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WHICH IS MORE PRODUCTIVE, PLOUGHING OR RIPPING?

USAID's ADVANCE II Project Report: JUNE 2018

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USAID's ADVANCE PROJECT REPORT

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Executuve Summary

Introduction

This report on "Which is more productive, ploughing or ripping" has been produced as one of the six 2017 Knowledge Management and Learning (KM&L) studies of the Agriculture Development and Value Chain Enhancement Project II (ADVANCE II). This study's orientation aligns with the Project's commitment to ensuring efficiency, which has been operationally defined by the Project as delivering interventions and using resources in a cost-effective manner. The farmers in the northern regions of Ghana till their land with the hoe, animal traction or with a tractor ploughing (conventional ploughing) (Houssou *et al.*, 2013). These methods of land preparation are laborious, costly and time consuming. The proposal to use climate smart approaches, specifically ripping, has received minimal attention among farmers, hence the Project's commitment to introducing it to Ghanaian farmers. Following a demonstration of the ripping method, the Project has contracted the Directorate of Research, Innovation and Consultancy of the University of Cape Coast (DRIC-UCC) to undertake a study on its productivity relative to conventional ploughing.

Objectives

In line with the broader objectives of the evaluation, the study focused on addressing the following objectives:

1. Assess farmers' accessibility of climate smart approaches in farming as compared to conventional ploughing systems.
2. Examine differences, if any, in yield and gross margins results from farmers who employed conventional ploughing method and ripping in land preparation during the 2016 production season.
3. Determine the stature of vegetative cover, soil mass and agroforestry in environs where ploughing and ripping were done.
4. Identify current community practices to intensify improved agricultural systems for effective climate mitigation and adaptation.
5. Undertake the economic analysis of different treatments of seeds and fertilizers on ploughed and ripped fields using 2015 and 2016 demo data.

Methodology

The study applied mixed (quantitative and qualitative) methods that involved collection and use of primary and secondary data to respond to the key research questions. The data collection methods included face-to-face interview and focus group discussion with Outgrower businesses (OBs) and outgrowers (OGs). The total number of OBs interviewed in this study was 11. A focus group discussion was also done with a group of six (6) males and one (1) female.

Key Findings

The key findings are summarized around the five research questions as detailed below:

1. The study revealed that application of the ripping technology has not been widely adopted by the OBs mainly because was the technology was first introduced in 2015. So Far the ripping has been done through the demonstration farms and model farms. Feedback from respondents showed that, only few OBs have received rippers from ADVANCE. Only four (4) out of the 11 representing about 34 percent of OBs interviewed were providing ripping services to OGs. On the other hand, conventional ploughing is widely practiced by all the OGs and so all the eleven OBs (100%). Thus, conventional ploughing is widely practiced in the region and so all the OBs have tractors and ploughs that enable them to provide ploughing services to their OGs.

2. Although ripping had been practiced only since 2015 in demonstration farms and models farms, majority of the OBs and OGs who participated in these farms reported that yield obtained from fields prepared through ripping were significantly higher than yield from lands prepared by conventional ploughing. We did the gross margin analysis using the 2016 Demonstration Data from ADVANCE.
3. The study showed that ripping method did not significantly disturb vegetative cover or soil in environs. Majority of the OGs and the OBs explained that ripping conserves soil water and soil mass because the rippers do not turn soil on the entire field but only turned the soil at places where seeds are to be sown. The respondents also indicated that the rippers only turn the soil at the places where the seeds are sown, while conventional tillage turns the soil on the entire field. Thus, ripping causes very little erosion, but ploughing leads to accelerated erosion. Moreover, they explained that during conventional ploughing the roots of most plants are cut through leading to either uprooting of the trees or their eventual death.
4. In terms of the current community practices to intensify improved agricultural systems for effective climate mitigation and adaptation, the study found that villages closer to the model farms and demonstration farms were mobilizing OGs into groups so as to take advantage of the ripping services. These include OGs who did not participate in the demonstration or model farms. Further, the OGs in communities where ripping has been practiced have agreed to increase fertilizer application rates using the additional savings they make from the additional yield from ripping to further increase their yields. Moreover, the OBs on whose fields the demonstration farms and model farms were established have agreed to provide ripping services to more OGs. Here a strong collaboration between ADVANCE and agro-based organizations such as AVNASH who provided seeds to the OBs; Agricare and Premium Foods who supplied fertilizers and seeds to the OBs. This collaboration is likely to further enhance production in farms where ripping has been done.
5. The study could not establish the comparative profitability between yields from fields prepared with ripping and those prepared with ploughing through gross margins analysis because it was found that ripping was introduced through minimum tillage demonstration plots in 2015 and further through model farms in 2017 and so application has been restricted to demonstration and model farms. Indeed, some of the OBs targeted to establish model farms had not received any rippers at the time they were interviewed.

Challenges and Lessons Learnt

The most important challenges documented in the course of the study were the non-suitability of the inadequate numbers of rippers and the non-suitability of the available rippers for rice production. Conversely, the stakeholders demonstrated high optimism about the effectiveness of ripping in enhancing crop production, particularly, for maize production. One important lesson that was learnt was that economic trees such as sheanut and *dawadawa* trees were considered very important trees, particularly, to the women and chiefs in the northern region. Therefore, where they are randomly located on the field in large numbers, ripping becomes difficult. Ripping has to be done in a straight line so that only the soil at the area where seeds are to be planted is turned compared to conventional ploughing in which soil on the entire field is turned. Thus, during conventional ploughing, the tractor can meander through tree impediments, which is difficult to do with rippers.

Recommendations

Based on the challenges and lessons learned, the following recommendations have been advanced:

1. ADVANCE should facilitate the acquisition of more rippers by the OBs and especially rippers that are suitable for rice production should be available to enable them provide ripping services to more OGs.

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ACRONYM LIST

ADVANCE II	Agricultural Development and Value Chain Enhancement Project II
DRIC	Directorate of Research, Innovation and Consultancy
FA	Framework Analysis
FGDs	Focus Group Discussions
GDP	Gross Domestic Product
IDIs	In-Depth Interviews
KII	Key Informant Interview
KM&L	Knowledge Management and Learning
MT/Ha	Metric Tonnes per Hectare
OBs	Outgrower Businesses
OGs	Outgrowers
SOW	Scope of Work
UCC	University of Cape Coast
USAID	United States Agency for International Development

1.0 Background

Agriculture is an important sector of the Ghanaian economy. In addition to providing much of the country's food needs, the crops, livestock, and fish that are produced contribute close to GH¢20 billion to the Ghanaian economy each year representing 22 percent of total Gross Domestic Product (GDP) (Ghana Statistical Service, 2014). Agriculture accounts for about 20 percent of Ghana's GDP and employs more than half of the workforce, mainly small landholders (Ghana Economy Profile, 2017).

Growing crops is highly dependent on specific climate conditions. Trying to understand the overall effect of climate change on our food supply can be difficult. Increases in carbon dioxide (CO_2) and subsequent temperature rises may be beneficial for some crops in some places. But to realize these benefits, soil nutrient levels, moisture availability must not be limiting. Changes in the frequency and severity of droughts and floods could pose challenges for farmers. Overall, climate change could make it more difficult to grow crops in the same ways and same places as we have done in the past.

The Ministry of Environment Science, Technology and Innovation (2013) predicts potential impacts of climate change in agriculture in Ghana to include reduced yields leading to more poverty and food insecurity (including the possibility of famine). It further predicts loss of national revenue from cash crops such as cocoa and severe impacts on land use, leading to loss of biodiversity and soil fertility. Land degradation and increased deforestation are expected to contribute to loss of ecosystem services. Based on a 20-year baseline climate observation, it is forecasted that maize and other cereal crop yields will reduce by seven percent by 2050 under business as usual scenario (Agyemang-Bonsu *et al.*, 2008).

Modern agriculture, food production and distribution are major contributors of greenhouse gas. Agriculture is directly responsible for 14 percent of total GHG emissions, and broader rural land use decisions have an even larger impact. Deforestation currently accounts for an additional 18 percent of emissions. Large scale changes such as deforestation and machine-intensive farming methods all contribute to increased carbon concentrations in the atmosphere. Soil erosion by water, wind and tillage affects both agriculture and the natural environment. Soil loss and its associated impacts on crop production, is one of the most important environmental problems of today.

Climate change impacts significantly on agricultural production. The adverse impacts of climate change can be exacerbated by soil tillage practices such as conventional tillage. Conventional tillage, which involves the use of the disc plough to till the land, often causes soil degradation through accelerated soil erosion, deforestation and rapid decline in soil fertility, resulting in low crop yields. Most farmers in the Northern Region of Ghana use the conventional tillage method to prepare their lands before planting their seed. Climate Smart Approaches such as ripping are, therefore, needed to deal with soil degradation that adversely affects agricultural productivity.

On the other hand, agriculture can contribute to mitigating climate change depending on how it is done. A recent research showed that switching from conventional to conservation tillage not only improves soil structure, but also reduces CO_2 emissions and contributes to increase in soil organic carbon (Rodale Institute, 2014). The dependence of conservation tillage systems on cover cropping for weed suppression, coupled with the benefits of organic management in general, have been shown to increase soil organic carbon content by nine percent after two years and 21 percent six years after conversion to organic no-till. No-till systems can best reverse the trend of soil organic carbon losses in agriculture when they are complemented by cover-cropping and appropriate crop rotations (Rodale Institute, 2014).

2.0 Purpose and Expected Use of the Survey

The purpose of this study is to juxtapose the effectiveness of conventional ploughing practices and the introduction of climate smart agricultural methodologies such as ripping in improving smallholder agricultural systems as a key response to both adapting to and mitigating climate change, while at the same time achieving food security and improving household income.

3.0 Objectives of the Survey

The study attempted to address the objectives:

1. Assess farmers' access to rippers.
2. Examine differences, if any, in yield and gross margins results from farmers who employed conventional ploughing method and ripping in land preparation during the 2016 production season.
3. Determine the stature of vegetative cover, soil mass and agroforestry in environs where ploughing and ripping were done.
4. Identify current community practices to intensify improved agricultural systems for effective climate mitigation and adaptation.
5. Undertake the economic analysis of different treatments of seeds and fertilizers on ploughed and ripped fields using 2015 and 2016 demo data.

4.0 Survey Methodology and Data Collection Techniques

4.1 Research Design

The ACDI/VOCA-ADVANCE recommended the use of mixed methods that entailed use of quantitative and qualitative approaches in the conduct of the review. The study therefore adopted a constructive response evaluation technique as the methodological framework to guide the Knowledge Management and Learning (KM&L). The technique assesses program interventions from the basis of policymaker's (in this context ACDI/VOCA-ADVANCE) goals and the engagement of stakeholders [in this context, outgrower businesses (OBs) and outgrowers (OGs)] about the relevance and effectiveness of the intervention and their practice (*see Abma, 2005*) towards theory of change. In this case, the profitability of ripping compared to ploughing. The technique also prescribes the triangulation of data to ensure validity. For this KM&L, the various reports, including annual and quarterly progress reports, the qualitative and quantitative data collected were used for validation purposes.

The study also entailed the use of both primary and secondary data to gather relevant information. The information obtained from the respondents enabled the project to learn whether the ripping approach introduced to the OBs involved was comparatively more profitable or not to the conventional ploughing method, which is the usual practice adopted by the farmers. The quantitative approach also helped to secure numerical evidence that enabled the study to answer to specific questions such as the number of OBs that have adopted the practice; how many of the outgrower farmers have benefitted from technology transfer.

4.2 Population, Sample Size and Sampling Procedure

Based on the operational strategy of the Client (USAIDADVANCE) intervention, two categories of respondents i.e. OBs and OGs were identified for interview. Activities of both categories of respondents

were considered very critical to the study as indicated in the Scope of Work (SOW) provided by the Client. Therefore, during the fieldwork, prominence was given to both categories of stakeholders.

Prior to undertaking the fieldwork, the DRIC Team considered all the five research questions outlined in the SOW regarding study 5 (which one is more profitable, ripping or ploughing?) all of which had been extensively considered in the design of the instruments for data collection. Three instruments were used in this study to elicit responses from OBs, OGs, and key informants, respectively. In accordance with the terms of the SOW, the DRIC team agreed on a mixed (quantitative and qualitative) approach in order to elicit information to establish the comparative profitability of the ripping ad ploughing.

Regarding the number of respondents, the client had initially proposed a total of 100 respondents comprising 5 OBs who have provided ploughing services to 10 OGs each and five (5) OBs who have provided ripping services to 10 OGs each. The Client proposed that the DRIC team used 2015 and 2016 demo data for the study. Again, the SOW indicated that opinion leaders such as chiefs at the communities where ripping and ploughing had been practiced since 2016 be visited and interviewed. However, data obtained from the client showed that due to the fact that rippers could not be delivered to the OBs in time, only a few OBs had actually practiced the ripping system since 2016. Furthermore, the study showed that prior to the introduction of the project, none of the OGs had actually practiced ripping on their farms as their own initiative. Ripping activities done so far had been in the form of demonstration and model farms.

The OGs were selected based on the information provided by the ACDI/VOCA headquarters and subsequently confirmed with the Tamale office. The DRIC Team conducted Key Informant Interviews (KIIs) with the 11 OGs whose names and locations were provided by the client. All the OBs also had their own farms therefore, the DRIC team interviewed them both as OBs in terms of the ripping and ploughing services they provide other OGs and as OGs in terms of the comparative impacts of ripping and ploughing on their own production. The team also provided the characteristics of the OBs interviewed. The characteristics were location, number of years in farming, gender, source of rippers (if any), other support and type of support received from the project. Based on the information from the Tamale office, OGs who had experienced the demonstration and model farms were identified. The team therefore, conducted one focus group discussion involving seven (7) OGs who had taken part in the model farm.

4.3 Survey Instruments

The DRIC Team engaged the ACDI/VOCA Team in a face-to-face discussion to have a clearer understanding of the operationalization and performance of the Project. Outcomes of the discussion contributed greatly to design and revising the research instruments as well as strategizing data collection approach. The instruments used in this study included the In-Depth Interview (IDI) guides and the focus group discussion (FGD) guide (*See Annex 4 to 6*). The IDI guides were developed to collect data from the Project beneficiaries such as OGs and OBs. The FGD guides were developed for OGs who had participated in the model farm. Besides, IDI guides were developed for two (2) key informants.

4.4 Recruitment and Training of Members of Evaluation Team

Training was organized for the Research Assistants on Monday, 23rd October 2017 at the International Conference Centre of the University for Development Studies in Tamale, Ghana, to enable them familiarize themselves with the Project and the contents of the research instruments. The training was handled by five (5) Resource Persons led by Prof. Annim of DRIC-UCC. The Research Assistants were taken through the various research tools [Structured Instruments, FGD Guides, IDI Guides and KII Guides] for the data collection as well as ethics and good practices for data collection. Discussion and translation of the questions were interspersed with role-play exercises.

4.5 Data Collection

The fieldwork was undertaken over a four-day period by the DRIC Team of two men and one female. Two main activities constituted the fieldwork stage. The study targeted OBs and OGs in the maize, rice and soy industry. The first was desk review of documents, including progress reports that were made available by ACDI/VOCA-ADVANCE. The purpose was to conduct content analysis to identify specific quantitative information to facilitate triangulation of results. The second activity was the conduct of IDIs, FGDs and observations. The KII, IDI and FGD for data collection started on 2nd November 2017 and ended on 4th November 2017. At each community, the Team worked with a Technical person from ACDI/VOCA-ADVANCE who had supervised the ripping activities (Demonstration or model farm).

The IDIs provided detailed information from the perspectives of individual stakeholders that were adequate to explain contextual issues as well as the quantitative information gathered. Overall, the DRIC team visited 11 communities across six (6) districts within the northern region of Ghana. Eleven IDIs were conducted for OBs and two IDIs for two key informants. The team also organized one focus group discussion with seven (7) OGs comprising six (6) males and one (1) female who had participated in a ripping demonstration plot activities. The rationale for conducting the FGDs was for the participants to provide experiences, views and information that relate to their groups or those involved in similar activities under the Project. Further, the team also visited one model farm to make observations at the farm sites of one OB.

4.6 Data Analyses

The framework analysis (FA) (often called thematic analysis) was adopted to analyze the results of the intervention so far, as contained in the ACDI/VOCA reports and the quantitative and qualitative data collected from the field. The reason the FA was used is that it provides systematic and visible stages to the analysis process so that policymakers, funders, implementers and others can be clear about the stages by which the results have been obtained from the data. It also allows the inclusion of emergent concepts (Lacey & Luff, 2007).

Five main stages were followed to analyze the data manually. These are:

1. Stage One - Familiarization of the data. Qualitative data collected from the field were transcribed and the transcripts, as well as the progress reports from ACDI/VOCA were read thoroughly. Guided by the research instruments and the five research questions, the thoughts and concepts in the data were identified;
2. Stage Two - the thoughts and concepts and ideas were organized according to their commonalities and differences;
3. Stage Three - The thoughts were coded at this stage;
4. Stage Four - This stage was mapping and interpreting the patterns, associations, linkages and variations; and
5. Stage Five - The data and information was triangulated, the ideas were displayed and the interpretations of the data and results were tested.

4.7 Ethical Issues

The consultant considered two primary issues that characterize the operations of the ACDI/VOCA-ADVANCE intervention and requirements for the study. These issues are confidentiality of information transmitted across the stakeholders during the implementation of the Project and the philosophy underlying the knowledge generation process to assess the progress of the KM&L. Confidentiality is critical to the implementation of the ACDI/VOCA-ADVANCE II. This is because OBs are ethically prohibited from

divulging financial transactions, assistance received from the project and information of their clients (OGs) to a third party unless express approval has been sought from the clients concerned.

To ensure that confidentiality is adhered to, the consultant signed a Conflict of Interest Form. Moreover, all the documents and data related to the KM&L were made available only to the team leader. The consultancy was carried out by five (5) core investigators for the data collection plus five researchers who provided support in the data collection process. Also, all the respondents were given an Informed Consent Form to read (and to the non-literate stakeholders it was explained to them) to assure them of confidentiality and anonymity.

5.0 Main Findings

The key findings are presented in accordance with the 5 research questions posed in the SOW as follows**:**

The study revealed that ripping technology is not readily available (*See Annex 3*). Not many OBs have invested in ripping technology mainly because ripping is a new approach (first introduced through minimum tillage demonstration plots in 2015 and further through model farms in 2017) and has not been widely adopted by the OGs. Feedback from respondents showed that, only the few OBs who participated in the model farms and demonstration farms have received rippers from ADVANCE. Only four (4) out of the 11 representing about 34 percent of OBs interviewed in the study had started providing ripping services to OGs (Annex 2). On the other hand, conventional ploughing is widely practiced by all the OGs and so all the eleven OBs (100%) were providing ploughing services and have tractors and ploughs that enable them to provide ploughing services to their OGs. Most of the stakeholders interviewed agreed that ripping was more effective as a land preparation method than ploughing. In this regard, they requested that the project help expand access to rippers since only few OBs had obtained rippers at the time of the study. Besides, they proposed that the rippers should be adjusted to make them applicable for land preparation on rice fields. Further, the respondents admitted that they still use ploughing as land preparation method for rice production as most of them still plant rice through the broadcasting method. Although most of the respondents agreed that ripping was more cost effective than ploughing in terms of time spent and the amount of fuel used, many of them continue to use ploughing to prepare their lands because of the presence of a number of trees on their fields. This makes ripping difficult coupled with the fact that rippers are not readily accessible.

Although ripping had been practiced only since 2016 in demonstration farms and model farms, the study showed that that yield obtained from fields prepared through ripping were significantly higher than yield obtained from lands prepared by conventional ploughing. For example, data from the field assessment showed that the average output of ripped land is 19.6 bags compared to 10 bags for ploughed land (see Annex 2). However, since ripping had been done only as demonstration farms and model farms, the differences in yield could not be established with gross margins results from farmers who employed conventional ploughing method and ripping in land preparation during the 2016 production season.

Feedback from OGs who participated in the model farms and demonstration plot revealed that, the application of ripping led to reduced cost of land preparation, increased output and enhanced incomes. Again, the yield obtained from fields prepared by ripping was higher than under ploughing. The respondents also revealed that the ACDI/VOCA-ADVANCE project has been timely and responsive to their needs, facilitating acquisition of fertilizers and seeds and technical knowhow. The respondents indicated that the timeliness of the ripping process and increased access to seeds and fertilizers by the OBs and OGs is likely to further increase crop yields. All the OBs who had practiced ripping confirmed that ripping was a more

effective land preparation method than ploughing because the former facilitates row planting, which leads into increased plant population and hence plant yields. Ripping also makes fertilizer application easier and also results in minimal fertilizer loss through erosion compared to ploughing.

According to the findings of the study, ripping improved soil and water conservation and minimized erosion compared to ploughing. Some of the assertions that the respondents made as a confirmation of this conclusion are as follows:

> *Ripping is more beneficial than ploughing because ripping does not disturb the soil much and hence does not promote soil erosion.*
>
> *The plant population on ripped field is higher than on ploughed fields because ripping makes row planting very easy.*
>
> *Again, ripping does not cause soil compaction but on ploughed fields it is sometimes very difficult to use the dibbler due to the hardness of the land*

The majority of the respondents stated that soil tillage with ripping did not cause excessive disturbance to soil and vegetation as ripping was done only at places where seeds are supposed to be planted. On the contrary, ploughing often result in accelerated erosion and devastation of vegetation as the soil on the entire field is turned during conventional ploughing. A respondent remarked that *the rippers don't cut as many plant roots as ploughing does.* However, the respondents indicated that ripping is more problematic on fields which have large numbers of economic trees like sheanut and dawadawa trees. This is because the ripper has to move in straight lines unlike the plough which can be manipulated to circumvent the trees.

In terms of the current community practices to intensify improved agricultural systems for effective climate mitigation and adaptation, the study found that villages closer to the model farms and demonstration farms were mobilizing OGs into groups so as to take advantage of the ripping services. Majority of the OBs and OGs (above 90 %) indicated that based on the increased yields they have witnessed in the demonstration farms and model farms, they are willing to increase their acreages under ripping. They also expressed the desire to promote the use of ripping by offering ripping services to more OGs. Indeed, the OBs also agreed that ripping was more profitable therefore, they were ready to switch their land preparations from ploughing to ripping. The challenge that is foreseen is the fact that the demand for ripping services is likely to exceed the availability of rippers to satisfy the increased demand.

There was agreement among the stakeholders interviewed that the ripping tools and processes deployed through the project are likely to be sustained after the end of the project. The project implementation architecture has ensured that the needed tools and inputs, including tractors, rippers, seeds and fertilizers are mainstreamed into the institutional arrangements of the implementing agency. This approach has ensured timely and synchronized land preparation and input supply to meet the start of the planting season. Therefore, yield losses have been greatly reduced.

Furthermore, all the OBs expressed the willingness to provide ripping services to more OGs apart from those already receiving services from them. The number of OGs currently receiving ripping services from their OBs range from 16 to 600 as indicated in Annex 2. The OGs also indicated that they are ready to become advocates for extending the 'good news' about the profitability and usefulness of ripping as a land preparation technology to other farmers who have not had any experience with the rippers. They, however, indicated that they wish to have the ripping done on their own farms instead of the model farms and demonstration plots.

Again, in order that more OGs will adopt ripping, all the OBs interviewed are willing to offer ripping services to their OGs on credit so that they could use the money saved to purchase seeds and additional fertilizer. The study showed that ripping was done only on few OBs field as demonstration plots or model farms in 2016. Therefore, economic analysis of different treatments of seeds and fertilizer on ploughed and ripped fields has been done using 2016 Demonstration Data from ADVANCE. Indeed, many of the OBs selected to establish model farms either received their rippers very late or had not received the rippers at all.

51. Effects of Ripping vs. Ploughing

This section depicts effects of ripping relative to ploughing on maize yield and value of sales using the 2016 Demonstration Data and the 2016 Gross Margin Survey. The demonstration farms of ADVANCE adopted the ripping approach to soil tillage, whereas the smallholder farmers prepared their farming lands through the conventional ploughing technique. In line with the SOW from ADVANCE, the section focuses only on the northern region of Ghana, albeit overall comparison was done in the context of the value of sales.

5.2 Effect of Ripping Compared to Ploughing on Yield in the Northern Region

Figure 2 shows average yield [Metric Tonnes (MT) per Hectare (Ha)] of maize from the smallholder farmers where ploughing was used in land tillage, and the demonstration farms of ADVANCE where ripping was adopted. The average yield from the demonstration farms was three-fold greater than that of the farms of the smallholder farmers in the Tamale metropolitan and Tolon district, but in the West Mamprusi district, maize yield from the farmers' field was higher than from the demonstration farm..

Figure 2 also shows these differences across districts in the Northern Region. The highest difference in yield between demonstration farms of ADVANCE and the smallholder farmers was recorded in the Tamale Metropolitan Area of 6.55 MT/Ha, followed by Tolon district (5.36 MT/Ha). However, in the case of the West Mamprusi district, the yield from the demonstration farms was less than that of the smallholder farmers by 1.05 MT/Ha.

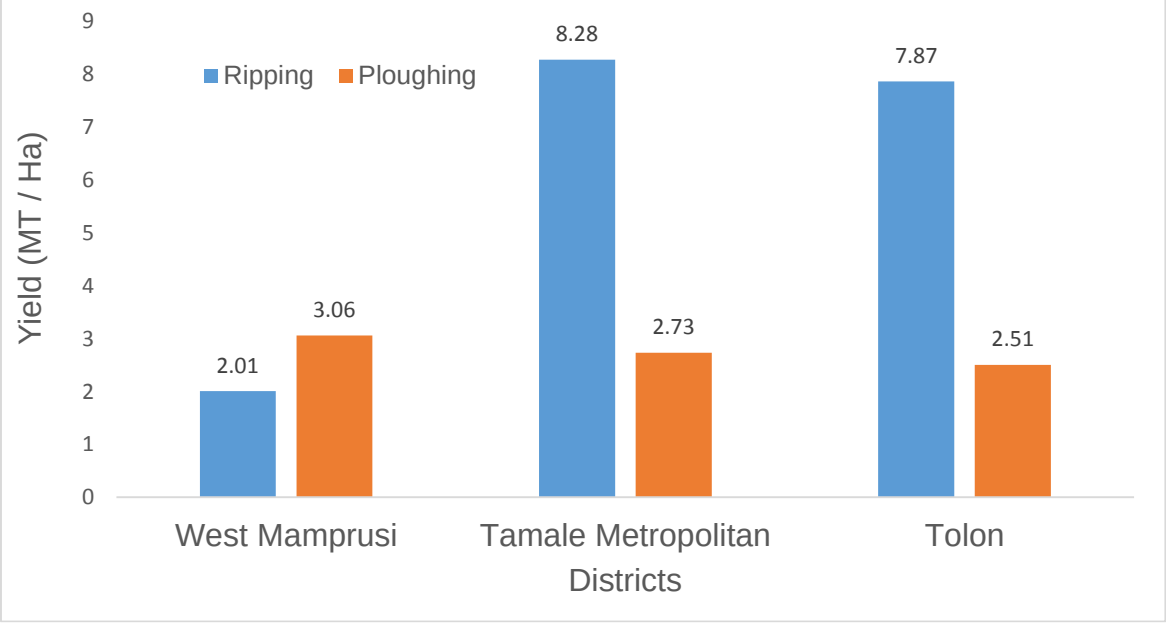

Figure 1 Effect of ripping compared to ploughing on maize yield (MT/ Ha)

Source: 2016 Demonstration Data

5.3 Effect of Ripping Compared to Ploughing on Value of Sales

The value of sales was calculated from the 2016 Demonstration Data as the product of total volume and unit price. The average value of sales, unlike the yield per hectare, is across all the zones of influence. Whereas the "farmer value of sales" are taken from the 2016 Gross Margin Survey, the "Demo Value of Sales" are taken from the 2016 Demonstration Data. The latter used the ripping technique, whereas the former used the convention ploughing technique in tilling the land. From Figure 3, the average sales of farmers exceed that of the demonstration farms by GH¢899.00.

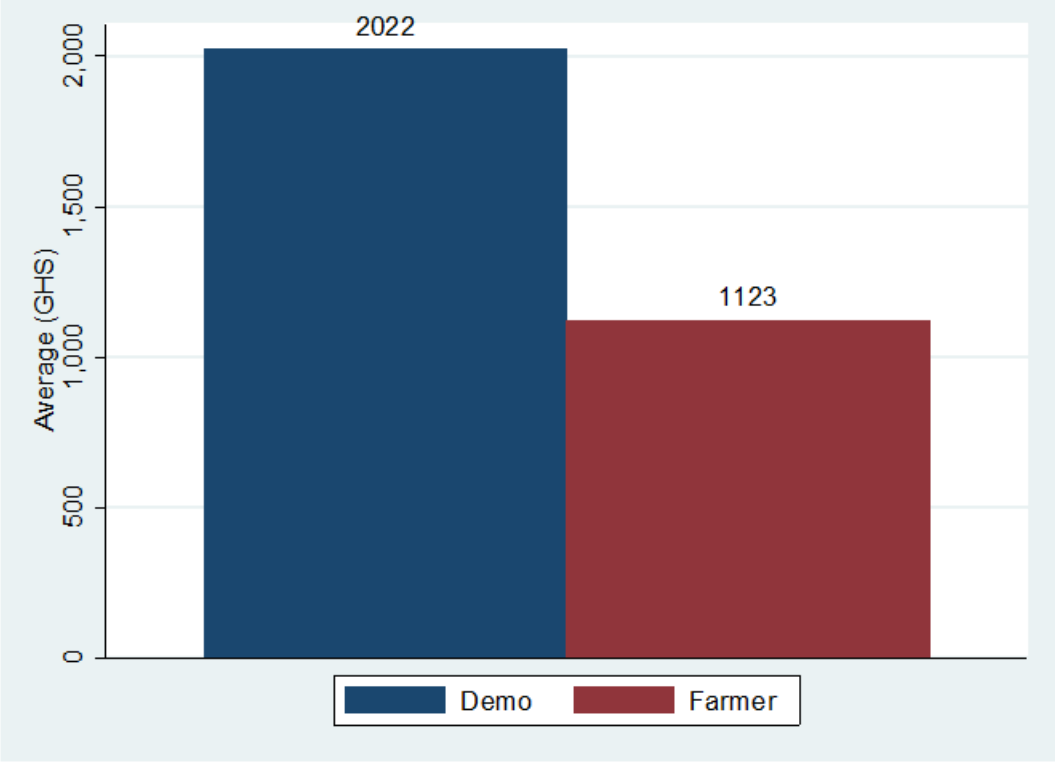

Figure 2: The effect of ripping compared to ploughing on Value of Sales
Source: 2016 Demonstration Data and 2016 Gross Margin Survey

6.0 Key Observations

- The study revealed that the value of sales from demonstration farms where ripping was done was greater than from the farmers' field where ploughing was used for land Preparation. Owing to this results, most of the OBs were willing to promote the practice to their OGs
- The study also showed that OGs who had participated in the model farms and demonstration farms were willing to switch from ploughing to ripping

7.0 Conclusion

Based on the main finding made during the study, we conclude that, compared to ploughing, ripping, as a climate smart option, is suitable for the Northern Region of Ghana, particularly for maize production in terms of value of sale, timeliness of operation and yield.

8.0 Recommendations

On the basis of the findings made during the study, the following recommendations have been advanced: ADVANCE should facilitate the acquisition of more rippers by the OBs and especially rippers that are suitable for rice production should be available to enable them provide ripping services to more OGs.

10.0 Annexes

Annex 1: Districts Visited, Types of Research Instruments Used and Number of Respondents interviewed

Districts	Number of communities	Type of research instrument	Number of respondents
Gushegu	1	IDI	1
Karaga	1	IDI	1
Nanumba-North	4	IDI	4
Tamale Metropolitan Assembly	3	IDI/FGD	3/1
Tolon	1	IDI	1
West-Mamprusi	1	IDI	1
TOTAL	**11**		

Annex 2: Summary Response Obtained from the Field Study

Name	Year of first Ploughing	Year of first Ripping	Duration of Ploughing (Per acre) minutes	Duration of Ripping (Per acre) minutes	Cost of Ploughing (Per acre) in GHC	Cost of Ripping (per acre) in GHC	No. of Outgrowers supported with Ploughing services	Number of Outgrowers supported with Ripping services	Output from Ploughing (Bags)	Output from Ripping (Bags)
Abubakari Tindani	1992	2015	0		60.00	60.00	600	0		
Abdul Karim Iddrisu	1997	2016	0				150	16	12	18
Issahaku Mohammed	2008	2017	0				250	0		
Yakubu Sulley	2004	2016	60	45	60.00	50.00	100	70	17	20
Mohammed Tia Yakubu	2008	2017	0		60.00		350	0		
Ibrahim Alabani	1985	2016	0				360	0		
Iddrisu Tia	2009	2016	0		60.00		375	0		
Ibrahim Abdul-Latif	2000	2012	0		70.00	40.00	150	600	7	21
Khalid Abubakari Giwah	2012	2017	45	30	70.00		500	0	4	
Alhassan Yusif	2009	2017	60	45	60.00	80. 00	450	55		

Subrilla Iddrisu	2010	2016	0		18.00	12.00	500	0		

Annex 3: Background Information regarding the Maize, Rice and Soy Businesses Involved in the Study

Years of operation
Average years in rice cultivation = 12.52 years
Average years in maize cultivation =12.08 years
Average years in soy cultivation = 12.44
Soy
A total of 8 out of the 12 respondents were engaged in soy farming
Highest education of respondents =Tertiary
3 respondents have no formal education
3 respondents have SHS education
Longest number of years in soya cultivation 17 years
Lowest number of years in soya cultivation
Most of the farmers (5) had worked between 5-10 years
Maize
11 people engaged in maize cultivation
Highest education =tertiary (3 people)
3 have no education
2 have primary education
3 have SHS education
Average age = 43.73
Highest age = 51 years
Lowest age = 38 years
Highest years in maize cultivation = 32 years
Average years of maize cultivation= 12 years
Range of years maize cultivation= 10-32 years (6)
Rice
10 people engaged in rice cultivation=
Average age of rice farmers= 51
Lowest years in rice cultivation =38 years

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