.

Table 4: Main animals reared by farmers in the study villages

Livestocks reared	Wa West (Bankpama)		Tolon (Kpalgun)		Total (n=80)
	Practising TCA (n=20)	Not Practising TCA (n=20)	Practising TCA (n=20)	Not Practising TCA (n=20)	
Cattle	9 (45%)	11 (55%)	4 (20%)	5 (25%)	29(36%)
Goat	14 (70%)	15 (75%)	12 (60%)	10 (50%)	51(64%)
Guinea fowl	18 (90%)	20 (100%)	15 (75%)	11 (55%)	64(80%)
Chickens	12 (60%)	15 (75%)	20 (100%)	16 (80%)	63(79%)
Pigs	5 (25%)	8 (40%)	9 (45%)	7 (35%)	29(36%)
Donkeys	2 (10%)	4 (20%)	1 (5%)	4 (20%)	11(14%)
None	2 (10%)	3 (15%)	5 (25%)	5 (25%)	15(19%)

From this survey, the majority of the farmers in this study own goat (64%), guinea fowl (80%) and chicken (79%). At the district level, farmers in Bankpama village who had stopped practicing TCA reported a highest

percentage (100%) for guinea fowl ownership as compared to those in Tolon with 55%. Guinea fowl is an important poultry animal in the area, serving households and income generating needs. There is moderate level of ownership of cattle, pigs, cattle and donkey in both Districts and categories of farmers in this survey (Table 4). Goats, sheep, cattle, chicken, guinea fowl, and pigs are the main animals raised (Dietz et al. 2004, Hesselberg & Yaro 2006).

3.4. General Factors Influencing the Practice and Non-Practice of Traditional Conservation Agriculture (TCA)

The reasons why farmers were prefer TCA were investigated in this study. From the survey, 80% of farmers from Wa West district said they were still practising TCA because they cannot hire tractor to plough their land. In Tolon, 85% cited the same responses for practising TCA. Farmers reiterated that the costs of hiring tractors for tilling and ploughing the land is too much for them to bare thus there would prefer to use their hand-held implements like hoes and cutlasses. Others also said that they do not make enough money to buy jab planters or knapsack sprayers so they continually use the matchet and planting stick. The bar chart (Figure 3) shows the responses in the two study districts.

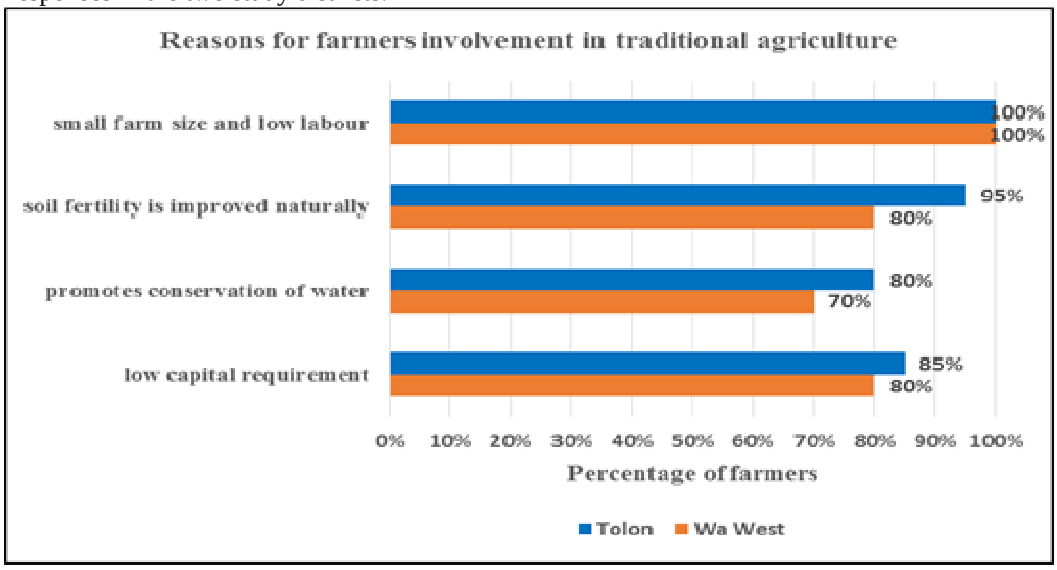

Fig 3. Farmers reason for practising TCA

Another reason mentioned by farmers from both study sites is water conservation. Farmers explained that practising traditional farming techniques means that they allow crop residues and mulch to be left on the farm plots after harvesting and this goes a long way in allowing the soil surface to be protected from torrential rainfall, which results in splash erosion. This inevitably reduces surface water evaporation as the residue acts as a shield for the soil against sunlight. In Wa West district, 70% of farmers mentioned this with, 80% from Tolon citing the same reason. A reason for the higher response in Tolon could be due to their severe experience of drought conditions compared to Wa West. Farmers further explain that the various practices under TCA leads to improved soil fertility on their farms. Eighty percent (80%) and 95% of farmers in Wa West and Tolon respectively mentioned this reason and went further to explain that residues and other mulch materials left on the farmlands including dung from cattle and other livestock are important soil enrichers after they decompose. They also stated that the planting of nitrogenous crops, such as cowpea and groundnuts are essential for improving soil quality. Additionally, all the farmers stated that their farm sizes were rather small and do not require a lot of inorganic fertiliser which is now common amongst farmers. As such, they prefer to keep applying traditional practices, which according to them require less labour. One farmer in Kpalgun stated:

"I know that practising traditional farming techniques is the best because it has been tried and tested by my fore fathers. Why should I adopt a modern practice which adds unwanted chemicals to the soil all in the name of herbicides? The best way to kill weeds in my opinion is to apply the traditional methods" (Ahmed, 65 years old, Kpalgun).

Farmers stated that there is inadequate labour to work on farms as most of the youthful population have moved to the city centres in search of jobs. With regards to the second group of farmers who had stopped applying traditional conservation practices, a number of reasons were cited for their decision (Figure 4). Low

yield from TCA as a result of poor soils was a major influencing factor for their movement away from traditional to modern or mechanised farming practices. In the Wa West and Tolon districts, 80% and 85% of farmers respectively indicated that they were no more motivated to use traditional practices as it tended to produce lower yields compared to farmers who had been using more 'modern' farming equipment and soil enrichment products like NPK and herbicides/weedicides like "condemn" (glyphosate)[1]. Respondents in both study districts mentioned intensive labour requirement as another reason. Seventy percent (70%) and ninety percent (90%) of farmers in Wa West and Tolon respectively stated this as a major reason. Some respondents also stated that labour availability is limited as the youth have migrated to urban centres in search of jobs. A good number of farmers also stated that they were disinterested in traditional farming practices as a result of the external support they are receiving from the Farming Services Centre scheme- an initiative by the government of Ghana that provides them access to tractor to plough their farmland on credit. To those farmers, this allows them to cultivate large areas of land during the farming season. One farmer during the focus group discussion re-emphasized openly;

> *"In the past, I could only cultivate a small piece of land for maize and millet but thanks to these tractor services, I cultivate and harvest over 60 bags of maize"* (Aakura Sokang, 58 years)

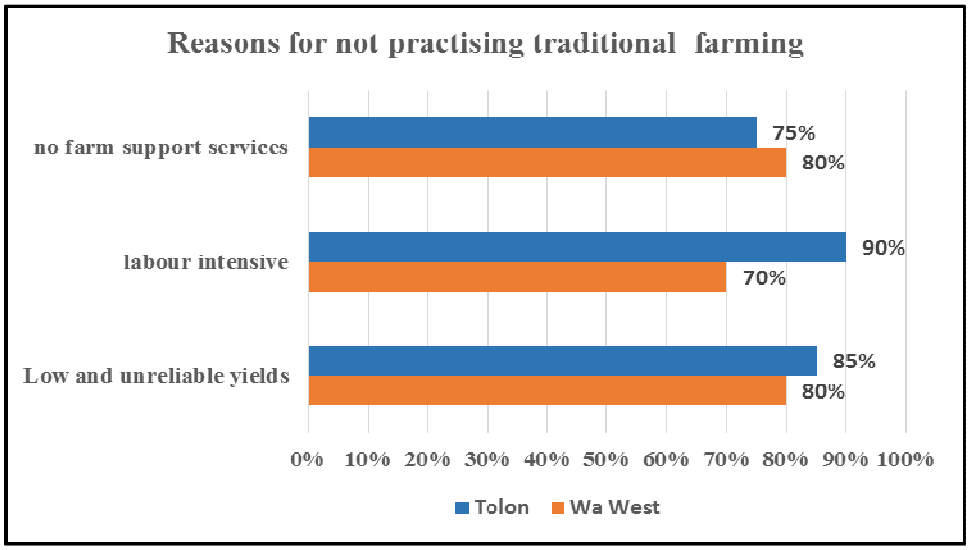

Fig 4. Farmer's reasons for not practicing TCA

3.5 Challenges to the Practice and Sustainability of Traditional Conservation Agriculture

Through the survey, farmers mentioned a number of factors constraining the practice of traditional conservation agriculture. The first is perennial floods and droughts often induced by climate change in recent decades. These were pre-eminently mentioned during the focus group discussions and interviews. To most farmers, the unpredictable climatic conditions are the biggest risk to the continual sustainability of traditional agriculture practices. This was cited in all the conversations by both categories of farmers and because traditional farming relies mainly on rain, its practice is under threat. Extensive drought is blamed for the drying up of earth dams in the dry season whiles torrential rains often destroys crops and households. A second factor constraining TCA that was revealed during this survey is land scarcity and conversion. Increasing population in the area means that land is constantly under use thus reducing the fallow period, an important feature of traditional farming. Relatedly, the emerging trend of selling large tracts of land to investors (foreign and local) for agriculture plantations, especially for the growth of biofuel crops like jatropha is a grave concern to local people as it inevitably competes with local food crop production.

The results confirm similar studies in Northern Ghana about such large scale land acquisition and its implications on food security and rural livelihoods (Schoneveld et al. 2010; Boamah, 2011). Lastly, the lack of external support to farmers still practising traditional farming techniques was also cited as a challenge. It became clear that in the attempt to modernise agriculture by the government of Ghana through its various support services, attention has been shifted from the traditional practices that have been the basis for food production for ages. Farmers complained that they are being encouraged to use tractors and chemicals on their farms but in their opinion, the sustainability of these modern farming techniques cannot be guaranteed in comparison with their traditional practices which is time tested.

[1] A local term used to signify its efficacy and high potency in killing weeds.

4. 0 Conclusions and Recommendation

This study revealed that traditional practices related to agriculture are still key ingredients of the current farming systems of communities in semi-arid Ghana. This is the case, despite the various attempts by governments over the years to transform agriculture in Ghana by employing modern agriculture practices and tools to improve agricultural yields and supply raw materials to agro-based industries. What this means is that the traditional and cultural elements of agriculture remain relevant. The practice of traditional conservation agriculture is influenced by key socio-economic factors including age, gender, size of farm plots and income levels of households. These factors were found to have a significant relationship with farmers practice or otherwise of traditional farming techniques. As with many other rural agro-based communities, increasing threat from human-induced climate change events manifesting in the form of unpredictable rainfall, extreme temperatures, droughts and flooding pose the biggest challenge to its sustainability and practice. Again, neglect of the traditional agriculture sector by policy makers and agencies at the international and local level is a noted challenge.

It is clear that the traditional farmer's techniques and practices have evolved over generations, and gone through rational methods of observations and experimentations within a specific cultural and ecological setting with proven results for sustainability. In this regard, the technical knowledge of traditional farmers should serve as the foundations for modern innovations in conservation agriculture. A study of the traditional farming systems to examine the inherent effects in order to find solutions that integrates traditional and modern strategies is highly recommended.

Acknowledgements

We are grateful to the *Enhancing Resilience to Climate and Ecosystem Changes in Semi-Arid Africa: An Integrated Approach* (CECAR Africa) Project for providing us the opportunity to undertake this study. We are equally thankful to JICA and JST for funding. We also want to express our appreciation to farmers from the two study districts (Tolon and Wa West), MOFA and EPA for their collaboration. Thanks also go to research assistants (field staff) from University for Development Studies (Nyankpala and Wa campuses).

References

Armah, F.A., Odoi, J.O., Yengoh, G.T., Obiri S., Yawson, D.O., & Afrifa, E.K.A. (2011). Food Security and Climate Change in Drought-sensitive Savannah Zones of Ghana. *Mitigation and Adaptation Strategies for Global Change*, 16(3), 291-306.

Benneh, G. (2011). *Technology Should Meet Tradition: Studies on Traditional Land Tenure and Smallholder Farming Systems in Ghana*. Accra: Ghana Universities Press.

Boamah, F. (2011). The Relationship between Land Grabbing for biofuels and Food Security, a Bane or Boon? The Food Security Implications of Jatropha Biodiesel Project in Northern Ghana. Paper Presented at the International Conference on Global Land Grabbing, 6-8 April 2011. Land Deals Politics, Initiative (LDPI), Future Agricultures Consortium, Institute of Development Studies, University of Sussex.

Boakye-Acheampong S, Osei, Mensah J, Aidoo R., & Osei-Agyemang K. (2012). The Role of Rural Women in the Attainment of Household Food Security in Ghana: A Case study of Women-Farmers in Ejura-Sekyeredumasi District. *International Journal of Pure Applied Science and Technology*. 12 (1), 29-38.

Dickson K.B. & Benneh G. (1988). *A New Geography of Ghana*. Longman, London.

Dietz, T.; Millar, D.; Dittoh, S.; Obeng, F.; Ofori-Sarpong, E. 2004. Climate and Livelihood change in North East Ghana. In: Dietz, A.J.; Ruben, R.; Verhagen, A.; eds. Environment and Policy Series Volume 39: The impact of climate change on drylands, with a focus on West Africa. Dordrecht/Boston/London: Kluwer Academic Publishers: 149-172

Erenstein, O. (2003). Smallholder Conservation Farming in the Tropics and Sub-Tropics: A Guide to Development and Dissemination of Mulching with Crop Residues and Cover Crops. *Agriculture, Ecosystem and Environment.* 100, 17-37.

FAO [Food and Agriculture Organisation] (2008). Investing in Sustainable Agricultural Intensification. The Role of Conservation Agriculture. A Framework for Action. Food and Agricultural Organization of the UN: Rome.

Friedrich, T. Kassam, A.H., & Shaxson, T.F. (2009). Conservation agriculture. In: Agriculture for Developing Countries. Science and Technology Options Assessment (STOA) Project. Karlshruhe, Germany.

GSS (Ghana Statistical Service), (2013a). 2010 PHC Demographic, Social, Economic and Housing Characteristics. GSS. Accra, Ghana.

GSS (Ghana Statistical Service), (2013b). "2010 Population and Housing Census: Regional Analytical Reports-Upper West Region. Ghana Statistical Service. Accra, Ghana.

GOG (Government of Ghana) (2013). The 2013 Budget Statement and Economic Policy. Ministry of Finance and Economic Planning, Accra. [Online]. Available: http://www.mofep.gov.gh/sites/default/files/budget/2013_Budget_Statement.pdf (December 8, 2013)

Gowing, J.W., & Palmer, M. (2008). Sustainable Agricultural Development in Sub-Saharan Africa: The Case for a Paradigm Shift in Land Husbandry. *Soil Use Manage*, 24, 92–99.

Hesselberg, J.; Yaro, J.A. 2006. An Assessment of the Extent and Causes of Food Insecurity in Northern Ghana Using a Livelihood Vulnerability Framework. *GeoJournal*. 67: 41-55

IPCC.(2007). Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA [Online]: Available http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf (November 20, 2013)

Jasaw G.S., Boafo Y.A & Lolig V. (2014) Factors Influencing the Adoption of Mucuna Pruriens as a Land Conservation Strategy, Evidence from Northern Ghana, *Journal of Science, Technology and Environment;* 4, (1). 1-11

Kassam, A. Friedrich, T, Shaxson, F., & Pretty, J. (2009). The Spread of Conservation Agriculture: Justification, Sustainability and Uptake. *International Journal of Agriculture Sustainability. 7-292-320.*

Knowler, D. & Bradshaw, B. (2007). Farmers' Adoption of Conservation Agriculture: A Review and Synthesis of Recent Research. *Food Policy*, 32, 25-48.

Mazvimavi, K. & Twomlow, S. (2009). Socio-economic and Institutional Factors Influencing Adoption of Conservation Farming by Vulnerable Households in Zimbabwe. *Agricultural Systems*, 101, 20-29.

MOFA [Ministry of Food and Agriculture] (2010). Agriculture in Ghana: Facts and Figures (2010). Accra: Statistics, Research and Information Directorate (SRID).

Okai, M. (1997).Agricultural Production, Food Security and West Africa. In Asenso-Okyere, W. K., Benneh, G. & Tims, W (eds.) *Sustainable Food Security in West Africa*., Boston, Massachusetts, Kluwer Academic Publishers.

Odame, H.H, Hafkin N, Wesseler G., & Boto I. (2002). Gender and Agriculture in the Information Society. International Service for National Agricultural Research Briefing, Paper No.55. The Hague, The Netherlands: ISNAR

Quansah, C. & Oduro, W. (2004). The Proka Mulching and No-Burn System: a Case study of Tano-Odumasi and Jachie, In Gyasi, E. A., Kranjac-Berisavljevic, G., Blay, E. T. and Oduro, W. (Eds): Managing Agrodiversity the Traditional Way: Lessons from West Africa in Sustainable Use of Biodiversity and Related Natural Resources. United Nations University Press, Tokyo, pp. 119–134

Schoneveld G.C., German, L.A. & Nutakor, E. (2010). Towards Sustainable Biofuel Development: Assessing the local impacts of large-scale foreign land acquisitions in Ghana. Paper presented at the World Bank Land Governance Conference, 26-27 April 2010.

UNEP (1995). United Nations Convention to Combat Desertification. Geneva: United Nations Environment Programme.

Yahaya A. & Amoah S.A. (2013). Bushfires in the Nandom District of the Upper West Region of Ghana: Perpetual Threat to Food Crop Production. *Journal of the Environment and Earth Sciences*, Vol. 3. No.7

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

Recent conferences: http://www.iiste.org/conference/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar