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Maize Production in Ghana: A Case Study of Asante Akim North Municipality

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MAIZE PRODUCTION IN GHANA: A CASE STUDY OF ASANTE AKIM NORTH MUNICIPALITY

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In spite of the numerous benefits of maize production in Ghana, its production is faced with a lot of challenges leading to production losses. Asante Akim North Municipality is one of the largest maize-producing areas in Ghana. However, studies on maize and its production in this municipality are under-researched, hence the need for this study. The main objective of the study is to analyze a 10-year (2013-2022) production trend of maize in Asante Akim North Municipality to identify factors affecting maize production in the municipality, so as to seek pragmatic measures to help improve maize yields in the municipality and Ghana at large. The mixed methods approach was adopted for the study. Furthermore, the data gathered from 150 informants in the study area through questionnaires, interviews, and secondary data were analysed using descriptive and inferential statistics with the aid of SPSS. One of the key findings of the study reveals that about 79% of the inhabitants are engaged in maize production for a living. The trend of maize production in the municipality is not static. Despite the increasing unpredictability of weather patterns, both the area of land under maize cultivation and the yield of maize are increasing. The drivers of maize production in the study area were found to include, but not limited to, climatic factors such as rainfall variability, disease and pest infestation, land tenure system, and availability of credit. Among these factors, rainfall variability and the land tenure system were found to be the most pressing issues regarding maize production failure in the area. Yield gap analysis for maize production is recommended to be undertaken to determine the major constraints militating against improvement in maize yield in the municipality.

MAIZE PRODUCTION IN GHANA: A CASE STUDY OF ASANTE AKIM NORTH MUNICIPALITY

by

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I. INTRODUCTION

1.1 Background of the study

For millions of people in Ghana, like many countries in Sub-Saharan Africa. Agriculture is the primary source of their livelihood. It provides food and economic needs for rural and urban households. In Ghana, agriculture is predominantly structured on a smallholding basis, characterized by low input and low technology use, high rain dependence, and low adoption of irrigation.

In Ghana, Maize constitutes the principal staple crop. It is the backbone of most Ghanaians' diet due to its vital role in numerous traditional food preparations such as kenkey, tuozafi, porridge, and banku (Morris, 1999). Maize is a cereal crop in the agricultural economy used as part of the human diet, animal feed, and raw materials for industrial production. In West Africa, maize is a cultivated cereal crop, accounting for slightly over 20% of the sub-region's domestic cereal production (IITA, 2000). The maize crop is grown on over 142 million hectares, producing 637 million tons of grain (Wanjala, 2014).

Moreover, maize is Ghana's second leading commodity crop after cocoa (ISSER, 2012). Maize is also the main constituent of poultry and livestock feed. Maize constitutes fifty to sixty percent (50–60%) of the sum of grain per country (ISSER, 2012). The mean yearly Maize cultivation in Ghana between 2007 and 2012 stood at 1.5 million M.T. (million M.T. (MoFA, 2012). Maize is ranked number one in Ghana, occupying about 1 million hectares (Wongnaa et al., 2019).

In Ghana, the cultivation of maize is mainly carried out under rain-fed conditions by smallholder resource-poor farmers (SARI, 1996). There are two main planting seasons: the major, between early March and April, and the late planting season in August. They use simple farm implements like the hoe and cutlass, making their farming methods relatively traditional

(Darfour & Rosentrater, 2016). A limited number of commercial maize farms are presently in Ghana (e.g., Ejura farms). The two critical factors of maize production (area planted and yield) have increased. However, the upward trends have been characterized by high year-to-year variability, typical of rain-fed agriculture. Following the relevance of maize to Ghana's economy, governmental and non-governmental interventions have been established and administered in the last three decades to improve maize grain production. Examples of such policies and programs include but are not limited to fertilizer subsidies, modernization, buffer stock schemes, and increased tariffs on the importation of maize grains (Obour et al., 2022). Also, from 1979 to 1997, from 2008 to 2020, the Ghana Grains Development Project (GGDP) and the Food Crops Development Project (FCDP) encouraged and introduced the cultivation of early maturing, drought-tolerant, and high-yielding maize varieties. In addition to the government's efforts to improve yield (Obour et al., 2022). Non-governmental agencies such as Masara N'Arziki also provided input into credit and extension services.

Despite all these efforts, challenges such as extreme rainfall events and fall armyworm infestations have reduced productivity in recent years. For example, in 2016, a severe El Niño significantly reduced maize crop yield (Owusu et al., 2019). This issue led to spikes and shortages in the prices of maize grains for food and maize-based animal feed (Owusu et al., 2019). Also, between 2020 and 2021, Ghana went through a severe maize grain crisis resulting from the 2020 minor season crop failure (Obour et al., 2022). This led to an increase in the prices of maize grains in the local market. Therefore, food security in households and the entire economy of Ghana was affected.

A pilot study in Asante Akim North Municipality, Ghana's second-largest Maize-producing area (MOFA, 2012), revealed other factors that equally affect maize production in Ghana, which cause differences in maize yields. This thesis is, therefore, geared towards a historical survey of maize production in Ghana, adding to the case study of Asante Akim North

Municipality. The findings from this research will examine all the factors causing differences in maize production in that municipality. After that, holistic measures to curb or minimize the reduction in maize crop yield will be identified and recommended to those whom such measures may concern, including governmental and non-governmental agencies building from Asante Akim to the larger Ghanaian area.

1.2 Research problem

In Ghana and most of Sub-Saharan Africa, maize constitutes the leading staple food for the inhabitants (Owusu et al., 2019). Given this, its production has caught the attention of many scholars across the globe, and Ghana is no exception. For example, Cudjoe, Antwi-Agyei, and Gyampoh (2021) have investigated the effect of climate variability on maize production in the Ejura-Sekyedumase Municipality, Ghana. They established the relationship between climate variables (rainfall and temperature) and maize yield in the study area. Their study showed that rainfall is shorter in duration and less predictable when the temperature increases.

This finding implies that the general relationship between rainfall, temperature, and maize yield is that maize yield increases with increasing rainfall of the right amount and distribution pattern and decreases with increasing temperature. Also, Obour, Arthur, and Owusu (2022) explored the 2020 maize production failure in Ghana, a case study of the Ejura-Sekyedumase Municipality. The study's findings revealed that the decline in maize grain yield was caused by the failure of the minor season rains and, more importantly, the destruction of maize plants by fall armyworms.

Figure 1 : A picture of fall armyworm

Source: https://encrypted-tbn0.gstatic.com/licensed-image?q= Wikipedia

There are few researchers on maize production in Asante Akim North Municipality, the second-largest maize-producing area to Ejura in Ghana (MOFA, 2012). Scholars such as Oppong (2013), Neizer, Frimpong-Anin, and Mintah (2020) have worked on maize production in Asante Akim North Municipality. However, none of their research was tailored to the determinants of the Municipality's maize production. A pilot study by Oppong (2013) in the Municipality revealed other factors in addition to those outlined by authors in the existing literature (e.g., those whose study area was Ejura-Sekyedumase), which caused a decline in maize production in Ghana.

In this light, this research needs to be undertaken to empirically identify all the factors causing a reduction in maize production in recent and past years and mitigate it by resorting to practical measures. In other words, the findings and recommendations deduced from this study

will go a long way to help policymakers and all stakeholders improve decision-making and stabilize the maize crop yield in Ghana.

1.3 Research objectives

The main objective of this thesis is to analyze the structure and trend of maize production in Asante Akim North Municipality. To achieve this objective, the study seeks to address the following specific objectives:

1. To evaluate the importance of maize production to farmers in Asante Akim North municipality.
2. To analyze a 10-year (2013-2022) maize production trend in Asante Akim North Municipality using data from public records.
3. To identify the factors that affect maize production in Asante Akim North Municipality.
4. To identify the factors that motivate farmers into maize production in the Municipality.
5. To identify the percentage of farmers in maize production in Asante Akim North Municipality.

1.4 Research questions

The study attempts to find answers to the following relevant questions:

1. What is the significance of maize production in Asante Akim North Municipality?
2. What has been the trend of maize production from 2013 to 2022 in Asante Akim North Municipality?
3. What factors influence maize production in Asante Akim North Municipality?
4. What motivates farmers to maize production in Asante Akim North Municipality?

5. What percentage of farmers are involved in maize production in Asante Akim North Municipality?

1.5 Significance of the study

This study will provide a more in-depth empirical analysis of the structure and historical trend of maize crop production in the Asante Akim North Municipality. The study revealed the past maize production trend and the determinants of this pattern, which helped the researcher offer relevant recommendations to improve maize production. The study's findings would help policymakers such as the Ministry of Food and Agriculture and the Municipal Assembly understand the maize crop production pattern in the municipality. This would aid policymakers in integrating the findings and the research's recommendations into the agricultural sector's overall development approaches, agenda, and policies. The findings also serve as a document that provides background information on maize crop production. It is expected that the findings of this research will further provide a platform for policy formulation for maize farmers through education aimed at building the capacity of farmers and stakeholders to increase crop yields.

Again, this research helped identify the weaknesses of the existing trend of maize production that need to be corrected to bring about the desired results. Also, the factors that determine maize production in the Asante Akim North Municipality are examined, and appropriate strategies have been suggested to farmers to improve the production of Maize in the Municipality.

Moreover, this research will serve as a secondary source of data and reference to other researchers who want to research in a similar field. Thus, the information provided here will be available to the relevant ministries, development agencies, and researchers.

This research will again speak to and complement a larger body of academic literature such as rural geographies, African geographies, geographies of farming, and climate change.

1.6 Scope of the study

The research is designed to analyze the structure and trend of maize production in Asante Akim North Municipality. It seeks to reveal the past maize production trend and the determinants of this pattern to proffer relevant recommendations to improve Maize production. Geographically, the study is planned to cover the Asante Akim North Municipality. This study area was selected because of its distance and cost advantage to the researcher and his team compared to other maize production areas. Also, food crop production is among the most dominant by smallholder farmers, with maize crops being the most produced in the Municipality (MoFA, 2016). About 72.7% of the total households in this area engage in agriculture, according to the Asante Akim North District Medium Term Development Plan (2014-2017). Moreover, about 98.4% of the households in the Municipality are involved in crop farming (Ghana et al., 2010).

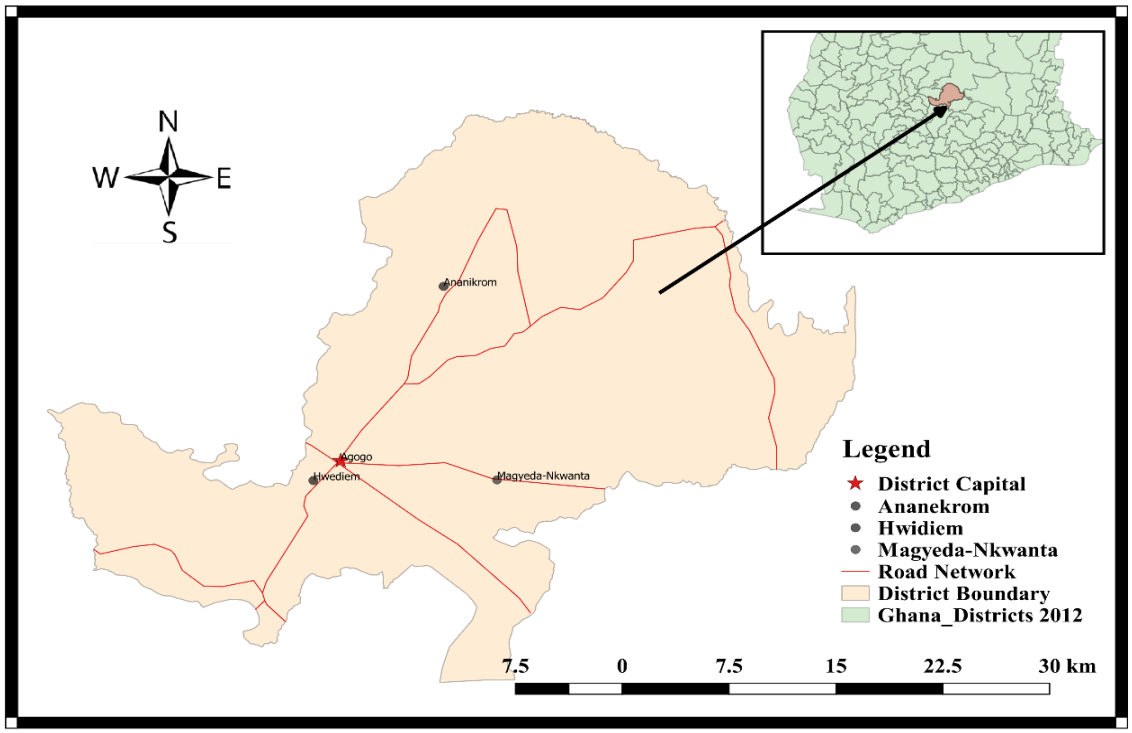
This research covers three farming communities in the Municipality. These are Hwidiem, Magyeda-Nkwanta, and Ananekrom. The choice of the study communities is mainly based on the intensive farming carried out by the farmers during the major and minor seasons and partly by the high production of staple food crops in these communities compared to other communities in the municipality. The research targets only a section of the three communities that generalize the study area population. Due to the interest in the trend in maize production, the research targets household maize farmers in the three farming communities in the Asante Akim North Municipality.

1.7 Profile of the study area: Description of location and size

Asante Akim North District is the geographical area that was earmarked for the study. This is because maize production is the area's primary occupation of agriculture, and there has been a recent development in mechanizing maize production in the municipality.

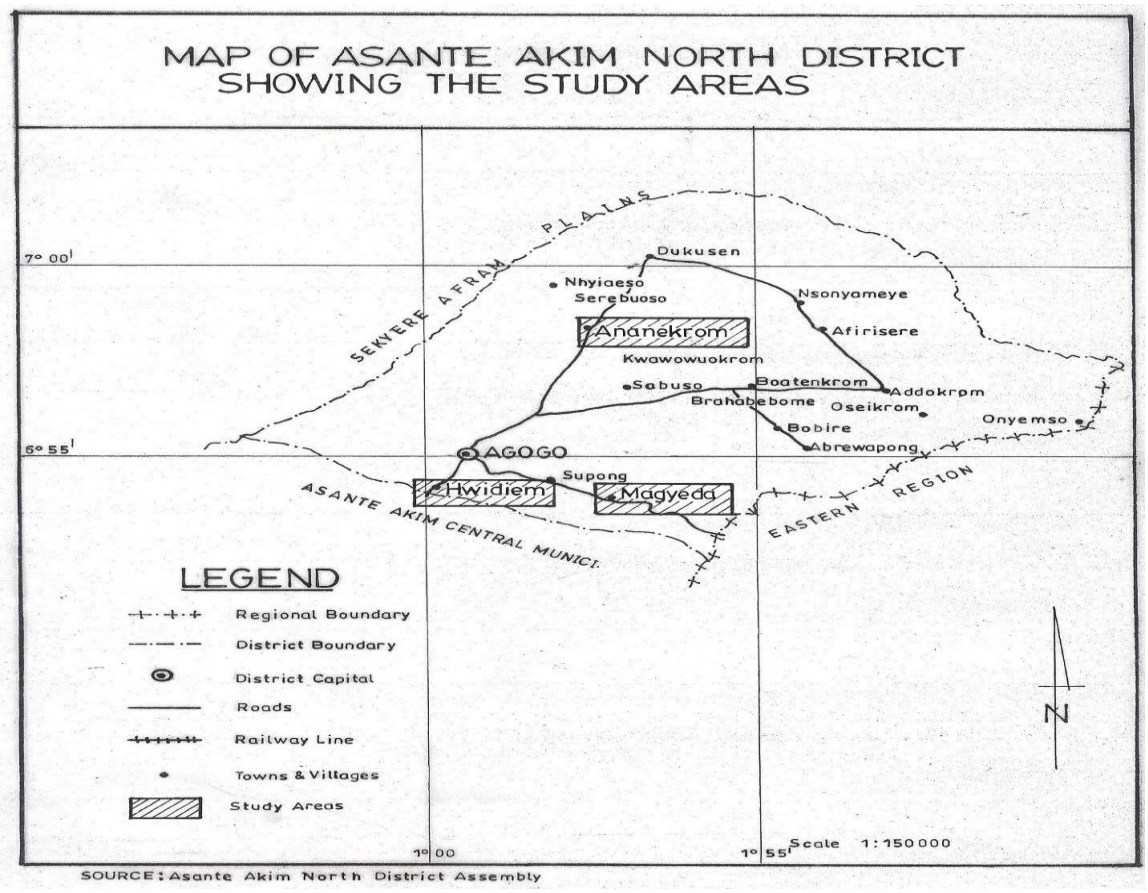
Until 2020, the Asante Akim North Municipal was called the Asante Akim North District. It was carved out of the then-Asante Akim North Municipal (now Asante Akim Central Municipal) in 2012. The municipality has Agogo as its capital, situated in the eastern part of the Ashanti region (AANM, 2023). The Municipality borders Sekyere Kumawu and Sekyere Afram Plains in the north, Kwahu East in the east, Asante Akim South and the Asante Akim Central Municipal in the South, and Sekyere East in the West. It is found in the eastern part of the Ashanti Region and lies between latitudes 6^0 30′ and 7^0 30′ North and longitudes 0^0 15′ and 1^0 20′ West and is approximately 80km east of Kumasi. It covers a land area of 1,125 square kilometers, constituting 4.6 percent of the region's land area (24,389 square kilometers) (AANDA, 2012). The proximity of the Municipality to the Eastern Region provides a ready market for its agricultural produce. Figure 1 of page 8 indicates the map of the Municipality, indicating the study communities in the national context.

Figure 2: Map of the Municipality in the National Context



Source: Researcher, 2023.

Figure 3: Map of the Municipality



1.8 Demographic characteristics

According to the 2010 Population and Housing Census, the total population of the then-Asante Akim North District was 69,186. This represents 1.4 percent of the Ashanti Region's population. The municipality has five communities assuming urban status with a population of 5,000. They are Agogo, Domeabra, Juansa, Hwidiem and Wioso. The Municipality has a population concentration of 61.46 persons per square kilometer. The 2010 Population and Housing Census shows a rural-urban split of 53.5:46.5 for the Municipality. The rural share of the population is 36,990, and the urban share is 32,196.

However, about 53.5 percent of the settlements in the Municipality are rural. The distribution of the population by sex shows that the male population is 48.8%, while the female population is 51.3%. This gives a sex ratio (i.e., number of males to 100 females) 95.1. This

further corroborates the assertion that the female population dominates in the Municipality. The average household size for the Municipality is 4.5. The mean number of rooms per household is 2.0, and the average number of people per room is 2.95 (AANDA, 2012). The household comprises individuals from the nuclear family, extended family, and persons outside the extended family. Heads of the households are mainly males. In the other households where females are heads, they are single or single-parent households. Children constitute about 42.2 percent of the average household.

Agriculture is the dominant occupation in the Municipality, constituting 72.7% of all occupations and employing inhabitants aged fifteen and above. Likewise, in other parts of Ghana, agriculture in the Municipality is still highly dominated by the smallholder farming system, with only 6% of farmers cultivating more than five acreages of land and 72% cultivating below five acres of land. Others engage in trading and vocational services at 16.3% and 15%, respectively (AANDA, 2015).

1.9. Relief and drainage

Topographically, the Municipality is undulating, ranging between 305 and 610 meters above sea level, interrupted by a stretch of the Akwapim-Mampong Ridge. The Akwapim-Mampong.The range serves as a watershed for the numerous rivers and streams in the Municipality. Such rivers as Oweri and Afram drain the Municipality. The existence of rivers has a potential for the building of dams for irrigational purposes. The steep slopes at Kyiriyawa near Hwidiem and Onyem have created waterfalls yet to be developed as tourist sites (AANDA, 2015).

1.9.1 Climate and vegetation

The Municipality experiences a wet semi-equatorial climate. The rainfall system is double maximum, with annual rainfall between 125cm and 175cm in July and November; the

first rainy season commences from May to July, with the second beginning in September to November. The dry harmattan season occurs between December and March and is characterized by drought conditions. Streams and other water bodies dry up during this period. Temperature is found to be evenly high all year round, with an average annual temperature of 26^0C (AANDA, 2015). The climate is favorable for the cultivation of tree crops and cereals.
The district is located within the moist semi-deciduous forest belt. The main vegetation types are the Open Forest over the highland areas, the Closed Forest on the range, and the Wooded Savannah. Tree species found in the forest are Wawa, Ofram, Otie, Sapele, Sanfina, and Onyina, among others.

To maintain the micro-climate, parts of the forests in the Municipality have been reserved. There are four (4) forest reserves in the Municipality.
These are the Bandai Hill Reserve at Nyinatokrom, Abrewapon, Bebome, and Nyamebekyere (AANDA, 2015). The forest reserves serve as a source of raw materials for the building and construction industries and a source of income to the Municipal Assembly and traditional authorities regarding royalties (stool lands) and registered timber firms operating in concessions within the Municipality. The forest reserves are endowed with mushrooms and snails; hence, the Municipality has the potential for mushroom and snail farming.

1.9.2 Economic activities

Asante Akim North is an agrarian economy. Agriculture employs about 72.7 percent of the labor force. Following agriculture, the service industry employs 20%, and the remaining 7.3% is in the industrial sector (AANDA, 2016). Agriculture constitutes the main economic activity in the Municipality. A total of 72.7 percent of the total households in the district are engaged in agriculture. Most (79.7%) of the rural households within the total rural population are engaged in agriculture.

Notwithstanding this fact, a sizeable proportion (64.4%) of urban households are also engaged in agriculture. Maize, cassava, plantain, and cocoyam are the major staple food crops, while cocoa is the only significant cash crop produced in the Municipality. The farming methods are mainly traditional, with agriculture being rain-dependent and lands cleared by slash and burn. The use of modern technology in agricultural practices is shallow, as farmers rely on traditional implements. Maize is the second highest crop produced after cocoa in the Municipality and the major cereal crop produced in the Municipality (29.6%) (MoFA, 2016). Industrial activities are on a low scale due to limited processing machines and storage facilities to meet the demands of the municipal agricultural sector. Major industries engaging the labor force in the Municipality are wholesale and retail.

On the other hand, some private entrepreneurs are involved in wood processing, batik making, and gari processing. There are also mining undertakings in the Municipality as the geological construction of the Municipality accounts for the presence of gold-bearing rocks in metamorphosed lava stretching from the Konongo-Odumasi area to Juansa, of which some are yet to be tapped to provide income and employment to the people using appropriate technology.

1.9.3 Organization of the study

The study is organized into five chapters. Chapter one of this research comprises the general background of the study, problem statement, research objectives, research questions and hypothesis, the study's significance, and scope. Chapter two of the study focuses on the review of literature related to the research. The section reviews empirical and theoretical studies on the trend of maize production, factors that affect maize crop production, and the significance of maize production.

Chapter three looks at the research methodology employed in the conduct of this thesis.

The chapter delves into the research approach and design, population, types and sources of data, methods of data collection, sampling techniques, sample frame, sample size, and data processing and analyses.

Chapter four also focuses on the description, presentation, and analysis of data. In this chapter, the study's outcome is discussed in detail, considering the study's objectives. Finally, chapter five summarizes the findings, study limitations, conclusions, and recommendations.

II. LITERATURE REVIEW

2.1 Introduction

This chapter concerns the literature review of the study. Seeking to unearth the various views held by scholars on the structure and trend of maize production, the chapter is categorized into five main sections. Section one looks at the overview and spectrum of maize crop production. Section two presents the historical trends of maize production at local and global levels, while section three examines the factors that affect maize production. In section four, the importance of maize production is assessed. The fifth section reviews the literature on factors motivating farmers to produce maize.

2.2 Overview or spectrum of maize production

2.2.1 History or origin and botany of maize

Maize is a versatile crop cultivated across various agroecological zones worldwide. Maize was derived from the domestication of a Mexican wild annual grass strain of teosinte (Zea mays parviglumis), indigenous to the Tehuacán Valley in the Mexican highlands and first cultivated by the native peoples there (IPBO, 2016). About 12% of maize genetic material is gotten from Zea mays mexicana through introgression; it is gotten through hybridization between small, domesticated maize (a slightly changed form of a wild maize) and a teosinte of section Luxuriantes, either Z. luxuriant or Z. diploperennis (Guat, and Doebley, 1997). Contemporary genetic evidence argues that maize production occurred 10,000 years ago in the Tehuacán Valley in the Mexican highlands in Central Mexico (IPBO, 2016). Later, it diffused to the Mexican lowlands and other regions of Latin America and further diffused to all other parts of the world (IPBO, 2016).

Evidence shows that Christopher Columbus introduced maize from Central and South America to Europe in 1492 and then spread to Africa (IITA, 1982). Later in the 15th Century, the Caribbean Flint became a common type of maize in Africa. It was introduced into East Africa by explorers from Portugal and the Persian Gulf (IITA, 1982). Maize became an essential crop in Africa only after 1900 when the Dutch introduced the crop variants in South Africa (Sanders, 1930). The most successful types, which eventually diffused into East Africa, were Hickory King, white Horse troth, Ladysmith White, Salisbury White, Champion white, Pearl, and Iowa Silver Mine (IITA, 1982). The local yellow maize in East Africa was possibly derived from the initial introductions of the Caribbean Flint and later introductions of yellow dents from South Africa. The last unique variant of maize to arrive in East Africa was the high-altitude race Cuzco from Peru (Grobman, 1961). Missionaries introduced it before WW1 from 1914-1918. Its soft flour grain is the most pronounced type, and it is presently the only variant of maize grown at altitudes above 2500M. Since its diffusion into Africa, maize has been extensively cultivated in Eastern and Western parts of Africa and has diffused into Senegal, Upper Volta, and Niger Republic. In West Africa, two main variants of maize are identified: the Northern Flints and Coastal Flours. The Northern Flint is perhaps related to the Caribbean Flint, while the coastal variants are possibly related to those of central and southern parts of America. Due to its long-term cultivation in different parts of Africa, the crop has adapted to various environmental niches.

Over 300 million Africans rely on maize as their primary food crop (IPBO, 2016). Approximately 1 billion tons of maize are produced in over 170 countries on about one hundred and eighty million (180) hectares of land. About 90% of the world's production is yellow maize, while 90% is white maize in Africa. Maize cultivation in Africa is shallow: while the mean yield globally is roughly 5.5 tons/hectare/year, production in Africa stagnates at around 2 tonnes/hectare/year (IPBO, 2016).

In Ghana, Maize cultivation commenced after the Portuguese introduced the crop in the 16th Century. By the 1930s, it became an essential staple crop in Ghana. Maize production in Ghana is mainly undertaken under traditional tillage and rain-fed conditions by poorly resourced smallholder farmers (SARI, 1996). Maize is a significant calorie provider in the country, and reports indicate that it has almost taken the place of sorghum and pearl millet as traditional staple crops in the northern part of Ghana (MoFA, 2011). However, maize output is low, around 1.0 t/ha. Low yields in maize production in Ghana result from substantial pre- and post-harvest losses due to diseases, weeds, and pests (Amanor, 2012). Maize acreage in Ghana 2009 was around 954,000 ha, but in 2015, the area cultivated was 880,000ha. There is a decline of about 8% of the area cultivated due to inadequate rainfall distribution and poor management of crops and equipment for production (SRID-MoFA, 2016).

The mean annual maize output was reported to be 1.5 million MT between 2007 and 2010 (Rondon, 2011), with a mean yield of about 1.7 t/ha (SRID, 2011). Though production occurs in all the country's ten (now sixteen) administrative regions, over 70% of maize yield comes from five regions in three agroecological zones. The five major producing regions are Northern, Brong-Ahafo, Ashanti, Eastern, and Central, and the three agroecological zones are the guinea savanna, forest-savanna transition, and the semi-deciduous rainforest as highlighted in Table 1 below (MoFA, 2016). Both the Forest savanna transition and the semi-deciduous agroecological zones experience a double maxima rainfall distribution pattern, with the significant season commencing in March and ending in July and the minor season commencing in September and November. The Guinea savanna agroecological zone has a unimodal rainfall distribution that starts in May and ends in September (MoFA, 2016).

Table 1: Top five maize producing regions and agroecological zones in Ghana

Region	Agro_Ecological Zone
Brong_ Ahafo	Forest savanna transition
Eastern	Semi-deciduous rainforest
Ashanti	Semi-deciduous rainforest
Central	Semi-deciduous rainforest
Northern	Guinea savannah

Source: (SRID-MoFA, 2016).

According to Asiedu (2010), in Asante Akim North Municipality, the farming system is characterized by food and export crop production, livestock rearing, and non-traditional activities. Peasant and large-scale commercial farming also characterize the landscape. Maize dominates as a food crop produced by smallholder farmers under traditional cultivation methods in the district. The Municipality under study is a newly carved one from the Asante Akim North Municipality in 2012, and maize production is one of the most dominant economic activities by smallholder cultivators in the district. The district is in the semi-deciduous rainforest Agro/Ecological Zone and has maize as the most widely produced crop. The farming practices are mainly traditional, where soil water is only obtained through rainfall. The application of advanced methods in agricultural practices is minimal as cultivators use traditional farm tools in Agogo, the Municipal capital (Ghana, 2010).

The presence of fertile land coupled with adequate rainfall in the Municipality has influenced the livelihoods of 79.7% and 64.4% of rural and urban households, respectively, to engage in agriculture (AANDA, 2015). Food crop production is the significant economic activity in the study area, with 98.4% of the people in the district undertaking food crop farming (Ghana et al., 2010). Maize growing season lasts 90 to 120 days, depending upon type and day

length, after which it can be harvested, threshed, dried, and preserved in silos for consumption or export. Soils ideal for maize cultivation are forest and savannah ochrosols. Maize is a significant food source for most households in the study area and is grown in all the farming communities (AANDA, 2016). Maize crop production contributes the highest percentage (29.6%) of food crops produced in the Municipality (MoFA, 2016). Maize is cultivated twice annually in the district due to the double maxima rainfall distribution pattern, with the significant season commencing in March and ending in July and the minor season commencing in September and ending in November (MoFA; AANDA, 2016). The yield of maize crop per hectare increased from 2.0MT/Ha in 2012 to 2.5MT/Ha in 2013 (MoFA, 2014) in the Municipality.

2.2.2 Botany and types of maize

Maize is classified as a grass and fits into the large and essential family, "Gramineae" (Salvador, 1997). They described maize as a tall, determinate annual plant producing large, narrow, opposite leaves, borne alternatively along the length of a solid stem. According to (IPBO, 2016), maize is the domesticated type of teosinte. However, both plants have a varied appearance: teosinte is a short, bushy plant with a small cob of 25mm long, while the maize commonly known today has a single tall stalk with numerous leaves. They are both crossbreeding plants and produce potent progeny. Maize has both male and female reproductive flowers.

The male germ cells are formed in the tassel at the plant's apex, while female cells are found in single or multiple ears, which develop from the lower parts of the leaves. The tassel contains anthers that get exposed when mature and discharge up to 100 million wind-distributed pollen grains. About 95% of flowers on a cob obtain pollen from plants nearby, while only 5% of the kernels are produced through self-pollination (pollen from the same

plant). The maize plant has rough leaves, and the outstanding feature of the crop is the division of the sexes into variant parts on the same plant. Ghosh (2004) also describes the male flowers as the tassels and the female flowers as the spikes on a modified lateral branch called the "cob or ear." The maize seed contains two structures: the embryo through which new plants evolve and the tissue that serves as a food source for germinating seed. Maize, being a cross-pollinated plant, has broad morphological variability; as a result, the kernels vary in color, ranging from white to yellow, red, and blue. Maize grows in a relatively short period, which can be grown separately or in a mixture with other crops, and its preparation as food is comparatively easy (Badu-Apraku, 2004). It can be cultivated once or twice annually, depending on the rainfall pattern in that climatic zone of the area.

Maize is the most-produced cereal worldwide. Maize is classified into five (5) types based on their endosperm color and texture: Dent corn (Zea mays var indentata), Where the seed has a cap of soft starch that shrinks upon drying and forms a dent at the top of the kernel. This is the highest yielding. Flint corn (Zea mays var indurate), where the kernel is hard and smooth. It is an indigenous variety in Africa that is more resistant to storage insects like weevil than dent and floury corn. The seed has a soft starch in floury corn (Zea mays var amylaceae) and is more prone to storage insects and breakages than the more challenging types (Gosh, 2004). Sweet corn (Zea mays var saccharata), where the seed is yellow.

It has a higher sugar content than any ordinary maize. It is also consumed in the immature stage, when only about one-third of the potential grain yield has been accumulated. It is more prone to insect damage, especially on the ears. In popcorn (Zea mays var evareta), the endosperm surrounds a small area of soft starch. This soft starch contains a significant amount of moisture, which, when heated, generates steam and pressure, resulting in swelling and bursting, giving a pop sound. Some local types of maize cultivated in the district are Okomasa, Mamaba, Obatanpa, Abeleechi, DorkeSR, Dobidi, etc (MoFA, 2016).

2.2.3 Maize production potential and growth characteristics

Varied approaches can be employed to verify output potential, with each approach having challenges. The most valid method is long-term output data collected by each farmer, as this depicts the innate yield of the location and the impact of production practices such as fertilizer use, soil tillage plant density, and managerial competencies of the individual farmers (MoFA, 2012). In underdeveloped territories, most farmers have no option but to make do with low yields because they cannot apply advanced science and technology and operate at small-scale subsistence levels.

The growth characteristics of the maize crop follow a specific pattern irrespective of the environmental conditions. Maize crop growth passes through different stages of growth, that is, the elementary, crop growth, mid-season, and late-season phases, with each phase having its characteristics, material, and husbandry needs. These stages and their characteristics must be known to the farmer for practical use in production decision-making (Ofori, 2004; Darfour & Rosentrater, 2016). Days to silking maturity determines the critical period of the maize plant. That is the period during which soil moisture is critical. The maize output or quality emanating from scarcity of soil water depends on the phase of crop growth (Ofori et al., 2004). Generally, early hybrids need greater plant densities for increased output than late hybrids (Tollenaar, 1992). The reason is that early hybrids like "Dorke SR" and "Dodzie" are mostly smaller in height, producing fewer leaves, characterized by a lower leaf area index that produces maximum interception of solar radiation.

2.2.4 Land preparation and planting of maize

Land preparation is a very vital activity in maize cultivation. The land needs to be set up adequately to reduce weeds. Nutrients can be reused, and a good surface can be used for direct sowing, etc (MoFA, 2016). Preparing the land could involve farming practices such as

zero tillage or minimal tillage, which reduces the disturbance of the soil to a thriving puddle field, which could destroy the structure of the soil. Land preparation could include tilling, harrowing, and land leveling (MoFA, 2016). Harrowing the field helps break down the lumps of the soil formed after plowing and return the plant residue into the soil, which helps improve the soil's structure. Leveling the land also helps equal distribution of water and nutrients on the field. Maize must be planted carefully and properly to attain the desired germination and emergence possible. Seeds will slowly germinate if the soil is too wet or dry (FAO, 2021). The soil should be weed-free, achieved through weeding or spraying with herbicides. Land preparation, therefore, aims at a loosened, deep soil with a suitably acceptable tilt to aid an equal seeding and identical emergence (Awoonor et al., 2023). Good soil should contain 5cm to 7cm of fine, stable soil devoid of weeds. The remaining soil profile should not have compacted layers resulting from excessive cultivation, which can limit moisture penetration and root development (FAO, 2021).

In Ghana and Asante Akim North Municipality, the traditional method of preparing land is mainly used: slashing and burning or plowing using bullocks to clear the weeds before planting (AANDA, 2015). However, maize planting can be done manually or mechanized; a leveled seedbed is required to prevent interference from huge clods. This will allow even faster germination and provide a relatively weed-free seedbed. Also, a non-leveled seedbed faces the risk of soil erosion (primarily when the field is located on a steep slope), silting, and soil compression, which also causes poor aeration. Proper germination of maize requires moist soil.

2.3 Historical trends of maize production in Ghana

Maize is a versatile crop grown over a wide variety of agroecological zones in the world and was first domesticated in Mexico about 10,000 years ago. Maize crop cultivation in Ghana seemingly commenced in the early 1930s after the Portuguese introduced the crop in the 16th Century. The role maize plays in human diet, animal feed, and industrial production increased

tremendously in the later part of the 20th Century. The trend in maize production in the country has since been fluctuating due to high postharvest losses resulting from diseases, weeds, and pests (Amanor, 2012) and farmers' inability to afford the modern level of technology. In Ghana, the trend line in maize production from 2006 to 2016, the volume of maize has been fluctuating; 1,189,000MT of maize was produced in 2006, 1,219,600MT in 2007, 1,470,080MT in 2008, 1,619,590MT in 2009, 1,800,000MT in 2010, 1,000,000MT in 2011, 1,950,000MT in 2012, 1,817,000MT in 2013, 1,762,000MT in 2014, 1,691,644MT in 2015, and 1,721,910MT in 2016 (SRID, 2016). Maize production has increased by 1.56% in those last four years, and this success is a result of improved technologies, a fertilizer subsidy program, and the provision of technical support services (MoFA, 2016).

However, in the Municipality, the trend in maize production has shown an increase in metric tons per hectare yield from 2.0MT/Ha in 2012 to 2.5MT/Ha in 2013. According to (SRID-MoFA, 2016), the maize area cultivated annually in the district averages about 8,400 hectares. The district's maize is intercropped with other crops, so planting concentrations are generally low. The mean grain output of maize is moderate when expressed per unit land area, averaging less than 2 t/ha. Total yearly maize production is over 1,645 metric tonnes (SRID-MoFA, 2016). Maize crop production contributes the highest percentage (29.6%) of food crops produced in the Municipality (MoFA, 2016).

2.4 Factors that affect maize production in Ghana.

In Ghana, numerous factors generally affect maize production, including climatic conditions, disease and pests, fertilizer type and application, soil requirements, water requirements, and access to credit.

2.4.1 Climatic conditions and maize production

Climate, particularly rainfall, is a critical limiting factor for maize cultivation in the tropics. According to the IPCC, climate change will lead to increases in the occurrence and number of natural catastrophes and adverse weather events such as droughts and floods, rising sea levels and the contamination of water supplies and arable land variations in rainfall distribution with an anticipated reduction in agricultural productivity in already fragile areas, and declining water quality and availability (IPCC, 2021).

Maize cultivation is greatly influenced by various climatic factors such as rainfall and temperature. Regions with an annual precipitation ranging from 500 mm to 1000 mm are predominantly suitable for maize cultivation (Li et al., 2019). However, the impact of excessive rainfall on maize yield can vary, with positive and negative outcomes depending on the region (Li et al., 2019). In cooler areas with poorly drained soils, excessive rainfall can significantly reduce maize yield, particularly when coupled with high preseason soil water storage (Li et al., 2019). Conversely, insufficient watering combined with lack of rainfall can also result in maize plant mortality (Omoyo et al., 2015). Inadequate watering deprives the plant of essential moisture, leading to either crop failure or reduced yield (Omoyo et al., 2015). Moreover, due to erratic rainfall patterns, maize farmers are confronted with the constant risk of complete crop loss (Omoyo et al., 2015).

A study by Cudjoe, Antwi-Agyei, and Gyampoh (2021) using Ejura-Sekyedumase as a case study states that the general relationship between rainfall, temperature, and maize yield increased with increasing rainfall of the right amount and distribution pattern and decreased with increasing temperature. Similarly, one of the factors that caused a decline in maize production in the Ejura-Sekyeredumase municipality, as reported by Obour, Arthur, and Owusu (2022), is the unpredictability of rainfall patterns in the area. According to the study,

one of the drivers of the area's low productivity in maize production was the recurrence of drought during that crop season. This suggests that the final yield of maize will depend on the climate variability in the area as climate is linked to other production dynamics (Ofori, 2006). For instance, in 2016, a severe El Niño significantly reduced maize crop yield in Ghana (Owusu et al., 2019). It can, therefore, be concluded that climate significantly affects crop production, including maize. For instance, variation in precipitation similarly affects maize production positively or negatively in the Asante Akim North Municipality, which needs to be investigated.

2.4.2 Disease and pest and maize production

Crop infections by diseases, insects, and weeds can significantly reduce crop yield in both the temperate and tropical world. In Ghana, the major diseases that affect maize include maize streaks, maize smuts, maize rust, bacteria blight, brown spots, and downy mildews (MoFA, 2016). The incidence and effect of disease are contingent on several factors, including but not limited to climatic conditions and the host plant's health, abundance, and varietal resistance (Obour et al., 2022). Maize diseases can potentially reduce yield because they inhibit average growth, reduce grain quality, and cause lodging. Stem borers, grasshoppers, weevils, termites, cutworms, larger grain borers, fall armyworms, spider mites, maggots, and chafers are the primary pests that attack the maize crop (MoFA, 2016). Storage insects cause grain losses after harvest. 2016, for instance, the fall armyworm attacked 4,046.60 hectares of maize fields in Ghana. In the report (i.e., MoFA, 2016), the Brong Ahafo region recorded the highest fall armyworm attack of almost 2765 hectares of maize field, representing 68.33%.

These findings show that diseases and pests can negatively affect the maize crop yield if not controlled (Obour et al., 2022). In like manner, smallholding farmers in Asante Akim

Municipality are affected by disease and pest thereby negatively influencing their maize crop yield which needs to be explored.

2.4.3 Fertilizer type and application and maize production

Another major factor that affects maize production is the fertilizer type and its application. In Ghana, maize production depends heavily on mineral fertilizer, sometimes supplemented by manure and legume rotation (MoFA, 2019). Maize responds well to applying organic manure, which improves the physical conditions of the soil and its water retention (Tetteh et al., 2018). However, a study conducted by Oppong (2013) identified a negative relationship between technical efficiency and fertilizer application. It implies that there is poor fertilizer management and the application of fertilizers. This is not ideal for the cultivation of maize as the untimely application of fertilizer and prolonged usage of fertilizer lead to the salinity of the soil.

Similarly, Adzawla et al. (2021) conducted a study on the characterization of farmers and the effect of fertilization on maize yields in the Sudan Savannah, Guinea Savannah, and Transitional agroecological zones of Ghana. Adzawla et al. (2021) indicate that even among the farmers involved in their survey who were from the districts with an ample supply of subsidized fertilizers, the level of fertilizer use was below the recommended application rate set out by MoFA (2019). Their study further outlined the reasons for this low fertilizer application, including financial constraints and availability. This suggests that despite the farmers' awareness of the subsidy on fertilizers and the benefits of fertilizer applications, the smallholder farmers are not able to afford the required quantities of the fertilizer, thereby applying the little they can afford without conforming to the application rates (Awunyo-Victor et al., 2016). This could be one of the reasons for the recent low maize yields in Ghana (Tetteh

et al., 2018). Thus, proper fertilizer application on maize farms positively affects the yield of maize and vice versa.

2.4.4 Soil requirement and maize production

Maize adapts well to different soil types with a pH range of 5.0 -7.0. The report by CSIR-SARI (2014) further indicates that shallow sandy or clayey soils should be avoided whenever possible as they are more adversely impacted by drought and reduce response to fertilizer application. Again, maize does not perform well in waterlogged soils. Therefore, all sites prone to waterlogging could impact maize crop yield (CSIR-SARI, 2014; Awoonor et al., 2023). The most suitable soil for maize is one with an adequate depth, favorable morphological properties, good internal drainage, an optimal moisture regime, sufficient and balanced quantities of plant nutrients, and chemical properties that are favorable specifically for maize production (Plessis, 2003). That is, while maize is adapted to a wide variety of soils in the tropics, ranging from sand to heavy clays, most maize is grown on well-structured soils of intermediate texture (sandy loam to clay loams), which provide adequate soil water, aeration, and penetrability. As discussed so far, one of the crucial elements that cannot be left out in crop production, including maize, is the soil and its requirements. Awoonor et al. (2023) assert that one of the challenges of smallholder farmers in Ghana is dependent on or associated with the suitability of soils for an intended purpose, hence the need to pay attention to soil suitability assessment. This assessment can go a long way to minimize the mismatch of crops with land use requirements to increase crop yield. For example, the two predominant soil types in the Asante Akim North Municipality are Forest ochrosols and Savannah ochrosols (MoFA, 2011). The Forest schools are fertile and support the cultivation of cereals, oil palm, cassava, plantain, cocoa, and vegetables.

2.4.5 Water requirement for maize production

Water requirement is also one of the fundamental drivers of maize production in Ghana. Maize is cultivated over various climatic conditions, contrasting in dispersion and amount of regular precipitation. Additionally, the crop is cultivated under irrigated and rain-fed conditions (MoFA, 2011). Rain-fed maize cultivation constitutes about 75% of farming in territories where the product is the general population's fundamental food source and revenue (Rockstrom et al., 2010). Maize requires significant dampness and warmth from germination to maturity. The most appropriate temperature for germination is around 21^0C, and for development, around 32^0C (FAO, 2021). Considerably high temperatures and low humidity amid flowering harm the foliage, drying up the dust and meddling with legitimate fertilization, bringing about poor grain development. Maize is susceptible to waterlogging, especially amid its beginning periods of development (FALC, 2006). According to Asare et al. (2011), even though maize flourishes best on soils having sufficient dampness during the developing season, the product endures dry periods, particularly amid the initial three to a month of development. In territories, for example, the semi-parched and dry sub-humid conditions, including the beachfront savannah condition, the measure of precipitation is not just the constraining variable of rain-dependent maize cultivation but additionally the unpredictable idea of precipitation (Asare et al., 2011). Water pressure occurring at various formative stages could conceivably restrain biomass gathering and thus diminish the grain yield of the maize crop. Late precipitation figures demonstrate a declining pattern with poor circulation (from 1,276 mm in 2008 to 834mm in 2016). The declining pattern might be inferred from the adjustments in the climate and other climatic variables (SRID, 2016). The level of reduction in maize output relies not only on the severity of the water stress or drought but also on the phase of the crop's growth, the crop's endurance to water stress/drought, and the efficiency with which the maize crop uses available soil water for growth, biomass accumulation and yield production (Asare et al., 2011).

2.4.6 Access to credit and maize production

Access to credit facilities is a major limiting factor to maize production. Many farmers faced with credit limitations have low production efficiencies (Oppong, 2013). Credit imperatives may keep farmers from undertaking the desired profitability improvement controls as credit-compelled agriculturists cannot buy basic-level inputs. A farmer's household's financial status is an essential factor influencing farmers' strategies to improve productivity. Household pressures always make farmers develop a solid willingness to respond to adaptive innovation, but credit facilities constrain them. Therefore, implementing adaptive strategies will become impossible without the available resources and technologies (Li, 2010). Access to credit facilities allows farmers to attain the capital needed to purchase production inputs for primary production, pay wages and utilities, and buy agro-inputs, which promotes production activities (Neizer et al., 2020). Access to credit facilities directly improves investments in fertilizers, herbicides, mechanized techniques, and seeds (Adzawla et al., 2021).

However, only a few financial institutions are available in the Asante Akim North Municipal, such as Asante Akyem Rural Bank and Sinapi Aba Trust, which financially support farmers to promote farming activities. As a result, it is challenging for maize farmers to acquire credit to finance their farming activities (AANDA, 2016).

A considerable number of farmers who are faced with credit limitations have low production efficiencies (Li, 2010). To make it empirically evident, Obour et al. (2022) report that many of the farmers they interviewed in their research area remarked that financial constraints affected their production and suggested making loans available and easing the modalities for acquiring loans from the financial institutions in their Municipality. From this, it can be inferred that if the interest rate charged on loans given to farmers, particularly maize farmers, is high, it negatively influences them, thereby reducing crop production. In other words, the financial status of farmers' households is an essential factor influencing farmers'

strategies to improve productivity. Farmers not having sufficient credit history or lacking collateral to secure a loan, farming on marginal lands and in unpredictable climatic conditions, as well as limited return on investment for lending agencies, are additional factors that influence farmers' strategies in terms of productivity improvement. [1]

2.5 Importance of maize production

The economic significance of maize cannot be overestimated, cutting across different spheres of life (Oyewo, 2009). A notable portion of maize production is for home utilization. Maize is utilized for three primary purposes: as a staple human food, as feed for domesticated animals, and as a raw material for some industrial items (FAO, 2005; Darfour & Rosentrater, 2016).

Maize contributes significantly to the national economy and the Agricultural sector as it promotes food security (Darfour & Rosentrater, 2022). In developing countries like Ghana, maize flour is a staple nourishment for the general population, and its stalks give dry season feed to domesticated animals and soil mulch where it is in excess (MoFA, 2012). Maize flour is processed into varying dishes among the different ethnic groups. Traditionally, meals like banku, kenkey, akple, wokple, obloyo, ekpegwemi, porridge, and others can be prepared from processed maize dough (Morris et al., 1999; MoFA, 2012). Ghanaians use maize as a starchy ingredient in many porridges, fixatives, cornmeal, and beverages. Green maize can be eaten dry, heated, or broiled; it is vital in filling the appetite gap after the dry season. Differentiated uses of maize include maize grain, starch items, corn oil, child nourishments, popcorn, maize flour, feed for domesticated animals, and maize fodder for animals during winter (Oppong,

[1] Asante Akyem Rural Bank Ltd in Ghana provides financial services primarily to rural and semi-urban areas within the Asante Akim region and beyond. Its services include offering savings and deposit accounts, loans (agricultural and non-agricultural), and money transfer services. Sinapi Aba Savings and Loans Ltd, based in Ghana, primarily focuses on providing financial services tailored to individuals and businesses in the lower-income bracket. Its scope of work typically includes, microfinance service, savings product, financial education, community development and entrepreneurial support.

2013; MoFA, 2012). All aspects of the maize plant have economic relevance: the grain, leaves, stalk, tuft, and cob could all be used to create a substantial assortment of sustenance and non-nourishment items (Darfour & Rosentrater, 2016; Obour et al., 2022). Maize is also an essential segment of poultry production, and to a lesser degree, the well-nourished domesticated animals could also serve as a substitute for the brewing industry. Generally, the central part of the produce used for animal rearing comprises grains and maize, which is also essential in the tropics. The dry grains are processed, and different ingredients are added to feed the distinctive classes of domesticated animals. Along these lines, this structures a decent channel for changing maize grain into meat, eggs, and dairy items. Maize supplies the carbohydrates for farm animals (Gage et al., 2012).

There are different beverages and mixed alcoholic drinks derived from maize locally and mechanically. Maize grains are saturated with water for 2-3 days and left to sprout. The seeds are exposed to sunlight upon germination, which stops the germination. The grains are then pounded and cooked for a few hours. The fluid part is removed, and when cooled, it is drunk as a soft drink at this stage (FAO, 2021).

The maize crop is of significant significance to traders at the retail level. They purchase small amounts, even in the scope of a couple of kilograms, until they have enough to offer (frequently together with their little produce) to a larger market. Also, mature dried grain has many industrial uses. It is used to manufacture beer, starch, and other pharmaceutical products.

2.6 Factors that motivate farmers to maize production.

2.6.1 Fertilizer subsidy

The Ghanaian government introduced a 50% reduction in fertilizer prices in 2008 to make fertilizer inexpensive for producers and encourage fertilizer use (FAO, 2012). The motive

behind introducing the cost of fertilizer is to absorb the operational charges of fertilizer, port handling charges, loading, and transportation costs (MoFA, 2014). This program motivated households to go into agriculture and maize production. The fertilizer subsidy program has aided producers in increasing their fertilizer use rate to improve crop output and production. Most subsistence household farmers could purchase fertilizer at these subsidized prices to broadcast on their farms and, as a result, increased the yield of maize from 102,100 metric tons in 2011 to 227,277 metric tons in 2014 (MoFA, 2014).

2.6.2 Mechanization programme

The Government of Ghana provides tractors to farmers at subsidized rates to encourage the mechanization of agricultural production. The Government of Ghana posits that this monumental initiative could increase output to 2.5 MT in 2011/2012, up from 1.89 MT in 2010 (FAO, 2012). It is based on this forecast that Agricultural Mechanization Services Enterprises Centers (AMSEC) spearheaded the formation and operation of eighty-four (84) companies to make agricultural mechanization services readily accessible in a timely and affordable manner to farmers (AESD, 2011). This promoted the production of maize among farmers.

2.6.3 Food stocks

The Government of Ghana established the National Food Buffer Stock Company (NAFCO) in March 2010, a public enterprise that is tasked to purchase, preserve, store, sell, and distribute surplus grains (including maize) in warehouses throughout the country (FAO, 2012). This initiative helps regulate the prices of grains, though the volumes traded are not significant compared to the total volume traded in the economy. The company buys and releases mainly maize, rice, and sometimes sorghum and millet into the market during periods of shortage, especially during the off-season (NAFCO, 2014). Establishing NAFCO is part of the grand scheme to minimize postharvest losses, guarantee price stability, and establish

emergency grain reserves. From 2011 to 2014, the company released at least 884,773 (50kg bags) of rice and maize to the market through various institutions. About 68% of this total was maize, with the remainder (32%) being rice. Further scrutiny of the data revealed that, for white maize, 69% was released to some poultry farmers in the middle sector of the country, 31% to NADMO, and 1% to flood victims in the Eastern Region during 2011 (NAFCO, 2014). This intervention has attracted many farmers into maize cultivation and, as a result, increased maize yield from 102,100 metric tons in 2011 to 227,277 metric tons in 2014 (NAFCO, 2014).

2.7 Summary of chapter

This chapter highlighted how climatic conditions, disease and pests, fertilizer type and application, soil requirements, water requirements, and access to credit are some factors that generally affect maize production in Ghana. Maize is one of the most consumed and grown cereals in Ghana. Therefore, it plays a vital role in the country's socioeconomic development. Maize is utilized for three primary purposes: as a staple human food, as feed for domesticated animals, and as a raw material for some industrial items. Fertilizer subsidies, mechanization programs, and food stocks are just a few factors that drive Ghanaian farmers into maize production.

III. METHODOLOGY

3.1 Introduction

This chapter focuses on the research design and methods employed to collect the data for the study. The chapter delves explicitly into the research approach and design, population, types and sources of data, methods of data collection, sampling techniques, sample size, and data processing and analyses.

3.2 Research approach

A mixed methods approach was employed for the survey based on the objectives and research questions outlined in the introductory chapter of this thesis. A mixed method of quantitative and qualitative research was applied in the study to adequately address the research objectives, questions, or problems. The purpose is to ensure reliability (the degree to which results are constant over time) and validity (how measurements are precise) of the survey, and both methods (quantitative and qualitative) complement each other in the conclusion. For example, the vital quotes from the transcripts emphasized the critical quantitative descriptions in the results and discussion sections.

3.3 Research design

A cross-sectional and time series study design was adopted to examine the structure and trend of maize production in Asante Akim North Municipality and to identify the factors that have influenced this pattern of maize production among the farmers. The cross-sectional study is convenient for evaluating people's practices, attitudes, knowledge, and beliefs about a specific phenomenon (Olsen & George, 2004). The cross-sectional survey was, therefore, used to assess the maize production trend of the farmers in the municipality and identify the factors that affected the production trend in the area.

The study, therefore, aimed at finding out the prevalence of the structure and trend in maize production by taking a cross-section of the population (sample of 150 respondents) and administering questionnaires as well as conducting interviews to obtain views on maize production in the municipality and to generalize on the trend of maize production in Asante Akim North Municipality. Also, a historical study approach was used to determine the pattern of change in maize production in the municipality concerning the year range (2013-2022). That is, to analyze the historical trend in maize production that has occurred in the past. The study analyzed the yield and area trends of maize production (examine past observation of the production variables), yield and area planted in the municipality, and how other factors influence these variables over time (2013-2022).

A time series study was employed to assess the factors that affect maize production (including climatic conditions, disease and pest, fertilizer type and application, soil requirement, water requirements, and access to credit). To examine past observations of maize production, the researcher administered questionnaires and conducted interviews with farmers to determine how these variables influence maize production. Also, the time series study was used to assess factors that motivate farmers to engage in maize production. Therefore, the study aimed to determine the prevalence of maize production amongst households by administering questionnaires and conducting interviews to obtain views influencing farmers' interest in maize production in the municipality.

Again, a time series study was used to explore the importance of maize production by administering questionnaires and conducting interviews to examine the past production yield of maize and its relevance to the farmer. Respondents were contacted using questionnaires and interview tools to obtain the required information on the relevance of maize production.

3.4 Target population

The survey's target population focused on all maize producers in the municipality to constitute the population. However, the study considered 150 maize farmers of the accessible population in the three selected communities (Hwidiem, Magyeda-Nkwanta, and Ananekrom), where maize is predominantly cultivated in the municipality. A multi-stage sampling method was used to choose 150 maize producers from the three communities in the municipality. Initially, the study employed purposive sampling to select the three maize-growing areas in the municipality because maize farmers are necessary for the study; therefore, interested places should be the maize-growing areas. Then, the convenience sampling method was adopted to choose the households in these communities, and respondents from the households who are farmers were interviewed.

3.5 Types of data

The study gathered qualitative and quantitative data from the respondents of the communities to avoid the shortcomings of basing the findings and conclusions on a single type of data. Information obtained from farmers and historical data for maize production, including those obtained from MoFA officials, formed the basis of the quantitative study. Similarly, qualitative data was also generated from the information from the farmers and other stakeholders during the interview sessions, which were later transcribed. Again, this data was relevant as it somewhat validated or emphasized the critical quantitative descriptions in this thesis's results and discussion sections.

3.6 Sources of data

The quantitative and qualitative data were obtained from both primary and secondary sources. The primary data was elicited from the farmers and officials from MoFA in Agogo, the municipal capital, from June 1, 2023, to July 31, 2023. The primary data collected were the information on the socio-demographic characteristics of respondents, observed changes in maize production, factors that affect maize production, importance of maize production, factors that motivate farmers into maize production, and number of households into maize production. The secondary data was also obtained from articles, journals, reports, and documents from government departments and institutions (MoFA, FAO, and SRID) about maize production to triangulate the primary data.

3.7 Methods of data collection

Based on the study's objectives, more than one method was adopted to collect the survey data. The primary data was obtained with questionnaires, structured interviews, and field observations. The questionnaires (see Appendix B) were administered to farmers, and the administration was face-to-face interactions. The participants were informed about the motive and significance of the survey, and informed consent was secured in compliance with Western Michigan University's Human Subjects Institutional Review Board before administering the questionnaires. Households were the critical units of respondents for the data collection.

Structured interview guides (see Appendix C) were employed to obtain additional information from some of the participants and other stakeholders, such as officials of MoFA, since they work directly with the farmers in the municipality. The purpose was to explain and verify the findings that were obtained from the administration of the questionnaires. The completion of interviews and questionnaires with a blend of open-ended and close-ended questions took about 30 to 45 minutes, and the study visits to the farmers or study sites were

thrice a week. The interviews were conducted in either English or Twi (L1), depending on the respondents' preference, and the conversations were recorded and later transcribed for analysis. Similarly, the author guided the respondents while administering the questionnaires.

Field observation was also employed to capture the social setting of respondents and the influence of the physical environment on the respondents' activities. For example, the types of farming occurring in the selected communities were characterized, which provided insight into the interaction between respondents and their physical environment and ascertained the ground realities.

3.8 Sampling technique

The survey drew on multi-stage, purposive, and simple convenience sampling methods. The purposive sampling procedure was used to choose the Asante Akim North Municipality as the study area and the three farming communities (Hwidiem, Magyeda-Nkwanta, and Ananekrom) for the research. These communities were chosen partly because of the intensive farming the farmers undertake during the major and minor crop seasons and the high cultivation of staple foods compared to other farming communities in the area. This, in turn, allowed the researcher to collect relevant data from relevant sources.

The study also used simple, convenient, and purposive sampling techniques to choose the respondents. A convenience sampling technique was used to choose households in the selected communities, as not everyone has an equal chance of forming part of the sample in the studied population. Other participants, such as local experts and agencies, were also intentionally selected to obtain relevant information about the study topic.

3.8.1 Sample size

A sample size of 150 respondents was used for the study. This comprised 145 household respondents comprising farmers from the three chosen study locations. The 145 household respondents were selected from 1,549 households in the study areas. Additionally, five key informants were included in the study. These comprised three local experts (one from each of the three communities), one representative from the Municipal Directorate of the Ministry of Food and Agriculture, and one from the municipality's Agriculture Extension Officials. The total number of households from the 2010 Population and Housing Census for Hwidiem, Magyeda-Nkwanta, and Ananekrom by the Ghana Statistical Service was 1,549. Out of this, 150 respondents were selected for the study. Approximately 97 percent of the selected number was allocated to farmers, while 3 percent was allotted to critical informants for the study. A higher sample size was allocated to farmers because farmers were the target population for the study investigating maize farming practices. Based on the total number of households in each of the communities selected, the sample of 145 farmers was distributed proportionately among the households in the three communities where the study will be undertaken. Based on the list of the total number of farmers in the municipality, the sample sizes of the communities were Hwidiem (80), Magyeda-Nkwanta (23), and Ananekrom (42), and the key informants of 5 respondents.

3.9 Ethical Considerations

To ensure that the participants' privacy was protected, the Western Michigan Institutional Review Board (IRB) assessed and approved all research instruments (see Appendix A). The researcher sought informed consent from the participants. It is to be noted that the names and complete addresses of the participants were not collected. Participants reserved the right to participate in the survey without compulsion or threats. All processes

outlined by the Institutional Review Board and the CITI program's Research Ethics and Compliance Training were duly followed.

3.9.1 Data processing and analyses

In accomplishing the objectives of the survey, the information gathered in the questionnaires, interviews, and secondary data sources was coded and entered into computer software (SPSS). The quantitative data was analyzed using descriptive and inferential statistics with the aid of the SPSS Statistics Software (IBM SPSS) and the Microsoft Excel Software. Analytical tools such as frequency, percentages, trend equations, and graphs were also used to analyze the quantitative data to facilitate easy understanding and interpretation. A time series of analyses was also adopted to examine the trend in maize production in the past ten years (2013 to 2022).

3.9.2 Summary of chapter

This chapter attempted to highlight information regarding the research design and various methods employed to collect data for the study. Sample size, techniques, and software package used to analyze the data were all captured in this chapter.

The fieldwork was conducted from June 1, 2023, to July 31, 2023, within the Asante Akim North Municipality, Ghana. Questionnaires, structured interviews, and field observations were adopted in the study to collect quantitative and qualitative data from 150 selected participants through purposive and convenience sampling techniques. The completion of interviews and questionnaires (in-person) featuring both open-ended and close-ended questions took about 30 to 45 minutes, and the study visits to the farmers or study sites were three times a week. The author statistically and thematically analyzed the data obtained from the participants through the questionnaires using SPSS. Similarly, some of the interview data were also analyzed through qualitative techniques.

VI. DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents the results of data gathered from field surveys to analyze the structure and trend of maize production in the municipality. This chapter provides a presentation and discussion of the demographic features of the respondents: their age, gender, marital status, educational background, and household size, among others. It was done using frequency and percentage distributions and cross-tabulation. It moves on to present the data analyses based on the study objectives and discusses the structure and trend of maize production. I build on further survey questions. Frequency and percentage distribution trend analysis, among others, were used. The IBM SPSS software (version 26) and the Excel Statistical Package were used to present the analyses. Discussions of the results were also linked to literature to make inferences and validations. This was vital as it enabled the study results to be compared to similar studies looking at the structure and trend in maize production. Thus, my discussion and conclusion are jointly in chapters 4 and 5.

4.2 Demographic characteristics of respondents

4.2.1 Gender of respondents

Most of the respondents interviewed during data collection were male household heads and farmers, representing 64.0% of respondents, as shown in Table 2 below. Thus, farming is dominated by males in Asante Akim North Municipality. Several factors may explain this observation. Among them are problems in land acquisition, ownership, access, inheritance, other farming inputs acquisition, availability of time and money, and females' inability to work in the field with their male counterparts due to domestic obligations and social expectations to meet other household needs through their socially reproductive labor (Gore & LeBaron, 2019). To buttress the point of females not being able to work with men might not be an issue of

inequality but a long-standing tradition and logic about a gendered division of labor in which men perform most of physical labor around the farm. In a typical Ghanaian setting like the study area, it is evident that, due to domestic responsibilities such as childbearing and caring, cooking, washing, and sweeping, females do not have enough time to do some farming activities. These domestic obligations limit women and probably cause gender disparity among maize farmers. As far as this study is concerned, the implication is that maize farming households were headed by males with support from spouses and other household members. This agrees with the Ghana Statistical Service (2010) findings that male-headed households largely dominate household headship in Ghana.

Table 2: Gender of respondents

Gender	Frequency	Percent (%)
Male	96	64.0
Female	54	36.0
Total	150	100.0

Source: Field Survey, 2023

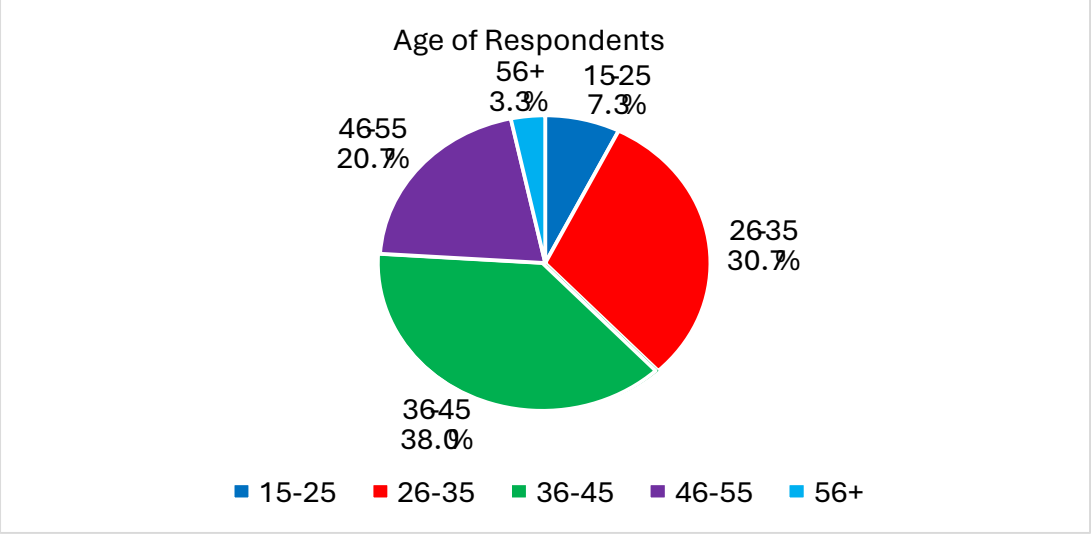
4.2.2 Age of respondents

The highest frequency, representing 38.0% of the respondents, were 36-45 years old (Figure 4). This is followed by the age group of respondents ranging from 26 to 35 years old, representing 30.7%. Following this age group are 20.7% of the target population within the age range of 46-55 years and 7.3% of the respondents within the age range of 15-25 years. Finally, the age group of 56+ years had the most minor frequency, representing just 3.3%. These results show the youthful nature of the farmers who participated in the survey. Most farmers were aged 26 to 45, demonstrating a young farming population, implying that maize cultivation is

attractive to the younger males, as shown in Figure 4 below. The 56+ age group formed the least of the population because farming activities are quite challenging for older people in the Ghanaian community as farming activities in Ghana are characteristically labor intensive.

Farm labor is one of the vital characteristics in maize production. The low percentage of older people suggests that farming is a labor-intensive venture. Therefore, farmers resort to hired labor, dominated mainly by the youth, for crop production. This is scarce and expensive (MoFA, 2012).

Figure 4: Age distribution of maize farmers sampled from the Asante Akim North



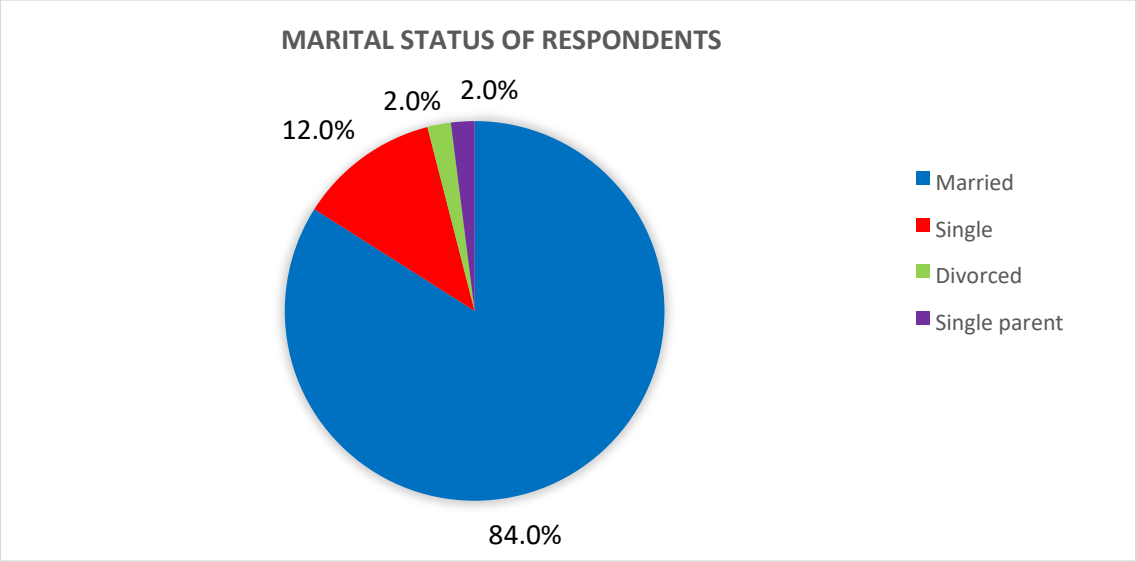
Source: Field survey, 2023

4.2.3 Marital status of respondents

Concerning marital status, the number of married farmers constituted 84.0%; 12.0% of the farmers surveyed were single, 2.0% were divorced, and 2.0% were single parents, as indicated in Fig 2 below. Many married farmers could be attributed to commercial farming

requiring mechanization. Therefore, without mechanization, spouses and children served as additional hands.

Figure 5: Distribution of marital of maize farmers sampled from the Asante Akim North Municipality



Source: Field Survey, 2023

4.2.4 Educational attainment of respondents

The survey showed that 40% of the producers have no formal education. However, the second highest percentage was household heads who had completed the Primary level of education at 34.7%. Those who completed the Junior High level of education were represented by 15.3%, but the proportion of the household heads who had completed the Senior High level was only 8.0%. In comparison, those who had completed tertiary education represented 2.0% of the household farmers. The results show that most respondents had no formal education, and the highest level of education completion among respondents was fundamentally at the primary level. A large percentage of the farmers (40.0 %) had a shallow level of education, as highlighted in Table 3 below. Poverty levels are high among Ghana

farmers, which may explain the limited number of farmers with formal education (Wilson, 2014).

Low levels of education have been viewed as affecting the level of technology acceptance and skills attainment among farmers (Oyekale, 2009). This confirms that most farmers are not formally educated and possibly unskilled with a meager economic reward, as modern agriculture is more than just tilling the land (MoFA, 2012). Due to this, MoFA offers career openings in research, environment, financial management, engineering, and other technical fields for the producers, especially the youth. Primary education is vital for smallholder maize farmers to enhance the adoption of new technologies and practices.

Table 3: The highest level of education of respondents

Educational status	**Frequency**	**Percent (%)**
None	60	40.0
Primary	52	34.7
JHS	23	15.3
Secondary	12	8.0
Tertiary	3	2.0
Total	150	100.0

Source: Field Survey, 2023

4.2.5 Occupation of respondents

From Table 4 below, the results show that most household heads (96.7%) were engaged in farming only (cultivation of maize, plantain, rice, and other food crops) as a permanent economic activity. Also, 2.0% of the household heads combined farming and trading as an

economic activity. In comparison, only 1.3 % of them were engaged in agriculture and other occupations as their economic activity (mining activities and teaching). The result, therefore, confirms the Asante Akim North Assembly Profile (2012) that agriculture is the prime livelihood venture among people aged 15 and above since as high as 72.7% of the populace in the municipality are agriculturists (Ghana Statistical Service, 2012). Most inhabitants in the Municipality (98.4%) are crop farmers (Maize et al., etc.), making crop farming the highest type of farming activity practiced in the Municipality (98.4%) (AANDA, 2012).

Table 4: Occupation of respondents

Occupation	**Frequency**	**Percent (%)**
Farming only	145	96.7
Farming and Trading	2	1.3
Carpentry	0	0.0
Farming and other works	3	2.0
Total	150	100.0

Source: Field Survey, 2023

4.2.6 Major crop of cultivation in the municipality

Seventy-eight percent of the farmers interviewed cultivated maize as their principal crop. Six percent grow maize and plantain, 3.3% farmers cultivate maize and cassava, while 12.7% cultivate maize and other crops. The crops they produced aside from maize were cocoyam, tubers, vegetables, and fruits for consumption and market sales.

Table 5: Major crop of cultivation

Crop	Frequency	Percent (%)
Maize	117	78.0
Maize & Plantain	9	6.0
Maize & Cassava	5	3.3
Mixed	19	12.7
Total	150	100.0

Source: Field Survey, 2023

4.2.7 The importance of maize production to farmers in the municipality

The survey also sought to assess the importance of maize production to farmers in the Asante Akim North Municipality. Maize farmers were interviewed, and all 150 respondents indicated that maize serves as a staple food for their families and helps them save income that would have been used to buy food to feed their families. Maize farmers were also interviewed to assess whether maize production employs the municipality's people. Most maize farmers interviewed (88.7%) strongly agreed that maize production serves as employment for people in the municipality, and 11.3% of the maize farmers interviewed also agreed to some extent that maize production is an employment opportunity for the people (Table 6).

Table 6: Maize production as an employment avenue for people in the municipality

Respondents	Frequency	Percent (%)
Strongly agreed	133	88.7
Agreed	17	11.3
Disagree	0	0
Strongly disagreed	0	0
Uncertain	0	0
Total	150	100.0

Source: Field Survey, 2023.

The assertion by the maize farmers interviewed, as indicated in Table 6 above, revealed that maize production is an economic activity that provides job avenue for farmers in the municipality, as stated in the Asante Akim North District Medium Term Development Plan 2014-2017, "maize production serves as employment for households as the sector employs 72.7 percent of households in the municipality into Agriculture" (AANDA, 2015). Also, farmers indicated that maize production serves as a source of income for their families for livelihood and payment of utility bills and other debts of the farmers. One female maize farmer emphasized this: “Engaging in maize farming helps me a lot. There are no jobs in this community except farming, which helps me generate income to cater to my family and care for my wards in school". This research participant centers maize farming as the primary economic activity within their community and highlights the importance of its profits in securing family and household life. Without income from maize farming, their family and pupils’ lives would become more precarious and threaten the community’s ability to thrive.

As emphasized by (Oyewo, 2009), the economic benefits of maize cannot be overestimated, and it affects various spheres of life. Most farmers enumerated several reasons why maize is so important to them. Maize cultivation is an employment avenue for them, a

source of income, and food for family consumption. Farmers were also asked to indicate whether the production of maize is profitable; the study revealed that the majority of maize farmers interviewed (87.3%) strongly agreed that maize production is profitable to them, while only a few farmers (12.7%) indicated that the production of maize had not yielded profits for them, which they attributed to the difficulty in acquiring land to cultivate maize crop on a commercial basis rather than subsistence farming.

4.3 Trend of maize production in the Asante Akim North Municipality from 2013 - 2022

4.3.1 Farming practices of maize farmers in Asante Akim North Municipality

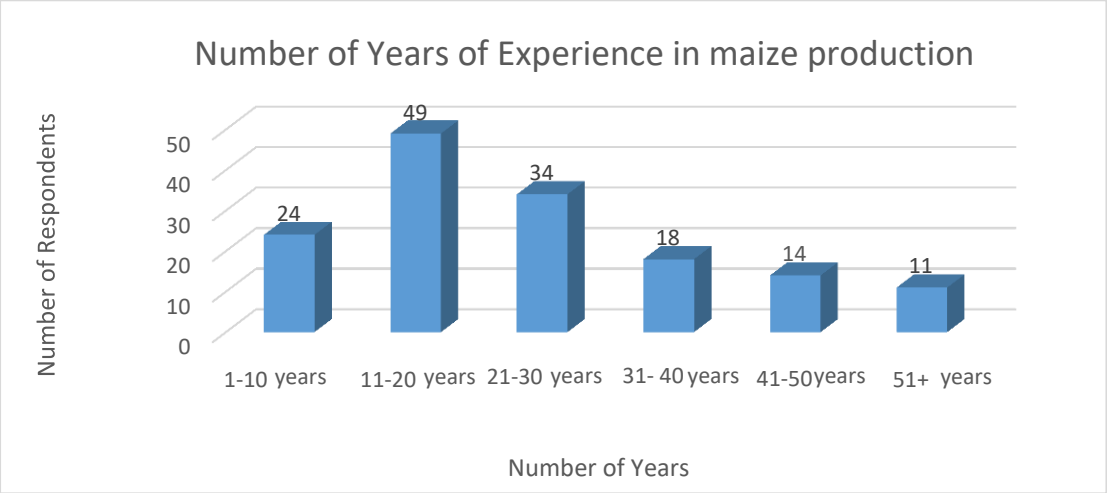
Experience in years of cultivation of maize amongst farmers varied. The results showed that 32.7% of farmers had about 11-20 years of experience in cultivating maize; 22.7% had 21-30 years of experience; 16.0% of the farmers had 1-10 years of experience in maize cultivation; 12.0% had experience of 31-40 years. At the same time, 9.3% and 7.3% had 41-50 and 51+ years of experience, respectively.

These results show that maize production in the Asante Akim North Municipality is average, cultivated from 25 to 30 years among household farmers. Production has seen a growing trend since 1965 in the country (Morris, 1999). Thus, there are many experienced farmers, and there experiences on maize farming are based on a long view of cultivating the crop in the region.

Most of the respondents have been cultivating maize for the last twenty years or more (Figure 6), and this is because they consider maize cultivation a profitable venture due to the high demand for the crop in Ghana. This is supported by one respondent who had this to say, “I generate a lot of income from selling my maize to cater to my family. I can access a ready market to sell my produce without much stress”. Based on this research participant’s assertion,

the importance of maize production in the study area cannot be overstated. This is because, through maize production, the financial burden on the inhabitants in the study area is largely reduced, thus leading to their long-term engagement in the cultivation of maize.

Figure 6: Number of years of experience in maize production of farmers sampled

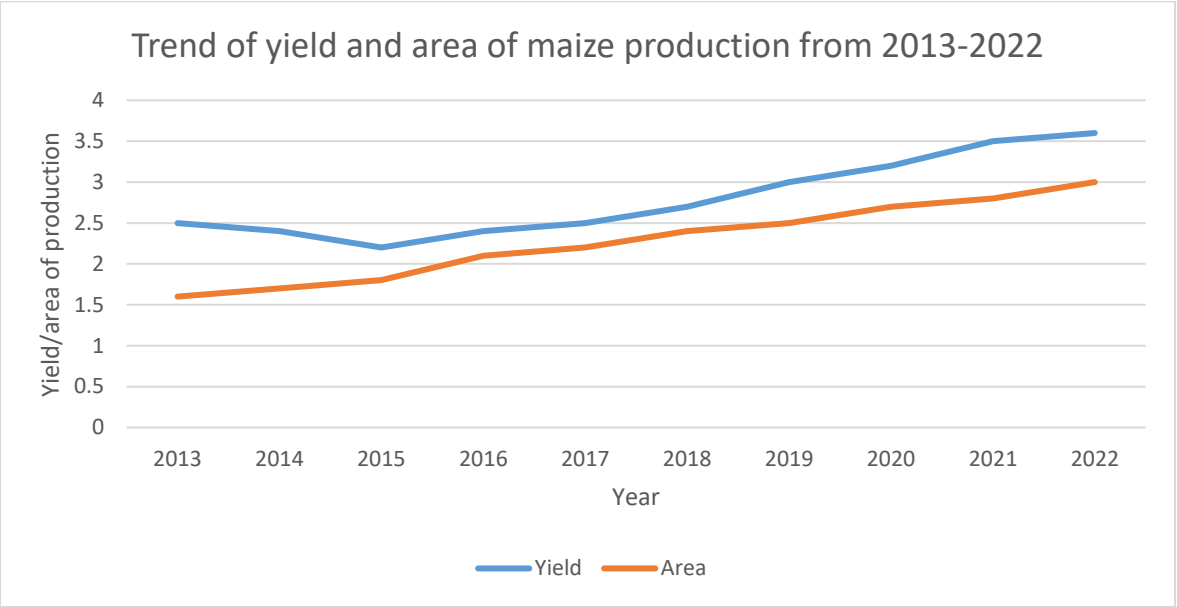


Source: Field Survey, 2023

4.3.2 Trend in yield and area planted maize in Asante Akim North Municipality

The trend of maize production, yield, and area planted in the Asante Akim North Municipality is not static, and it is mainly attributed to climatic factors such as rainfall variability, as well as disease and pest infestation, land tenure system, availability of credit, and some activities of nomadic herdsmen (AANDA, 2016).

Figure 7: Production trend of maize in Asante Akim North Municipality from 2013-2022



Source: MoFA: Asante Akim North Municipality.

As seen in Figure 7, the annual maize yield for 2013 was 2.5MT/Ha. However, the cultivation area increased from 1.6 ha (2013) to 1.8 ha (2015). The yields, however, steadily declined to 2.4MT/Ha and 2.2MT/Ha in 2014 and 2015, respectively, as per the data above. Therefore, careful observation of the data points to the fact that 2015 produced the lowest yield, which respondents blamed on the widespread destruction of farms by stray cattle, unreliable rainfall, and lack of access to field extension services. However, there was a tremendous and continuous increase in the annual maize yield from 2.4MT/Ha in 2016 to 3.6MT/Ha in 2022 (Figure 7). The year 2022 thus constitutes the year with the highest production output. The informants opined that the recent rise in maize yield in the municipality could result from reliable rainfall, early planting, and the subsidized fertilizer cost, among others. It is worth noting that the significant increase in maize yield in the Asante Akim North Municipality, as the data above highlights, is consistent with previous studies conducted in Ghana and some parts of Africa. For instance, Baffour-Ata et al. (2021a) reported a rise in maize yield from 1995 to 2016 in northern Ghana by case studying five districts. Atiah et al. (2022) also reported

that maize annual yields in Ghana from 1961 to 2015 have increased significantly. This discussion concludes that although the yearly maize yields in Ghana and other parts of the world have generally been changing, there has been a significant increasing trend regarding maize production.

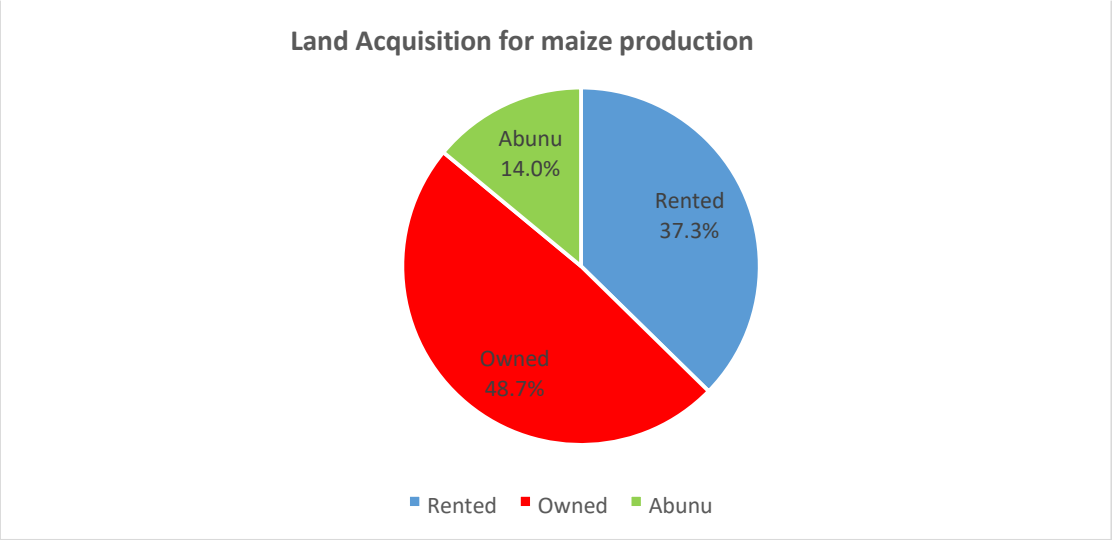
4.3.3 How land is acquired for maize cultivation in the Asante Akim North

The research revealed that land ownership is complicated for families and individuals. Respondents who are landowners were 73 (48.7%), whereas 77 (51.3%) did not own land but acquired one through the land custodians by leasing for some number of years or working on the land and sharing proceeds into two with the landowner (*Abunu*) after harvest. Out of the 150 respondents interviewed, farmers who own land account for 48.7%, 37.3% for rented, and 14.0% for *Abunu*, respectively. The land is also obtained through the *Abunu* agreement for maize cropping; it involves sharecropping, which is shared on a 50:50 basis between the landowner and the tenant. This suggests that the land custodians need to be educated on the need to consider situations where the farmer makes losses in the cultivation process, not to place the farmer at the losing end. Farmers acquire land by renting an acre of Land at GHC 400.00 per year.

One of the farmers interviewed claimed that currently, land acquisition in the study area is challenging due to the landowners' assertion that maize cropping encourages grassland development, which is easily destroyed by rampant cattle invasions, depletion of soil nutrients, and bushfires, among others. Moreover, comparing maize to cocoa, cocoa fetches more in everything than maize. Regarding government support through fertilizer supply and financial assistance, cocoa is ahead in the Municipality as cocoa is the major export commodity in Ghana. The *Abunu* land acquisition system in the Municipality is not encouraging as farmers complained that the system is not profitable, as they risk incurring more costs when their crop yield is low but must share the little harvest with the landowner equally. This is what one of

the research participant remarked, “Financing the farming in terms of labor and all the necessary chemicals solely by the farmer (Abunu) only increases expenditure and work rather than profit, which is different compared to the landowner who just sat in the house and waits for a share”. This is why only 14% of the participants acquired their lands for maize cropping through this model. According to these farmers, they still resort to the abunu system despite their knowledge of its problems, as they cannot afford the cost of renting the farmland.

Figure 8: Land acquisition for maize cultivation in the municipality



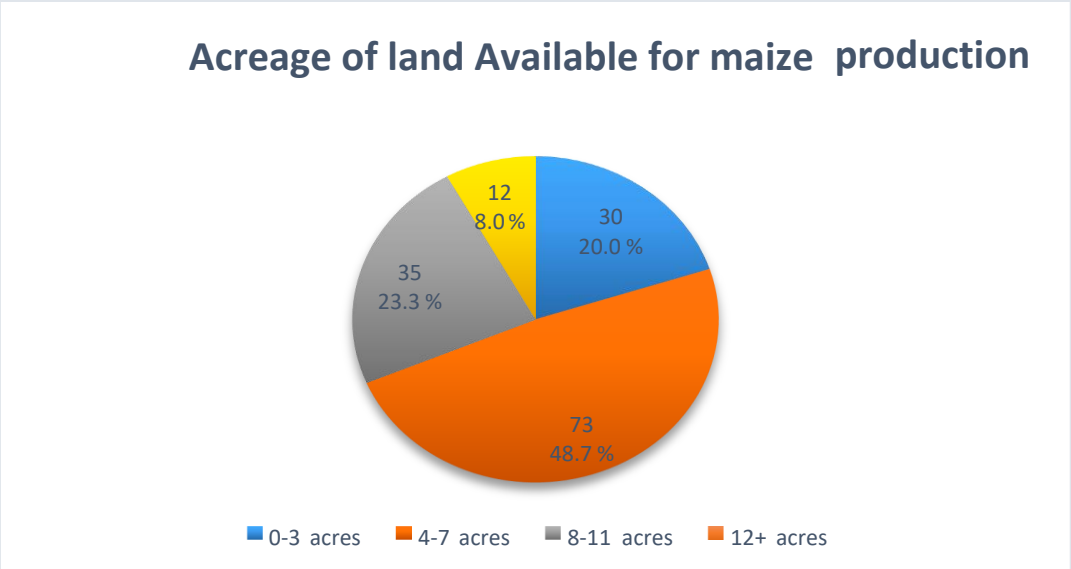
Source: Field Survey, 2023

4.3.4 Land available for farmers for the cultivation of maize in the municipality

Most of the farmers interviewed (48.7%) said they have at their disposal 4-7 acres of land available for cultivation, 23.3% of the farmers have 8-11 acres at their disposal for maize, and 0-3 acres of land is available to 20.0% of producers interviewed. More than 90% of maize farmers in the Asante Akim North Municipality are small-scale farmers who harvest their crop on plots smaller than 12 acres (5 hectares), mirroring trends of an unequal agricultural model prevalent across the Global South. In contrast, a minority of farmers (8.0%) have 12 or more

acres of land to cultivate maize. The results from Figure 9 below show that most maize farmers do not have large acres of land at their disposal, as the results depict few maize farmers having 12 or more acres of land available. This confirms that land acquisition for maize production is complex because landowners in the municipality consider it less profitable than cocoa production and tend to give out their lands to cocoa farmers rather than maize farmers (AANDA, 2016). However, since the farmers think maize is profitable, the complexities would not deter them. Since maize production is the major staple crop in the municipality, there should be some intervention strategies that could make its production more attractive compared to cocoa. For example, the government of Ghana can financially assist farmers in this study area to rent more acres of land for maize cropping, as the farm size definitely affects the crop yield.

Figure 9: Acreage of land for maize available for maize cultivation



Source: Field Survey, 2023

4.3.5 The relationship between land acquisition and availability for maize production

Table 3 below shows land availability and acquisition in the Asante Akim North Municipality. The 38% of farmers that acquire land through rent land sizes are as follows: 18.0% of the farmers rent 4-7 acres of land, 9.3% of the farmers rent 0-3 acres of land, and

7.3% of the farmers rent 8-11 acres of land, 2.7% of the farmers rent 12 acres or more of land available for maize production. On the other hand, of farmers that own available land for maize production, 24.0% own 4-7 acres of land, 13.3% own 811 acres of land, 6.7% own 0-3 acres, and 4.7% of the farmers own 12 acres or more. Farmers that use the *Abunu* system to acquire available land for maize production shows that 6.7% of farmers gained access to 4-7 acres of land available for maize production, 4.0% gained access to 0-3 acres of land available, 2.7% gained access to 8-11 acres of land available, and only 0.7% of the farmers through the *Abunu* system acquired 12 or more acres of land for the production of maize.

Table 7: Cross-tabulation of land acquisition and land availability for maize farmers

Land Acquisition	**Acreage of Land Available for maize production**				**Total**
	0-3 acres	4-7 acres	8-11 acres	12+ acres	
Rented	14 9.3%	27 18.0%	11 7.3%	4 2.7%	56 37.3%
Owned	10 6.7%	36 24.0%	20 13.3%	7 4.7%	73 47.8%
Abunu	6 4.0%	10 6.7%	4 2.7%	1 0.7%	21 14%
Total	30 20%	73 48.7%	35 23.3%	12 8.0%	150 100%

Source: Field Survey, 2023

4.3.6 Relationship between gender of farmers and land acquisition

Table 8 below shows the gender of the farmers and land acquisition in the Asante Akim North Municipality. The farmers interviewed show that 34.7% of male farmers own available land for maize production, 22.6% rent the land to produce maize, and 6.7% acquire land through the *Abunu* system. On the other hand, 14.7% of female farmers rented the land for maize production, and 14.0% of female farmers owned the land. In comparison, only 7.3% of female farmers acquire land through the *Abunu* farming system. This suggests that females mostly use the abunu system and/or sharecrop their produce more than males. This demonstrates that females are engaged in a more precarious form of agriculture and are potentially subject to other limiting factors.

Table 8: Cross-tabulation of the gender of respondents and land acquisition

Gender of farmers	**Acquisition of Land for maize production**			**Total**
	Rented	Owned	Abunu	
Male	34 22.6%	52 34.7%	10 6.7%	96 64%
Female	22 14.7%	21 14%	11 7.3%	54 36%
Total	56 37.3%	73 48.7%	21 14%	150 100%

Source: Field Survey, 2023

4.3.7 Seasons of maize cultivation

Most of the farmers interviewed (60.0 %) cultivate maize during the significant season (March-July) only, 9.3 % plant maize in the minor season (September-November) only, and 30.7 % grow maize in both the major and minor seasons (Table 9).

Table 9: Seasons of cultivating maize

Season of cultivation	**Frequency**	**Percent (%)**
Major season only (March-July)	90	60.0
Minor season only (Sept-Nov.)	14	9.3
Both Seasons	46	30.7
Total	150	100.0

Source: Field Survey, 2023

4.4 Factors that affect maize cultivation in the municipality.

This section presents factors influencing maize cultivation in the municipality. Several factors significantly affect the yield and production of maize worldwide and my study area. According to the literature of other research, maize production is affected by many factors, including climatic conditions, disease and pests, fertilizer type and application, soil requirement, access to credit, and many others. This study has tried to identify some using various open-ended questions.

The first question was: *What are the factors that affect your maize production?*

Farmers were asked whether rainfall distribution affects their production of maize. Most of the farmers interviewed, 99.3%, asserted that rainfall patterns in the municipality significantly affect maize production. Leaving only 0.7% stated that rainfall patterns do not

affect maize production. Most of the farmers interviewed stipulated that rainfall patterns in the area in recent years are not reliable enough to support maize production practices. According to a farmer in Ananekrom, one of the study communities in the municipality, “Most of my maize crops got destroyed, and the yield reduced drastically because at the time of tasseling my maize crops, the rain stopped for over a month, and I incurred the highest cost ever in 2016 since I started maize farming". This means that when farmers are not educated on rainfall patterns in the study area, it will negatively affect their yield and, by extension, discourage them from engaging in maize farming. Moreover, solely depending on rain-fed agriculture could be detrimental to maize farmers and their production. Rainfall can be complemented with mechanized irrigation through stakeholders to mitigate this challenge.

This statement also reflects the views of most farmers in the municipality that rainfall affects maize production, as corroborated in the literature, and that farming in Ghana relies primarily on the amount of precipitation and its pattern. For instance, rainfall records indicated a decreasing trend with unreliable distribution from 1,276 mm in 2008 to 834mm in 2015. The declining trend contributed to the decline in the agricultural productivity of maize (SRID, 2016). Although rainfall patterns have not been consistent in recent times in the municipality, as most of the surveyed farmers asserted, their impact on maize production has been positive. One of the informants remarked that, "I observed that the rains have come late in recent years compared to ten years ago. Therefore, I have adjusted my farming practices, such as the planting period, to meet the rains accordingly. This has helped me consistently increase maize yield from 2016 to date". This implies that to increase crop yield, farming practices, including maize farming, involve a lot of observations and adjustments regarding rainfall variability. The desire to adjust one's farming practices could thus go a long way in increasing crop yield, including maize.

Table 10: Rainfall and maize production

Rainfall	Frequency	Percent
Yes	149	99.3
No	1	0.7
Total	150	100.0

Source: Field Survey, 2023

The second question asked to indicate whether they had once encountered a disease or pest in their maize farm or not. The findings are shown in Table 11 below.

Table 11: Diseases and pests and maize production

Disease and pest incidence (Respondents)	Frequency	Percent (%)
Yes	150	100.0
No	0	0.0
Total	150	100.0

Source: Field Survey, 2023

Diseases, pests, and maize production in the municipality amongst farmers are common. The results in Table 11 above indicate that all 150 farmers were interviewed. 100% asserted that they have encountered diseases and pests in their farms.

The types of diseases and pests that attack maize crops were sampled, and some of the diseases and pests indicated by most farmers have been encountered. The farmers indicated that diseases and pests affect maize production, as shown in Table 12 below.

Table 12: Diseases encountered by maize farmers

Diseases	Frequency	Percent (%)
Corn smut	6	4.0
Stalk rot	55	36.7
Grey leaf spot	45	30.0
Maize rust	44	29.3
Total	150	100.0

Source: Field Survey, 2023

Table 13: Effects of diseases and pests on maize production in the Asante Akim North Municipality

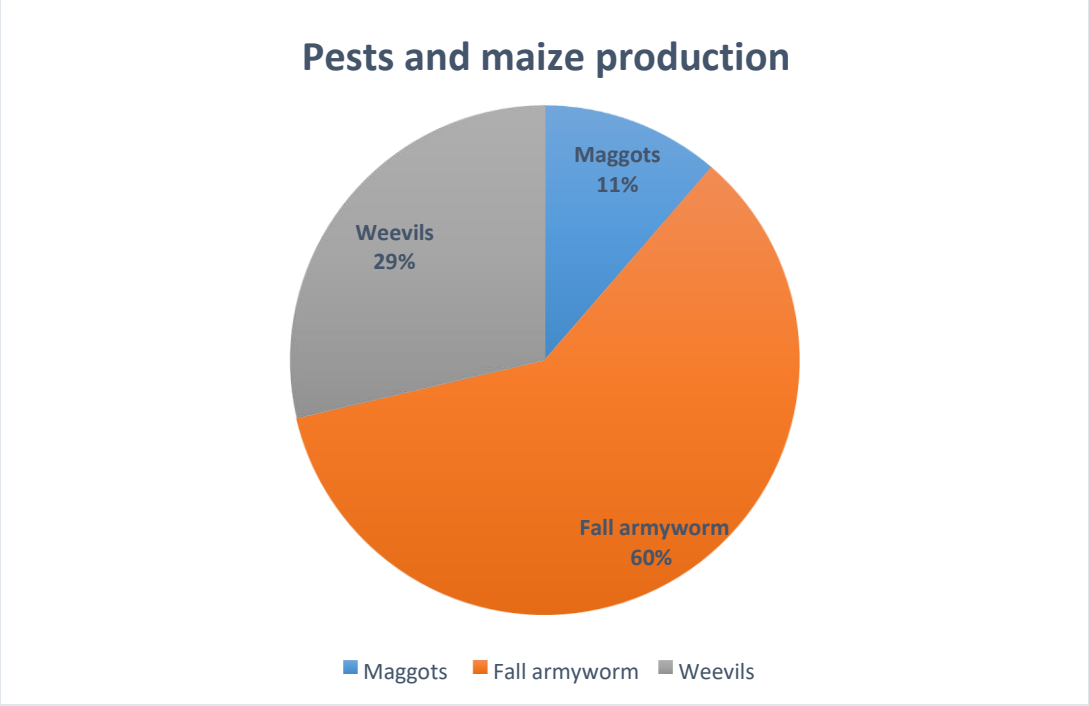
Effects	Frequency	Percent (%)
Reduced yield	103	68.7
Increased production cost	43	31.3
Discouraged maize production	0	0.0
Total	150	100.0

Source: Field Survey, 2023

The results from Table 13 above indicate that the prevalent disease encountered mainly by farmers is stalk rot, as 36.7% of the interviewees agreed on experiencing the disease several

times. About 30.0% of the farmers interviewed experienced the infestation of the grey leaf spot disease, and 29.3% also encountered the maize rust disease in their maize farms. The least prevalent disease to have affected maize production in the municipality is corn smut since 4.0% of the farmers have encountered this type of maize disease. This result has confirmed the position of MoFA that in 2016, the Ashanti Region lost almost 1,765 hectares of maize fields, representing 48.33% of the maize production land due to disease infestations. This could reduce the expected yield of maize by an average of 12% if not controlled in good time (MoFA, 2017).

Figure 10: Pests and maize production in Asante Akim North Municipality



Source: Field Survey, 2023

The results from Figure 10 above indicate that the pest that most affects maize cultivation is the fall armyworm since 60.0% of the maize farmers interviewed have experienced this infestation in 2017 and 2020 when its outbreak cut across the whole country. 28.7% of the farmers interviewed have experienced the infestation of weevils when they stored their maize grains, while 11.3% of the farmers also said to have encountered maggots in their

maize farms. This assertion by the respondents confirmed that pests and diseases commonly cause low yields in maize production. In 2016, 4,046.60 hectares of maize fields were attacked by the fall armyworm in Ghana. Brong Ahafo Region recorded the highest fall armyworm attack of almost 2,765 hectares of maize fields, representing 68.33% of their total production lost. This reduced the expected maize yield by an average of 12% (MoFA, 2017).

4.4.1 How maize farmers control diseases and pests in the Asante Akim North

Farmers were able to indicate methods of controlling diseases and pests when their farms were attacked. A few of the farmers interviewed indicated that they spray their farms with agrochemicals such as insecticides, pesticides, and other poisonous chemicals to defend the crop. Most of the farmers interviewed indicated they do not have any disease and pest control method due to a lack of knowledge and the required resources to control diseases and pests on their farms. The farmers revealed that they are usually left to their fate whenever diseases and pests attack their farms. They also indicated that the chemicals for spraying the maize crops to control the diseases and pests are expensive and difficult for them to acquire for use. Generally, maize farmers in the municipality face many challenges in controlling diseases and pests due to financial constraints, lack of knowledge in controlling the diseases and pests, and inaccessibility of extension services, which negatively affect the output in the municipality. The challenge of disease and pest control amongst various production stages is particularly pronounced in the small-holder, resource-constrained schemes under which maize is naturally cultivated in the municipality (AANDA, 2016). The use of insecticides to control or treat stored maize is a practice the farmers learn from one another. The study revealed that most of the chemicals used by municipal producers were not of the recommended type for maize. It was interesting to note that the chemicals they were using were not yielding the desired results, yet they still relied on them every year. Farmers found to use unapproved chemicals gave reasons such as lack of information on the chemical from recommended agents, high cost of

recommended chemicals, and the difficulty in finding the sale post of such chemicals for the treatment of stored grain.

In the municipality, the majority (83.3%) of the maize farmers interviewed asserted that they control diseases and pests personally when their farms are attacked, and only 12.0% claimed that they can access extension services when attacked by diseases and pests. Only 4.7% of the maize farmers interviewed had assistance from cooperative groups in controlling diseases and pests on their farms.

Table 14: The help received from agency(ies) in controlling diseases and pests

Agency	Frequency	Percent (%)
Extension officers	18	12.0
Cooperatives	7	4.7
Other (personal)	125	83.3
Total	150	100.0

Source: Field Survey, 2023

Some of the maize farmers interviewed indicated that they burn the dried grasses after harvest to destroy all the causative agents of diseases and pests in the land before planting to protect their farms. One respondent said, "I usually burn my farm before planting for the new season to destroy all disease/pest breeding grounds or pathogens on my farm to save my farm from any disease/pest attack in the future." Despite the negative effects of pests and disease on maize crop production, the role of pest and disease responses can increase crop yield. The traditional way of preventing disease or pest infestation is crucial as it saves costs.

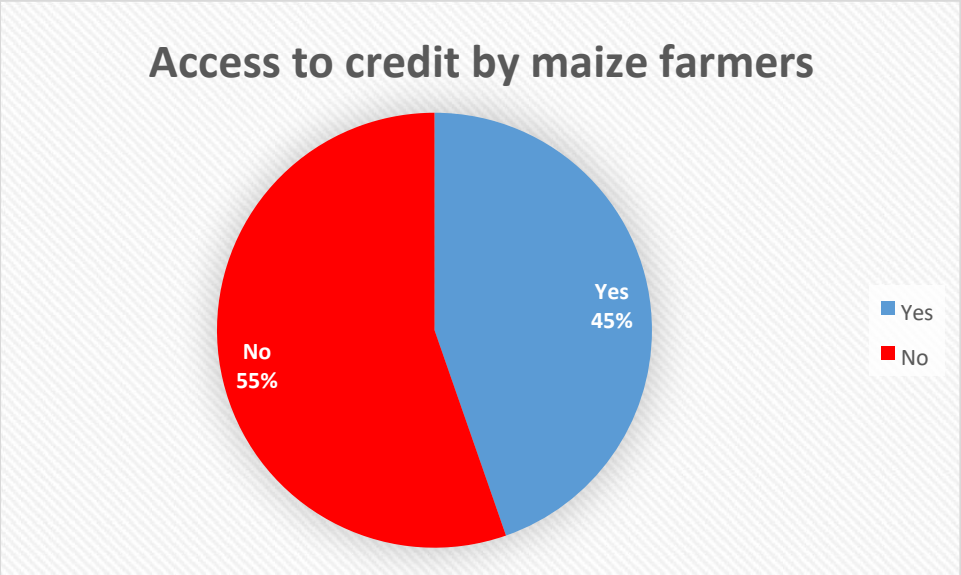
Also, some of the farmers interviewed indicated that they do not have any preventive measures for protecting their farms from diseases and pests. One said, “I don't do anything to

protect my farm from diseases and pest attacks." This could go a long way toward reducing crop yield.

4.4.2 Credit accessibility and maize production in the Asante Akim North

Respondents were asked to indicate whether they receive credit from financial institutions, government, and other sources. Previous research indicates that lack of access to reliable credit is a limiting factor in maize production due to the high costs of modern agricultural production (Obour et al., 2022). These high costs are related to increased input costs for contemporary farmers who must purchase expensive hybridized or genetically modified seeds, mechanized equipment, and fuel, as well as agrochemicals to increase yields. The findings are shown in Figure 11.

Figure 11: Access to credits and maize production in Asante Akim North Municipality



Source: Field Survey, 2023

From Figure 11 above, approximately 55% of the respondents had never received credit from a financial institution, family members, or any other source for producing maize. In

comparison, 45% had received credit from a bank, cooperative union, family, or others. The responses showed that most of the farmers in the municipality do not have access to credit facilities for producing maize. This could be due to limited knowledge, fear of nonpayment of the loan, or lack of collateral. These discoveries confirm Wittlinger (2006), who stated that small-scale producers encounter various hindrances to obtaining credit. These categories of farmers need fixed conditions, planned unions with affiliates, low bills, and a conditional climate because these farmers obtain credit only in these conditions. This assertion showed that the proportion of farmers getting credit is insignificant. The results explain why most farmers in the municipality do not accept contemporary farming practices and, hence, engage in subsistence farming. Farm credit is amongst the crucial factors required for efficient production, and with it, farmers can purchase farm inputs such as farm equipment, transport farm produce, and hire labor. The cultivation of maize is negatively affected in the municipality due to the inaccessibility of credit by maize farmers in the study area.

4.4.3 Fertility of the soil and maize production in the Asante Akim North Municipality

Table 15: Fertility of the soil and maize cultivation in the municipality

Respondents	Frequency	Percent (%)
Yes	150	100.0
No	0	0.0
Total	150	100.0

Source: Field Survey, 2023

All 150 farmers interviewed agreed on the assertion that soil fertility dramatically affects maize production. Most farmers intimated that the soil fertility in the municipality has been declining over the years due to continuous cultivation on the same tracks of land without

replenishing the lost nutrients in the soil. This result has confirmed the assertion of the Asante Akim North Municipality that the forest soils are the fertile soil in the municipality and aid the production of cereals, cassava, plantain, cocoa, oil palm, and vegetables but continually depleting its nutrients due to overexploitation or dependence by human activities (AANDA, 2016). Generally, the fertility requirements for maize are comparatively high and amount to about 200 kg/ha N, 50 to 80 kg/ha P, and 60 to 100 kg/ha K (FAO, 2012) within the soil ratios. The crop can be grown continuously if soil fertility is sustained (Plessis, 2003). The low output of maize in Africa results mainly from the quantity and distribution of precipitation and fertility of the soil, as well as biological factors comprising diseases and pests (IITA, 2009). Based on this assertion, the production of maize in the municipality is affected by soil fertility because the soil nutrients in the municipality are continually depleted. Therefore, crops do not produce to their maximum.

4.4.4 Storage facilities and maize production in the Asante Akim North Municipality.

Table16: Storage facilities used by maize farmers

Storage facilities	**Frequency**	**Percent (%)**
Silos	0	0.0
Sacks	51	34.0
Warehouse	0	0.0
Other (Barn)	99	66.0
Total	150	100.0

Source: Field Survey, 2023

The reaction of farmers to the challenge of storage varied. Most farmers indicated that the primary reason for storing maize was for food and surplus to be sold if there were any. Farmers in the municipality reported that food becomes difficult to obtain during the off-season

(season without planting and harvest); therefore, they do not sell their stored maize. The study revealed that farmers still use conventional storage methods to keep their farm produce. From the table above, most of the farmers interviewed, representing 66.0%, store their produce in a barn. While 34.0% of the farmers store their produce in sacks in a dedicated confined room or facility. One maize farmer interviewed said, "I store my harvest in the barn on my farm because I don't have access to any storage facility that can better ensure the safety of my produce if I convey it to the house." Thus, in the absence of storage facilities, farmers try to find alternative ways to store their yields, which can protect them from post-harvest losses.

Most farmers lamented their inability to access modern storage facilities, which could save them from seasonal post-harvest losses they record due to their continuous reliance on outdated traditional preservation methods. Although traditional storage structures are inexpensive to construct and maintain, they cannot hold commodities, retain moisture, control enzymatic activity and microbial growth, and keep out rodents, insects, and thieves. This assertion could be confirmed by the statement that "Despite significant improvement in food storage methods, many communities in Ghana still use traditional storage methods for food and seed. This has led to shortfalls in maize supply, which has been attributed to improper traditional methods of storage and handling practices" (Armah, 2003). This is because traditional storage structures and improper handling practices provide limited protection against fungal growth insect and rodent damage, especially in areas where the climate is warm and humid, which always adds to post-harvest losses.

4.4.5 Field extension services and maize production in the Asante Akim North

The survey revealed that most of the farmers interviewed (78.0%) had no access to field extension services, as only 22.0% of the farmers interviewed had access to them, as shown in Table 17 below. The poor accessibility of extension services to farmers contributes to the low yield of maize in the study area. Field extension services are a crucial player in the agricultural

sector and have been considered a principal means of technological diffusion into new areas. The limited availability of extension services to farmers and difficulty in accessing the services of these extension workers in the municipality indicates that the adoption of new maize technology and production strategies by farmers would be relatively narrow, and, as such, there would be no improvement in the production of maize. This is per the findings of Bokor (2005), who suggested that access to extension services is the only avenue through which the expected transformations can be achieved in the agricultural productivity of farming communities. However, the few maize farmers with access to extension services indicated they were given some recommended chemicals to spray the crops early to protect them from diseases and pests infestation.

Table 17: Access to extension services in the municipality

Respondents	Frequency	Percent (%)
Yes	33	22.0
No	117	78.0
Total	150	100.0

Source: Field Survey, 2023

4.4.6 Road network and maize production in the Asante Akim North

The survey interviewed 50 maize farmers in the three communities of study to assess the nature of the road network in the municipality and its implication on maize production. The survey results in Table 18 below reveal that most farmers (74%) did not have a good road network linking their community and Agogo, the municipal capital where they transport their produce for sale. While 26% of the farmers (at Magyeda- Nkwanta) complained of a poorly developed road network linking the community and Agogo.

Table 18: Road networks and maize production in the municipality

Respondents	Frequency	Percent (%)
Yes	37	74.0
No	13	26.0
Total	50	100.0

Source: Field Survey, 2023

Moreover, farmers in Magyeda-Nkwanta indicated that during rainy seasons vehicles find it difficult to traverse the Magyeda-Nkwanta to Agogo feeder road because the road is not tarred and most of their farm produce gets spoilt as they find it difficult in transporting the produce to the municipal capital for sale. They also indicated that they are sometimes forced to transport their farm produce by carrying it on a human head or using tricycles (Aboboyaa), which is inconvenient as some of their produce perished. This assertion by the farmers in the Magyeda-Nkwanta community is confirmed by the Asante Akim North District Medium Term Development Plan, 2014 – 2017, which indicates that most of the feeder roads linking rural communities and the district capital are very poor as most of these roads are not tarred. Most maize farmers indicated that the transportation network is vital for cultivating maize. One household head said, "There are delays in transporting the maize produce from the farm to the market centers to sell due to poor road network, making it difficult for vehicles to have access to the farms or community. This makes some of the produce perish as they are left to the mercy of harsh environmental conditions on the farm." This assertion by the farmers has revealed that the transportation network contributes to seasonal post-harvest losses suffered by maize farmers and, as a result, a reduction in maize yield, increase in production costs, and low profit to farmers.

The same 50 farmers indicated the mode of transportation they use to transport their maize produce to marketing centers for sale in the municipality. The results of the survey in Table 19 below revealed that most of the farmers (50.0%) transport their farm produce to market by vehicles/cars, 42.0% of maize farmers use tricycles (Aboboyaa) and (8.0%) of the farmers interviewed indicated that they carry their produce on human head to the market.

Table 19: Mode of transportation of farm produce to the market

Respondents	**Frequency**	**Percent (%)**
Cars/Vehicles	25	50.0
Tricycles (Aboboyaa)	21	42.0
Human Heads	4	8.0
Total	50	100.0

Source: Field Survey, 2023

Table 20: Cross-tabulation of communities and mode of transportation

Name of Community	**Mode of transportation to market centres**			**Total(%)**
	Vehicles/Cars (%)	Tricycles (Aboboyaa) (%)	Human head (%)	
Hwidiem	13 (26.0%)	7 (14.0%)	0 (0.0%)	20 (40.0%)
Ananekrom	9 (18.0%)	8 (16.0%)	0 (0.0%)	17 (34.0%)
Magyeda – Nkwanta	3 (6.0%)	6 (12.0%)	4 (8.0%)	13 (26.0%)
Total, (%)	25 50.0%	21 (42.0%)	4 (8.0%)	50 (100.0%)

Source: Field Survey, 2023

The results from Table 20 above reveal that 26% of maize farmers in Hwidiem transport their farm produce to the market by vehicles/cars, 18% of maize farmers in Ananekrom use vehicles/cars, and only 6% of maize farmers in Magyeda – Nkwanta use vehicles/cars, the low usage of vehicles/cars by farmers in Magyeda-Nkwanta to transport their farm produce as compared to the first two communities is due to the wrong road network as indicated by most farmers in the community. Also, 16% of maize farmers in Ananekrom use tricycles (Aboboyaa) to transport their farm produce, 14% of maize farmers in Hwidiem use tricycles (Aboboyaa), and 12% of maize farmers in Magyeda-Nkwanta use tricycles (Aboboyaa). However, 8.0% of maize farmers in Magyeda-Nkwanta transport their produce to the market by carrying on the human head. The revelation can be attributed to the poor road network linking the community

and the municipal capital through which maize farmers transport their produce. As such, they have no alternative mode of transport other than to rely on human labor to transport their maize produce.

4.4.7 Fertilizer application and maize production in the municipality

Maize farmers were asked whether they applied fertilizer to the land to improve maize production. The results showed that most of the maize producers (54%) interviewed in the municipality do not apply fertilizer on their farmlands, while 41.3% revealed that they apply inorganic fertilizer on their farmlands. About 4.7% of farmers indicated that they apply organic fertilizer on their farmlands (Table 21). According to the maize farmers interviewed, most maize farmers in the municipality do not apply fertilizer, be it organic (animal droppings, household refuse, etc.) or inorganic.

Table 21: Application of fertilizer on maize farmlands in the municipality

Respondents	**Frequency**	**Percent (%)**
None	81	54.0
Organic fertilizer	7	4.7
Inorganic fertilizer	62	41.3
Total	150	100.0

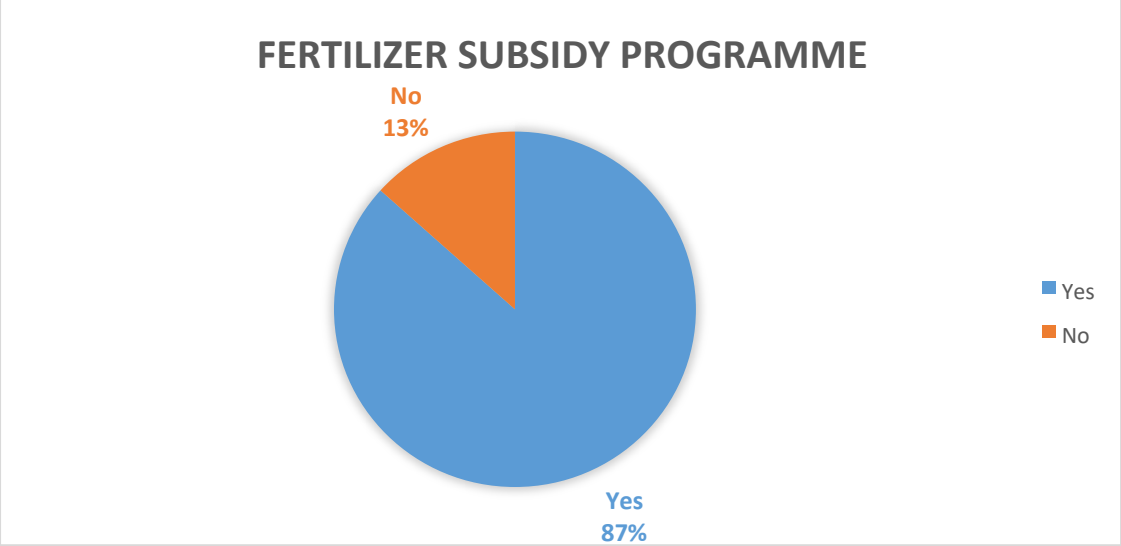
Source: Field Survey, 2023

The results from Table 21 above shows yield potential of maize would be affected by the fertility level of the soil. Maize requires enormous nutrients, especially nitrogen, phosphorus, and potassium. Among these significant nutrients, nitrogen (N) is the one that most often limits yield. It influences the number of leaves the plants produce and the number of seeds per cob, hence the critical determinant of output. (SARI, 2014). This reveals that the yield potential of maize in the municipality is inefficient because most farmers do not apply inorganic

fertilizer, which contains nitrogen content, to supplement the soil to augment the yield of maize in the municipality. This is affirmed by Shamie Zingore (2016), who stated that "high crop yield is achieved when Nitrogen is applied in combination with manure across fields." And this implies that farmers would benefit from secure supply of Nitrogen fertilizers to reliably increase maize yields in Asante Akim North Municipality and across Ghana.

4.4.8 The fertilizer subsidy program in the municipality

Figure 12: Fertilizer subsidy program in the municipality



Source: Field Survey, 2023

The results shown in Figure 12 above indicate that 87% of farmers in the municipality are aware of the fertilizer subsidy program introduced by the Ghanaian government. The government introduced a 50% reduction in fertilizer prices in 2008 to make fertilizer inexpensive for producers and increase fertilizer patronage (FAO, 2012). Most farmers indicated that they had heard about the program but had not benefited; thus, they did not apply inorganic fertilizer on their farms. However, some farmers interviewed intimated that the program has benefited them as the cost of purchasing fertilizer has been reduced, resulting in reduced production costs. Therefore, it has brought about an increase in farmers' profit margins.

4.5 The importance of maize production to farmers in the municipality

Maize farmers were also interviewed to assess whether maize production employs the municipality's people. Most maize farmers interviewed (88.7%) strongly agreed that maize production serves as employment for people in the municipality, and 11.3% of the maize farmers interviewed also agreed to some extent that maize production is an employment opportunity for people (Table 22).

Table 22: Maize production as an employment avenue for people in the municipality

Respondents	**Frequency**	**Percent (%)**
Strongly agreed	133	88.7
Agreed	17	11.3
Disagree	0	0
Strongly disagreed	0	0
Uncertain	0	0
Total	150	100.0

Source: Field Survey, 2023.

The assertion by the maize farmers interviewed, as indicated in Table 22 above, revealed that maize production is an economic activity that provides job avenue for farmers in the municipality, as stated in the Asante Akim North District Medium Term Development Plan 2014-2017, "maize production serves as employment for households as the sector employs 72.7 percent of households in the municipality into Agriculture" (AANDA, 2015). Also, farmers indicated that maize production serves as a source of income for their families for livelihood and payment of utility bills and other debts of the farmers. This was emphasized by one female maize farmer who said: "Engaging in maize farming helps me a lot. There are no jobs in this community except farming, which helps me generate income to cater to my family and care for

my wards in school". Since maize production is a source of livelihood for most of the inhabitants in the study area, its production must be of national interest.

As emphasized by (Oyewo, 2009), the economic benefits of maize cannot be overestimated, and it affects various spheres of life. Most farmers enumerated several reasons why maize is so important to them. Maize cultivation is an employment avenue for them, a source of income, and food for family consumption.

Farmers were also asked to indicate whether the production of maize is profitable; the study revealed that the majority of maize farmers interviewed (87.3%) strongly agreed that maize production is profitable to them, while only a few farmers (12.7%) indicated that the production of maize had not yielded profits for them, which they attributed to the difficulty in acquiring land to cultivate maize crop on a commercial basis rather than subsistence farming.

4.6 The factors that motivate farmers into maize production in the Asante Akim North

The study attempted to investigate the factors that motivate people to take up maize production instead of other crops. Farmers were asked whether maize is the easiest crop to cultivate in the municipality. Most maize farmers interviewed (86.0%) strongly agreed that maize production is the easiest, and 7.3% also agreed to some extent that maize production is the easiest crop to produce. However, 6.7% of the farmers interviewed disagreed that maize is the easiest crop to cultivate. This indicated that maize crops are vulnerable to adverse environmental conditions, and as such, farmers must make sure maize crops are planted at the right time of the season and harvested at the right time. If not, the production yield of maize would always be inferior.

Table 23: Is the maize crop the easiest to cultivate in the municipality

Respondents	Frequency	Percent (%)
Strongly agree	129	86.0
Agree	11	7.3
Disagree	10	6.7
Strongly disagree	0	0
Uncertain	0	0
Total	150	100.0

Source: Field Survey, 2023

Based on the responses from farmers, maize production is profitable to maize farmers in the municipality. Planting and harvesting maize is a pragmatic decision within an economy that enables farmers to grow a crop with minimal inputs and interventions and maximal benefits to farmers.

4.6.1 Other factors that motivate farmers into maize production in the municipality

Based on the maize farmers interviewed, 33.3% indicated that a ready market for maize motivates them to cultivate the crop, 31.4% of the farmers asserted that maize serves as a staple food for their families, 17.3% indicated that maize production is a source of income for them, 13.3% of the maize farmers indicated that, availability of land to them for the cultivation of maize attracts them into maize farming. In comparison, 4.7% of the maize farmers indicated that access to credit motivates them to cultivate maize (Table 24).

Table 24: Factors that motivate farmers into maize production in the municipality

Factors	Respondents	Percent (%)
Access to loan	7	4.7
Ready market	50	33.3
Availability of land	20	17.3
Food staple for family	47	31.4
Source of income	26	17.3
Total	150	100.0

Source: Field Survey, 2023

4.6.2 The buffer stock company in the country

The survey interviewed 50 maize farmers in the three study communities to assess whether maize farmers have knowledge of the buffer stock company in the municipality and how it helps reduce post-harvest losses. The buffer stock company can be explained as a definite public entity mandated to buy, preserve, store, sell, and distribute surplus grains in designated distribution centers across the nation. (FAO, 2012). The Ghanaian government created the buffer stock company to support farmers across the country and make agricultural production more predictable. Most of the maize farmers (78.0%) interviewed stated that they are not aware of the company in the municipality, and 22.0% of the farmers interviewed indicated that they are aware of the company in the municipality, especially the maize farmers in the Hwidiem community that is closer to the municipal capital and urbanized as compared to the other two study communities (Ananekrom and Magyeda – Nkwanta).

Table 25: Buffer stock company in the municipality

Respondents	Frequency	Percent (%)
Yes	11	22.0
No	39	78.0
Total	50	100.0

Source: Field Survey, 2023

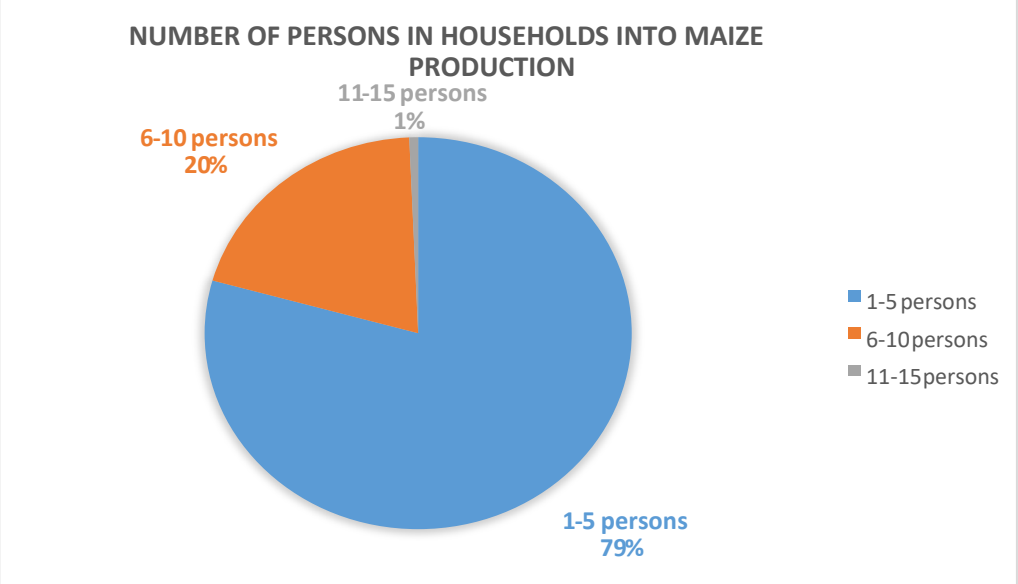
A few farmers indicated that the company provides them with a ready market for their produce and buys their maize produce at a profitable price even when prices are low in the open market. As a result, farmers are encouraged to go into maize cultivation in the municipality as there is an available market for their produce. A farmer in Hwidiem had this to say, "The company has been helpful to farmers in this area; it provides a market for us to sell our maize produce at a profitable price during bumper harvests and also sells the maize grain to us at affordable prices any time of the year for consumption". This assertion by most of the farmers comes to support the argument of NAFCO (2014) that the intervention has attracted a lot of farmers into maize cultivation and, as a result, an increase in yield of maize from 102,100 metric tons in 2011 to 227,277 metric tons in 2014.

4.7 The percentage of farmers engaged in maize production in Asante Akim North

Figure 13 below shows the total households of farmers interviewed engaged in only maize cultivation. The majority (79.3%) of the farmers interviewed indicated that 1-5 persons in their households within the municipality are involved in maize production. 20.0% of farmers interviewed indicated that an average of 6-10 persons in their household cultivate maize as an economic activity. At the same time, only one household has 11-15 persons engaged in maize production. This is to confirm that five persons in a household engage in maze production.

Planting, caring for, and harvesting maize across Asante Akim North Municipality is a household effort. This also indicates the household head is less relevant in this analysis, as multigenerational collections of males, females, children, and grandparents likely engage in harvesting maize across the growing seasons.

Figure 13: Number of household members engaged in maize production in the municipality



Source: Field Survey, 2023

4.8 Summary of chapter

This chapter has presented and discussed the results of the data gathered from the field survey through qualitative and statistical analytical tools. The chapter initially presented the respondents' demographic information, including gender, age, marital status, and educational background. Most of the farmers involved in this study were in the age range of 26-45, demonstrating that maize production is attractive to the youth in the municipality. The chapter also highlights the trend of maize production in the municipality from 2013 to 2022. The secondary data obtained from the MoFA directorate in the municipality revealed that maize production in the municipality has been increasing in recent times, and the contributing factors

have been discussed. The relevance and motivations of maize production, as emerged from the field survey, have also been discussed in this chapter.

V. SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter contains the summary of findings, conclusion on the study, and recommendations based on the findings of the study. The section also highlights the limitations of the survey. The study analyzed the structure and trend of maize production in Asante Akim North Municipality and the determinants of this pattern of maize production. One of the key findings of the study reveals that the trend of maize production in the municipality is not static, as the yield and area planted to maize has since not been stable. Despite increasing unpredictability of weather patterns, both the area of land under maize cultivation and the yield of maize are both increasing. The land tenure system and destruction caused to farmlands by activities of nomadic herdsmen are other drivers of maize production in the study area.

The study also revealed that about half of the farmers do not own land but acquire land through the land custodians. It was also discovered that many farmers rent or acquire land through the *Abunu* system and females tend to use rent and utilize sharecropping agreements more frequently than males. The findings also revealed that most male maize farmers own the land, unlike their female counterparts, who mainly rent land for farming.

Regarding the factors that affect maize production in the Asante Akim North Municipality, the study revealed that rainfall patterns affect production as maize cultivation is not mechanized to provide irrigation but rather rain-fed. The study also discovered that diseases and pests infestation affect the output of the maize crop, which always causes a reduction in the yield of maize and increases production costs. The survey revealed that a few maize farmers are able to control diseases and pests using agrochemicals to spray their farms, while majority of them do not control diseases and pests due to lack of knowledge in diseases and pests control, financial constraints and inaccessibility to field extension services.

The study further revealed that most farmers in the study area do not have access to credit facilities. Some respondents get assistance from cooperatives and family members for their farming activities. This could be the reason why maize farmers in the study area are unable to adopt improved methods of farming. Modern agricultural production is a capital-intensive endeavor, and farmers without access to capital will continue to struggle to increase yields and reliability.

In the study further revealed that farmers still use the conventional methods of storage in preserving their farm produce, justifying why post-harvest losses are so rampant in the study area since traditional storage structures are saddled with improper handling practices providing limited protection against fungal growth, insect and rodent damage, especially in areas where climate is warm and humid.

In terms of fertilizer application, it was found that the low yield recorded annually by maize farmers in the study area is due to the failure to apply fertilizer. Closely linked to fertilizer application is the Fertilizer Subsidy Programme introduced by the government in 2008. The study found that most of the farmers only heard about the programme but have not benefited from it hence, the failure of most farmers to apply fertilizer on their farms.

The state of the road network was also looked at. Two out of the three study communities (Hwidiem and Ananekrom) did not have any peculiar challenges regarding accessibility to both the market and farms. However, one of the study communities (Magyeda Nkwanta) had issues with their road network. Vehicles do not have easy access to farms and the community in the rainy season, leaving most farmers no option other than employing the services of human labor to convey their produce to the market and home.

The survey revealed that a number of factors attracted people to maize cultivation in the Asante Akim North Municipality. Among them are comparatively, maize is the easiest

crop to cultivate hence its attractiveness to farmers, availability of ready market for the maize produce, as well as maize serving as staple food and a source of income for farmers.

5.2 Limitations of the study

The major challenge that mitigated against the study had to do with time. The researcher intended to cover a broader territory in the municipality. However, due to time constraints, it was not possible to cover most of the farming communities in the study area. The researcher therefore selected three communities for the study. This however, did not affect the findings of the study since all the vital information needed were provided by the informants within these communities.

Again, some of the participants who had initially accepted to participate in the survey after explaining the study's intention to them later decided not to participate since they were no longer interested in the survey. Therefore, the researcher had to find new participants to replace those who had left, which was very challenging. Also, some maize farmers were reluctant to divulge critical information on variables such as maize yields, farm extent for fear of denial of any assistance from government. However, farmers were made aware of the research objective and assured of the confidentiality of any information given.

5.3 Conclusion and recommendations

Maize cultivation is the major contributor to household income and promotes food security in the municipality. However, it is evident from the study that most farmers cultivate maize because the crop has ready market and farmers make profit from the sales of maize produce. Approximately 79% of households in the municipality are engaged in maize production. Maize production in the Asante Akim North Municipality is mostly done by non-

formally educated males aged 25-45. Most maize farmers do not own land and obtain access through the land custodians by renting or shared agreement such as *abunu*.

In general, the study concludes that maize production in the Asante Akim North Municipality is a viable economic activity for many households. Drawing from the outcomes of the survey, several recommendations have been proposed, as captured below:

1. To increase the maize production yield in the study area, the farmers should be given opportunities to undertake formal, non-formal, or some training workshops to upgrade their farming methodology.
2. Also, a demarcation of grazing reserves for the nomadic herdsmen on a portion of the municipality's forest by the government through the Forestry Commission would help reduce the destruction of maize farms.
3. The government should employ more Agricultural Extension Officers (AEAs) and resource them adequately to educate maize farmers on environmentally sustainable maize production practices.
4. Moreover, the Central Bank of Ghana can give a particular directive to financial institutions to inject most of their loan portfolio into the agricultural sector. In addition to that, farmers should reinvest or plow back their profit as additional credit.

5.4 Areas for future research

Additionally, yield gap analysis for maize production should be undertaken to determine the significant constraints militating against improved maize yield in the municipality. The comparative study can examine the maize production trend in the study area and other maize-producing districts in Ghana to tease out the challenges facing maize production in Ghana so that pragmatic measures can be recommended to mitigate them.

Potential researchers can also analyze rainfall, temperature, and maize yield trends in the study area employing different statistical techniques such as Mann-Kendall trend test. Also, the interviews in the survey can be complemented with focus group discussions as a data collection instrument in future research. Lastly, other drivers not considered in the present study can be accounted for by future researchers. For instance, urbanization/migration can be considered by potential researchers as a variable in the assessment of maize production in the study area and beyond.

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A. HSIRB Approval Letter

IRB-2023-121 - Initial: Exempt Approval_VChair

From: do-not-reply@cayuse.com
To: Lucius F Hallett lucius.hallett@wmich.edu, Vincent Osei vincent.osei@wmich.edu
Date: Tue, 18 Jul 2023, 8:27 AM

Attention: This email is from outside Western Michigan University. Use caution when opening links and attachments.

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: July 18, 2023

To: Lucius Hallett, Principal Investigator

Re: Initial - IRB-2023-121
MAIZE PRODUCTION IN GHANA: THE CASE STUDY OF ASANTE AKIM NORTH MUNICIPALITY

This letter will serve as confirmation that your research project titled MAIZE PRODUCTION IN GHANA: THE CASE STUDY OF ASANTE AKIM NORTH MUNICIPALITY has been reviewed by the Western Michigan University Institutional Review Board (WMU IRB) and **approved** under the **Exempt** 7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

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The conditions and duration of this approval are specified in the policies of Western Michigan University. You may now begin to implement the research as described in the application. **Please note:** This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., ***add an investigator, increase number of subjects beyond the number stated in your application, etc.***). Failure to obtain approval for changes will result in a protocol deviation.

1 / 2

In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB or the Associate Director Research Compliance for consultation.

If required: Stamped Consent Document(s) location - Study Details/Submissions/Initial/Attachments

The Board wishes you success in the pursuit of your research goals.

Sincerely,

Robert Wall Emerson, PhD, Vice Chair WMU IRB

For a study to remain open after one year, a Post Approval Monitoring report (please use the continuing review submission form) is required on or prior to (no more than 30 days**) June 26, 2024** and each year thereafter until closing of the study. When this study closes, complete a Closure Submission.
Note: All research data must be kept in a secure location on the WMU campus for at least three (3) years after the study closes.

B. Informed Consent

Western Michigan University
Department of Geography, Environment, and Tourism

Principal Investigator: Lucius Hallett IV
Student Investigator: Vincent Osei
Title of Study: Maize Production in Ghana: The Case Study of Asante Akim North Municipality

You are invited to participate in this research project titled "*Maize Production in Ghana: The Case Study of Asante Akim North Municipality.*"

STUDY SUMMARY: This consent form is part of an informed consent process for a research study, and it will provide information that will help you decide whether you want to participate in this study. Participation in this study is completely voluntary. The research aims to bring to bear all the factors causing fluctuations in maize production and will serve as Vincent Osei's research project for the requirements of the MSc degree in Geography. Participants in this study will be asked to have a say about how the municipality's maize production trend has been from 2013 to 2022. Your time in the study will take ***30-45 minutes***. Possible risks and costs to you for taking part in the study may be spending 30-45 minutes answering concise and simple questions, and potential benefits of taking part will benefit participants after the study in terms of improving the farming experience. Your alternative to participating in the research study is not to participate.

The following information in this consent form will provide more detail about the research study. Please ask any questions if you need more clarification, and we will assist you in deciding if you wish to participate in the research study. You are not giving up any of your legal rights by agreeing to participate in this research or signing this consent form. After all your questions have been answered and the consent document reviewed, you will be asked to sign this consent form if you decide to participate in this study.

What are we trying to find out in this study?
This study is therefore geared towards a historical survey of maize production in Ghana through a case study of Asante Akim North Municipality.

Who can participate in this study?
Persons who are Ghanaians aged 18 years and over will be included in this study. Persons who are non-Ghanaians and below 18 years will be excluded from the study. Anyone with vision or hearing impairments will be excluded.

Where will this study take place?
The study will occur in the Asante North Municipality, Hwidiem, Magyeda-Nkwanta, and Ananekrom.

C. Interview Questions

WESTERN MICHIGAN UNIVERSITY, KALAMAZOO, MICHIGAN.
DEPARTMENT OF GEOGRAPHY, ENVIRONMENT, AND TOURISM
RESEARCH QUESTIONNAIRES ON THE TOPIC: Maize Production in Ghana: The Case Study of Asante Akim North Municipality

This research partially fulfills the Master of Science Degree in Geography, Environment, and Tourism. The researcher kindly requests that you answer the following questions as best you can. The researcher assures you that your information will be protected, and your identity shall not be revealed. Your cooperation in this regard is important and is most appreciated. Participation in this project is voluntary. Interviewees may end the questionnaire session at any time.
Thank you for accepting my request.

Questionnaire for inhabitants of the selected communities for Data Collection:
Name of community .....
Please tick [√] or fill in the spaces provided where appropriate.

1. What is your occupation?
1. Farming [ ] 2. Trading [ ] 3. Carpentry [ ]
4. Other (specify).....

2. What is your major crop of cultivation?
1. Maize [ ] 2. Plantain [ ] 3. Cassava [ ]
4. Other (specify).....

3. How much land is available to you as a farmer for maize cultivation?
1. 0-3acres [ ] 2.4-7 acres [ ] 3. 8-11acres [ ] 4. 12+ acres

4. Do you rent the land for maize cultivation, or do you own it?
1. Rented [ ] 2. Owned [ ] 3. Other (specify).....

5. How many acres of land do you use to cultivate maize in a season?
1. 0-3 [ ] 2. 4-7 [ ] 3. 8-11 [ ] 4. 12+ [ ]

6. Do you agree that rainfall affects maize production output?
1. Yes [ ] 2. No [ ].

7. Do you cultivate maize in the two seasons available in the year?
1. Yes [ ] 2. No [ ]

8. If yes, which of the two seasons do you cultivate the most?
1. Major season (March-July) [ ] 2. Minor season (September-November) [ ]

9. Does the fertility of the soil affect crop yield?
1. Yes [ ] 2. No [ ]

10. Why do you grow maize instead of other crops?
1. Availability of market [ ] 2. Good roads [ ] 3. Rainfall reliability [ ] 4. Availability of maize seed [ ]

11. Does the government support farmers engaged in the cultivation of maize?
1. Yes [ ] 2. No [ ]

Interview questions-continued

12. What is the form of support you get from the government?
1. Subsidized fertilizer [ ] 2. Farm equipment [ ] 3. Financial support [ ]
4. Other (specify)……

13. What motivates you to do maize farming?
1. Access to loans [ ] 2. Ready market [ ] 3. Availability of land []
4. Other (Specify)……

14. If yes, what is the source of credit?
1. Banks [ ] 2. Co-operatives [ ] 3. Family members [ ]
4. Other (specify)……

15. How does the availability of credit help you in your maize farming activities?
1. Purchase of farm inputs [ ] 2. The hiring of farm labor [ ]
3. Transportation of farm produce [ ] **4. Other (specify)**……

16. Regarding subsistence (food) for your household, how helpful is maize to you as a farmer?
1. Staple food for the family [ ] 2. Feed for my animals [ ]
3. A symbol of wealth [ ]
4. Others (specify)……

17. The maize crop is the easiest to cultivate.

1. Strongly agree [ ] 2. Agree [ ] 3. Disagree [ ] 4. Strongly disagree [ ]
5. Uncertain [ ]

18. Maize crop farming is an employment opportunity for the people of Asante Akim North Municipality
1. Strongly agree [ ] 2. Agree [ ] 3. Disagree [ ] 4. Strongly disagree [ ]
5. Uncertain [ ]

19. Is the cultivation of maize profitable?
1. Yes [ ] 2. No [ ]
Explain……

20. How many maize farmers are in your household?
1. 1-5 [ ] 2. 6-10 [ ] 3. 11-15 [ ] 4. 16+ [ ]

21. How do you fertilize your farmland?
1. Organic fertilizer [ ] 2. Inorganic fertilizer [ ]

22. How helpful has the Fertilizer Subsidy Program been for your maize farming activities?
Briefly **explain**……

23. How do you store your farm produce after harvest?
1. In silos [ ] 2. In sacks [ ] 3. Warehouse [ ]
4. Others (specify)……

24. Do you have a ready market for your farm produce (maize)?
1. Yes [ ] 2. No [ ]

Interview questions-continued.

25. If yes, which diseases/pests have you encountered on your farm?

Diseases	Pests
1. Corn smut [ ]	1. Fall armyworm [ ]
2. Stalk rot [ ].	2. Spider mites [ ]
3. Grey leaf spot [ ].	3. Maggots [ ]
4. Maize rusts [ ]	4. Weevils [ ]
5. Other (specify)…….	**5. Other (specify)……**

26. How do you control diseases/pests affecting your crops?

……
……

27. What preventive measures do you take to safeguard your farm from disease/pest infestation?

……
……

28. How does disease/pest affect your maize production?

1. Reduce yields [ ] 2. Increased production cost [ ]
3. Discourage maize production [ ] 4. Other (specify)……

29. Which agency (ies) helps control disease/pest on your farm?
1. Extension officers [ ] 2. NGOs [ ] 3. Co-operatives [ ]
4. Other (specify)……

30. What other factors do you think affect maize production in this area?……

31. Sex (gender): 1. Male [ ] 2. Female [ ]

3. Age: 1. 18-25 [ ] 2. 26-35 [ ] 3. 36-45 [ ] 4. 46-55 [ ] 5. 56+ [ ]

33. Marital status: 1. Married [ ] 2. Single [ ] 3. Divorced [ ] 4. Single parent [ ]

34. Educational Status. 1. None [ ] 2. Primary [ ] 3. JHS [ ]
4. Secondary [ ] 4. Tertiary [ ]