**Unveiling the Economic Potential of Smallholder Pepper Production in the Kumbungu District of Northern Ghana**


## Abstract

This study examines the economic benefits and constraints associated with smallholder pepper production in the Kumbungu District of Northern Ghana. Using a multistage sampling method and semi-structured questionnaire,data were gathered from 200 pepper producers from various communities within the district. Gross Margin analysis, descriptive statistics and Kendall's Concordance method were employed to analyze the data. The results revealed that male farmers dominated with 88% whiles the remaining 12% were women, the mean age of the respondent was 34.21. Majority of the respondents were married (72.5%) while the remaining were single (27.5%) with no divorcees or widows. 85.5% cultivate pepper on farm size between 1.1 to 2.0 hectares with relatively highest mean productivity. In addition, pepper production in the study area is profitable due to GH₵1.98 return for every GH₵1 invested.Major factors identified and ranked as the main constraints in order of importance were; Insufficient working capital, High cost of production inputs, Low level of government support, Inadequate storage facilities, Perishable nature of pepper, Poor mode of transportation, long distance to market, difficulty in getting land for production and insufficient knowledge in pepper production. Therefore, NGOs and Financial institutions who have interest in agriculture should offer credit facilities to pepper farmers for expanding production. The provision of incentive in the form of subsidy, cost-sharing, price control among others should be instituted by the Government, MOFA and Non-Governmental Organization to aid in the expansion of pepper production in the study area.



**Keywords:**Economic benefits, Descriptive Statistics, Pepper production, Northern Ghana




## Introduction

The agricultural sector continues to be an anchor of development in Ghana. Research indicates that in 2019, the sector's contribution to the country's GDPwas about 20%, employment of the total workforce by the sector was about 45%(GSS, 2019).A growing number of people are therefore turning to a variety of income-generating activities as a means of eradicating poverty and improving rural livelihoods in developing countries including Ghana. One of these activities is vegetable production under irrigation which enables all year-round production (Adams et al., 2023). With respect to agriculture in Ghana, there are two types of crop farming that is large scale production for commercialization, and relatively small-scale cultivation primarily for home subsistence. The majority of Ghana's large-scale farmers have the knowledge of not seeing agriculture only as an activity to provide household food security but also as an enterprise established to efficiently utilize their farming expertise for income generation(Forkuor et al., 2022).

Pepper is one of the important vegetables that is being cultivated in the Northern Region of Ghana. It is either cultivated in backyards for subsistence use or on a relatively large scale for commercial purposes. It is the most widely used spice, providing consumers with nutritional benefits, including vitamin A and E, as well as flavoring and coloring to food(Gobie and Yildiz, 2019). The nutritional value of pepper cannot be over-emphasized. Pepper, whether hot or sweet contains vitamin that contributes to building of healthy body immune system that prevent individuals from cold and flu than any other vegetable. Pepper is not only a nutritional crop but also an economiccrop which is the world's second important vegetable, ranking after tomatoes. It is the most produced type of spices that is used as medicine and antioxidant compounds (Lee et al., 2020). In Ghana, there is a considerable increase in demand for pepper. Almost all Ghanaian cuisines includes it, whether fresh or dried. Pepper is a high-value cash crop grown in Ghana for export and domestic consumption. In addition, the urban metropolis mostly serves as a marketplace or hub where others from nearby metropolitan areas and regions purchase in large quantities to be sold to ultimate consumers(Adams et al., 2023).

Due to high demand for vegetables such as pepper resulting from the rising population in Ghana, its production has become a lucrative business for some farm households. Pepper production which is perennial is cultivated twice yearly (dry and wet seasons), and this has a significant impact on its growth and yield as well as the profit margin of pepper producers (Alegewe et al.,

2023). However, there are some constraints that these producers face in their quest to meet the demands of their ultimate consumers. Given the fact that agriculture has complex problem which seems to be infinite over the years, researchers seem unable to provide studies that depict the causes and consequences of economic analysis of pepper production(Hegena and Tigistu, 2022). On this basis, this study tries to unveil the economic potential and constraintsof pepper production in Kumbungu District of northern Ghana

Most people believe that increase in population size and agriculture are incompatible activities that compete for limited land space. The trend of rising number of people in various areas of the region, leads to a rise in food demand, access and security(Woodhill et al., 2022). This study however, can provide immediate answers and restorative approaches to food problems and related obstacles, particularly highly limited access to resources for the production of vegetables. It will also serve as a motivation to increase the participation of the rising young population in agriculture as a side job opportunity they can utilize alongside other service sector employment, or as full-time work. Planners and policymakers will gain valuable information that will aid them in their planning and decision making, to place a greater emphasis in supporting and developing agriculture in the study area. For individuals who would want to venture into the production of vegetables such as pepper, the study may also serve as a guide in giving them adequate information on how to minimize cost of production and maximize profit margin, as well as providing them with knowledge about the various challenges that one may face in the business of pepper production within Kumbungu District.

## 2.0 Literature Review

### 2.1 Importance of Pepper Production in Ghana

The AVRDC (2006) reports that compared to growing basic crops, vegetable cultivation offers peasant farmers a substantially better revenue and extra opportunities. The possibility for reducing poverty and enhancing food security is however assured. A significant high-value cash crop in Ghana is the chili pepper (*Capsicum annuum*), which is mainly grown for local use and export by both urbanized and countryside residents. In addition to its commercial worth, pepper is an essential crop because of the fruits' high nutritional value, medical properties, and availability of natural pigments and antioxidants (Howard et al., 2000). Capsaicin, a phenolic component, is what gives peppers their pungency. Vitamins A, C, and E, thiamine, beta carotene,

folic acid, and vitamin B6 are present organic nutrients of pepper. Condiments, spices, pickles, and sauces are various forms in which pepper can be processed into. Food is garnished with it to increase flavor and taste. The international market for pepper has experienced a significant growth in interest and demand in subsequent years, rendering the crop economically significant. In contradiction to peppers from other areas of the world, Ghanaian peppers, particularly the Legon 18 variety, are well-known for their exceptional recognition in the European markets. This is because of their great taste and longer shelf life. Most food processing industries in Ghana utilize it to produce flavor-infused spices, to season processed food, whiles food vendors also use it to prepare delicious dishes that are devoured by many people. In terms of pepper production, Ghana has been found to have comparative and competitive advantages over other African nations, coming in fourth place behind Egypt, Nigeria, and Algeria (MiDA, 2010). An effective agriculture policy should therefore acknowledge this and enhance it.

**2.2Production of Pepper in Ghana**

Around 27.6 million tons of fresh chili and sweet peppers were produced globally in 2012 (MIDA 2010). 888,400 tons of this production came from Ghana and Nigeria. Nevertheless, more than 70% of the world's chili pepper is produced in China, Mexico, and Turkey, making them the top three producers. With an approximated total production of 88,000 metric tons in 2011, amounting for $96,397, Ghana was also ranked as the 11th largest pepper producer in the world and the second largest producer in Africa (FAOSTAT, 2011). After cassava, plantains, and yams, peppers come off as the fourth most widely grown crop, with enormous market potential. Approximately 984,586 farmers cultivate peppers (GSS, 2019).

The basic impediments on pepper yield are those pertaining to water or nutrient shortages, out of all the conditions that can affect pepper productivity. Owing to its tolerance to warm, humid climates with temperatures between 18 and 30 °C, pepper thrives in tropical environments. The development and absorption of nutrients by soil are influenced by slight environmental changes. For the best growth (early and late reproductive phases) and output of peppers, well-drained moisture-holding loamy soil with higher proportions of N, P, and K and other micronutrients is recommended. In the wet and dry seasons, pepper cultivation and growth start in the months of April and August, respectively.

Due to the lack of or high expense of irrigation systems, the majority of rural pepper farmers rely primarily on rainfall, which causes a decline in the availability and level of production of fresh pepper during the dry season. Up until about 1995, pepper was typically produced on a modest scale to suit domestic demand. Bigger scale production commenced later for exports, with a high yearly production that began to fall in 2004. The spread of pests and illnesses on farms, the difficulty of handpicking peppers by bending over for extended periods of time, and no access to financing facilities to maintain and increase production are some issues that pepper growers have had to deal with throughout the years. In terms of their production and marketing, price changes might be seen as a barrier for pepper growers.

Middlemen (wholesalers and retailers), who visit farm gates to buy outputs that is ready for the market, disseminate vegetables such as pepper across the nation. The reason for this is that, there are obstacles established by cooperatives that market intermediaries purposefully organized in order to implement price and quantity regulation measures aimed at preserving product price stability and reducing product gluts in the marketplaces (VanAsselt et al., 2018). To the detriment of the farmers, it appears that the speculative actions and functions of these middlemen in the supply chain are considered exploitative. Nevertheless, it is suggested by Boateng et. al. (2023) that pepper farming offers farmers with greater and more consistent earnings since production is extremely lucrative irrespective of the numerous production problems that are involved.

### 2.3 Household Benefits of Pepper

In comparison to growing basic crops, vegetable cultivation offers smallholder farmers a substantially greater revenue and more jobs. From the perspective of rural farmers, pepper is produced either for domestic use or commercially to earn cash to pay for other household expenses. According to information from the Ghana Living Standards Survey IV (GLSS IV, 2000), the yearly demand for pepper is estimated at GH₵ 27,000.00 and represents around 9.6% of all food expenditures in Ghana. Consumption is also anticipated to increase with rising population. In nearly every region of the nation, pepper has a ready market. It can be eaten fresh, dried, or processed Nkansah et al (2011).

According to Grubben and Denton's (2004) study, the pungent pepper varieties are used in local medicine, particularly by herbal practitioners who produce ointments for rheumatism and joint

problems. They are however ingested in low amounts as a condiment or spice to season food and increase appetite. Practically all Ghanaian cuisines contain pepper. It is used to make soup and stew as well as the popular pepper sauce known to most Ghanaians as "shito", which serves as accompaniments to foods like cereal and root vegetables. It is also used to make toothache and sore throat medicines (Saleh et al., 2018). There should nevertheless be techniques to enhance the production of pepper, with the anticipation of stabilizing prices, generating jobs and boosting income for the rural pepper producers.

**2.5 Marketing of Pepper**

Agricultural marketing outlines every activity that takes place between the time a farmer plans to fulfill demand expectations and market potential and the time the produce is delivered to the consumer (Ferreira et al., 2022). Pepper is one of the major vegetables cultivated in Ghana with high local and international market potential. It is usually purchased from the farm gates of rural farmers by middlemen and subsequently sold to other distributors such as wholesalers and retailers till it becomes accessible to the ultimate consumers. But the amount paid to the producers locally is frequently far less than what is offered on the global market (Darkoh, 2002).

It is however significant at the country's export level as it generates revenue for the provision of other social amenities. Prior to the production and marketing of pepper, the market niche as well as the ultimate consumers are taken into consideration. Production of peppers has a significant potential for revenue generation due to its rapid growth hence, a good commodity for alleviating poverty.

**2.6 Constraints of Pepper Production in Ghana**

Despite the existence of numerous initiatives to strengthen the agricultural industry, it still faces countless issues over the years. However, a number of problematic biotic (pests and infections) and abiotic (climate, including drought, flooding, high winds, extreme temperatures, and sunlight, as well as soil moisture and nutrient content), have an impact on pepper productivity. In addition to this, pepper producers are confronted with challenges such the ongoing rise in the cost of production inputs, which are intended to be substitute technology and management systems to boost production efficiency(Abate et al., 2019).

Due to lack of money and access to credit facilities from financial institutions, which are brought about by insufficient revenue and a lack of farm records to act as a credit guarantee, respectively, farmers are unable to obtain some or most of these inputs(Anang and Asante, 2020). Other barriers to pepper production include lack of viable disease-resistant seeds, insect and disease outbreaks, poor road conditions that elevate transportation costs, post-harvest losses due to the perishable nature of pepper and insufficient storage facilities. Given the time-sensitive nature of pepper farming, there should be an assurance strategy to address these issues to improve production and productivity. The returns (i.e., gross and net margins) in pepper businesses are significantly impacted by issues with pepper production.

## 3. Methodology

### 3.1 Study Design

Before undertaking research, it is necessary to develop standards that will provide structure, guidance and direction to the study so as to not lose sight of the research question (Best, 2003). Quantitative and qualitative surveys were used in conducting this research. This approach is a form of gathering data that involves asking people, identified as respondents, for information through verbal or written questions. These are usually persons who have specific information, have witnessed certain events, or have been involved in a social process that the researcher is interested in, and hence satisfy the research objectives/questions (Ahiadeke, 2008).

### 3.2 Study Area

With the enactment of L. I. 2062 in 2011, the Kumbungu District was separated from the former Tolon/Kumbungu District. On June 28, 2012, it was officially established, with Kumbungu having to serve as its capital. The district is bordered to the north by Mamprugu/Moagduri District, to the west by the districts of Tolon and North Gonja, to the south by the district of Sagnerigu, and to the east by the municipality of Savelugu/Nanton. One of the smallest of the sixteen districts in the Northern region, the district has a total land area of 1,599 sq. km. The projected population of the five sub districts that make up Kumbungu district, which includes 144 settlements, is 46,171. It has a single rainfall season that last from May to October, and a dry season from November to March. The amount of rainfallwithin a year is between 1005 and 1150 mm, with August experiencing the highest rainfall. The area is part of the savannah vegetation

zone, which is dominated by large grasslands highlighted by widely dispersed, economically important trees including baobab (*Adansonia digitata*), dawadawa (*Parkia biglobosa*), acacia (*Acacia cognata*), and shea trees (*Vitellaria paradoxa*). Subsistence and peasant practices continue to be prevalent in the region, with an approximated 60 to 70% of the total population involved in agriculture. They mostly grow crops including millet, sorghum, yams, groundnuts, rice, and maize. Along with economic crops including cotton, tobacco, and cashew, garden eggs, tomatoes, peppers and okra are also planted. Livestock and poultry production are among the district's further agricultural pursuits. The majority of women work in petty trading, shea butter production, and dressmaking, among other occupations. Thus, the district's role in pepper production will be the subject of this study. To examine the pepper production economically, specific areas will be captured. Figure 1 represents the map of Kumbungu District of Ghana.


Fig. 1 Map of Kumbungu District. Source:Lahabalikɔligu:Kumbungu district map.png - Dagbani Wikipedia**.**

### 3.3 Sampling procedure and Data Collection

This study used a multi-stage sampling procedure to collect household data in June 2022. Two types of sampling-purposive and stratified random sampling procedures were used in this research. The specific communities and farmers that practice pepper production were determined using a purposive sampling strategy. 200 farmers were chosen for the research, each growing pepper variety of either traditional or improved. The study also used the stratified simple random sample method to find respondents because, it is considered that this method will not influence the representation of the samples, (thus farmers representing each community) but will ensure that all farmers have an equal chance of being chosen. Data was gathered from various communities in the district, using Participatory Research Appraisal methods and techniques such as field visits, interview, personal observations and individual interviews using questionnaires. The questionnaire was designed with both open-ended and closed-ended questions. Closed-ended questions make it easier for respondents to react quickly and precisely, and easier for the researcher to collect and summarize responses as well. Open-ended questions are employed to allow respondents to express their own opinions on the subject.

### 3.4 Method of Data Analysis

To make the acquired raw data relevant and to develop reasonable conclusions based on the research findings, they were carefully structured, summarized, processed, and evaluated using proper data analysis procedures. The data gathered through the questionnaire were quantitatively analyzed and presented using statistical methods such as frequency distribution, tables and bar graphs, and percentages. Statistical tool such as Stata was utilized for all data entries, coding and convections. The information gathered through interviews and personal observations were qualitatively and quantitatively examined. Descriptive statistics was used to analyze and present the productivity levels of pepper production with the aid of tables, bar charts and frequency distributions. Gross margin, Net margin and Return on Investment (ROI) were used to analyze the profitability of pepper production in the study area, with the following formulae:

Gross Margin=Total Revenue-Total Variable Cost

Net Margin=Total Revenue-Total Cost

Return on Investment=Net Margin/Total Production Cost

The constraints faced by pepper producers were analyzed using Kendall's Concordance Coefficient which is given by the relation:

$W = \frac{12*S}{[p^2(n^3-n)-pT]}$ *where W, P, T, S* and *n* represents Kendall's Concordance Coefficient, Number of respondents (urban pepper producers) who are ranking the constraints, Correction factors for tied ranks, Sum of square statistic over the row sums of ranks (Ri) and Number of constraints respectively. The sum of square statistics and the correction factors for tied ranks are however denoted by the following formula:

$S= \sum_{i=1}^{n}(R_i - R)^2$ *AND* $T=\sum_{k=1}^{m}(t^3 - t)$

Where $R_i$ is the row sums of ranks, $R$ is the mean of $R_i$ and $t$ is the number of ranks in each ($k$) of $m$ group of ties.

To test the significance of the Kendall's concordance, the chi-square (X2) statistic was used and hypothesis statements were imposed to aid in conducting this test.

Ho: There is no agreement among the 200 pepper production respondents regarding the 9 constraints

H1: There is agreement among the 200 pepper production respondents regarding the 9 constraints; Where Ho and H1 are null and alternate hypothesis respectively.

The chi-square statistic was computed using the formula;X2 = p (n-1) W

where n = number of constraints p = number of respondents, W = Kendall's coefficient of concordance.The null hypothesis is rejected in support of the alternate hypothesis that there is agreement among the rankings of the constraints by pepper farmers in Kumbungu District if the calculated chi-square's value is higher than that of the chi-square critical.

## 4. Results and Discussion

### 4.1 Demographic Characteristics of Respondents

This section presents and discusses the descriptive results of gender distribution, age distribution, educational background of respondents, marital status and the variety of pepper produced by pepper producers in the sampled communities within Kumbungu District. The results are

reported in Table 1. The results show that male farmers dominate the pepper production business with 88% whilst the females were only 12%. This is contrary to Thepa and Pant (2021)which talks about the cultivation of vegetables such as pepper, as being a feminine based activity.37% of the sampled farmers were within the age range of 28-38 years which therefore implies that the study area is dominated by youthful and middle-aged men and women who are actively engaged in pepper production. The mean of the ages recorded for the respondents was 34.21, with a minimum and maximum of 17 and 75, respectively.

Farmers with no formal education were 71% whereas 29% acquired either Primary, Junior High School, Senior High School or Tertiary formal education. This suggests that majority of the smallholder pepper producers have not been through formal schooling, albeit education plays a critical role in enhancing agriculture and rural livelihood improvement. With respect to marital status, 72.5% of the sample size are married, 27.5% being single and with no divorcees or widows. 98.5% of the respondents cultivate traditional variety of pepper whiles the remaining 1.5% are into the production of improved variety of pepper. This finding indicates that adoption of improved varieties is still very low among pepper producers in the Kumbungu district.

**Table1: Descriptive results of pepper producers in Kumbungu District**

| VARIABLES | FREQUENCY | PERCENTAGE | MEAN |
|---|---|---|---|
| **Gender** | | | |
| Male | 176 | 88 | |
| Female | 24 | 12 | |
| Total | 200 | 100 | 0.88 |
| **Age (years)** | | | |
| 17-27 | 62 | 31 | |
| 28-38 | 74 | 37 | |
| 39-49 | 45 | 22 | |
| 50-60 | 15 | 7.5 | |
| 60 and above | 4 | 2 | |
| Total | 200 | 100 | 34.21 |
| **Educational Background** | | | |

| | | | |
|---|---|---|---|
| No Education | 142 | 71 | |
| Primary/JHS | 37 | 18.5 | |
| Secondary/SHS | 12 | 6 | |
| Tertiary | 9 | 4.5 | |
| Total | 200 | 100 | |
| **Marital Status** | | | |
| Married | 145 | 72.5 | |
| Single | 55 | 27.5 | |
| Total | 200 | 100 | |
| **Pepper variety** | | | |
| Traditional | 197 | 98.5 | |
| Improved | 3 | 1.5 | |
| Total | 200 | 100 | |

### 4.2 Profitability Analysis of Pepper Production

Table2 presents the gross margin and various costs of inputs incurred by pepper producers in some communities within Kumbungu District. It also includes the total cost and return on investments made towards the production of pepper in the study area. The total cost incurred was GH₵191,603.50 with a total revenue of GH₵ 571,240.00, which resulted in a net margin of GH₵ 379,636.50. The difference between the total revenue (GH₵ 571,240.00) and the total variable cost (GH₵ 167,677.50) yielded a gross margin of GH₵ 403,562.50. A return on investment of 1.98 implies that for every GH₵ 1.00 invested into the production of pepper in the study area, an amount of GH₵ 1.98 is gained as returns. These findings are consistent with Akolgo (2021) and Vigneri et al. (2021).

**Table 2 Profitability Analysis of Pepper Production in Kumbungu District**

| **ITEMS** | **COST (GH₵)** |
|---|---|
| **Variable Input** | |
| Fertilizer | 102,659.00 |

| | |
|---|---|
| Chemical | 5,874.50 |
| Transporting pepper | 5,609.00 |
| Jute sack | 5,035.00 |
| Twine | 271.00 |
| Sowing pepper bag | 2,675.00 |
| Loading bag of pepper | 627.00 |
| Offloading bag of pepper | 616.00 |
| Marketing levy | 2,263.50 |
| Pepper seeds | 1,176.00 |
| Labor | 23,117.50 |
| Land preparation | 17,754.00 |
| **Total** | **167,677.50** |
| **Fixed input** | |
| Cutlass | 4,292.00 |
| Hoe | 4,621.00 |
| Knapsack sprayer | 15,013.00 |
| **Total** | **23,926.00** |
| **Total cost** | **191,603.50** |
| **Total Revenue** | **571,240.00** |
| **Gross margin** | **403,562.50** |
| **Net margin** | **379,636.50** |
| **Net margin percent** | **66.46%** |

| | |
|---|---|
| **Return on investment** | **1.98** |

### 4.3 Productivity Levels of Pepper Producers

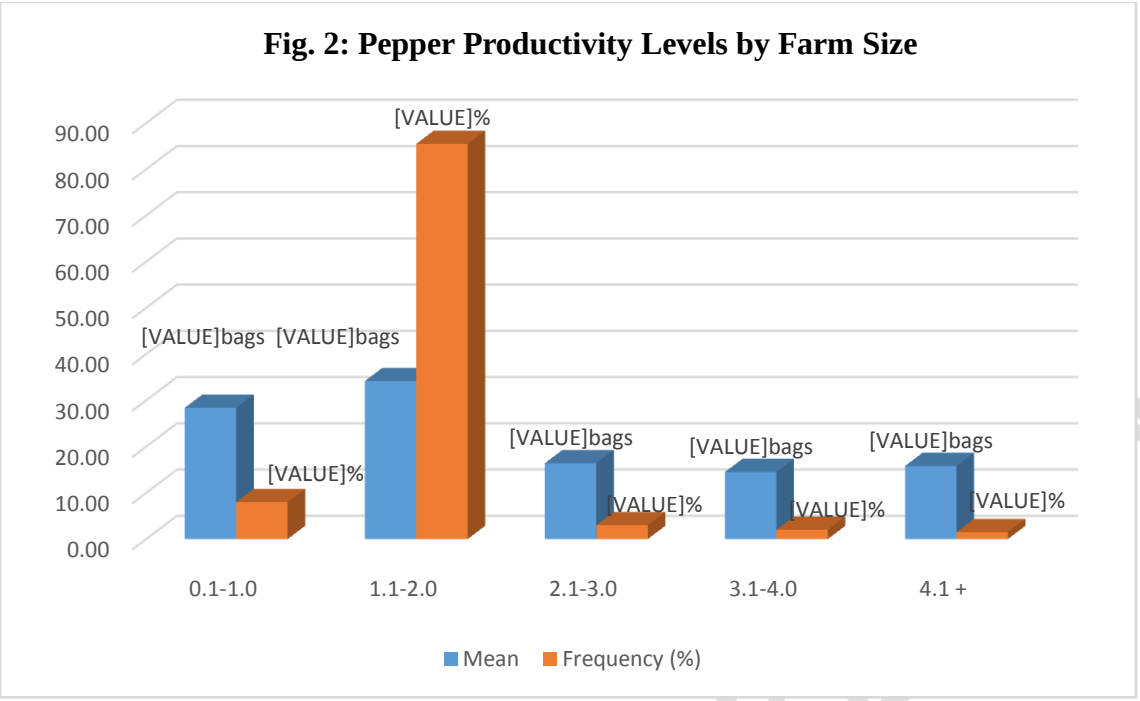
Figure 2 shows the results of farm sizes along with their productivity levels of pepper production in the study area. 85.5% of the sampled farmers possessed a farm holding ranging from1.1-2.0 acres, 8% with farm size ranging from 0.1-1.0 acres, 3% with farm holding from 2.1-3.0 acres, 2% also with farm size of 3.1- 4.0 acres, while the smallest percentage which is only 1.5% own a relatively larger farm size of 4.1 and above. However, comparing the productivity of the largest farm size to that of the other farm sizes, it was revealed that the farm size of 1.1- 2.0 acres had the highest mean productivity of 34.18 bags/acre, as compared to that of 4.1 and above acres of farm size (14.50bags/acre). This implies that although farm size may be a factor contributing to productivity in the study area, there are however other factors such as access to adequate farm inputs, intensive labour, post-harvest handling techniques, etc.

The pooled mean productivity was 32.28 bags/acre which is equivalent to 1.619 MT/ha. This indicates that as compared to the Recent Global Production of Pepper and that of Ghana from Table 3, the productivity of the study area (1.619 MT/ha) falls below the World productivity of 19.100Mt/ha and Ghana's productivity of 9.694 Mt/ha in 2019, which is further less than the achievable yield of 32.30Mt/ha FAOSTAT (2021).

**Table 3: Recent Global and National Production of Pepper**

| Crop | Year | World (Metric tons/ha) | Ghana (Metric tons/ha) |
|---|---|---|---|
| Pepper | 2019 | 19.100 | 9.694 |
| | 2018 | 18.747 | 9.370 |
| | 2017 | 17.897 | 8.500 |
| | 2016 | 17.664 | 8.500 |
| | 2015 | 16.555 | 8.500 |

**Fig. 2: Pepper Productivity Levels by Farm Size**




### 4.4 Constraints of Pepper Producers

Table 4 illustrates the mean scores and the level of ranking of constraints that pepper producers in Kumbungu District face, from most compelling to least pressuring, as well as measuring the degree of agreement between them. According to the table, insufficient working capital which can be attributed to low income earning and inaccessibility to credit facilities from financial institutions is considered the most critical challenge, out of the nine constraints listed to being faced by the respondents. However, it is suggested by the respondents and the analysis of the study data, that the least problem of pepper producers in some communities within the study area happens to be insufficient knowledge in pepper production due to pepper being one of the common vegetables cultivated in the study area. The chi-square ($X^2$) statistic was used to test the significance of the Kendall's concordance coefficient with the following hypothesis statements:

$H_0$: There is no agreement among the rankings of the constraints.

$H_1$: There is an agreement among the rankings of the constraints.

Where $H_0$ and $H_1$ are null and alternate hypothesis, respectively. In so doing, the Kendall's Concordance Coefficient (W) is calculated by the relation W = 12S/p2 (n3-n) –pT. From the data analysis,

Sum of square statistic over the row sums of ranks(S) = 1714761

Number of respondents (pepper producers) who are ranking the constraints (P) =200

Number of constraints (n) = 9

Correction factors for tied ranks (T) = 0

W = 12S/p2 (n3-n) –pT

$W = 12(1714761)/ (200)^2 (9^3-9) - (200 \times 0)$

W = 20577132/28800000

W = 0.71

This implies that, there was 71% level of agreement among the respondents regarding the constraints.

The chi-square statistic is then computed using the formula;$X^2 = p (n-1) W$

Where n = number of constraints, p = number of respondents, W = Kendall's coefficient of concordance.

$X^2 = p (n-1) W$

$X^2= 200 \times (9-1) (0.71)$

$X^2= 200 \times (8) (0.71)$

$X^2= 1136$

For chi-square critical (level of significance), α is 0.005 and degree of freedom n-1=9-1=8. The tabular value of $X^2$ is 21.96.

This therefore implies that since the computed value of $X^2= 1136$ is greater that the tabular value of $X^2= 21.96$, the null hypothesis is rejected in support of the alternate hypothesis that there is

agreement among the 200 respondents' rankings of the 9 listed constraints by the pepper farmers in Kumbungu District.

**Table 4: Constraints of Pepper Producers**

| Constraints | Ranks | Mean score |
|---|---|---|
| Insufficient working capital | 1st | 1.65 |
| High cost of production inputs | 2nd | 1.70 |
| Low level of government support | 3rd | 3.60 |
| Inadequate storage facilities | 4th | 5.23 |
| Perishable nature of pepper | 5th | 5.38 |
| Poor mode of transportation | 6th | 5.73 |
| Long distance to market | 7th | 6.07 |
| Difficulty in getting land for production | 8th | 7.31 |
| Insufficient knowledge in pepper production | 9th | 8.38 |

## 5. Recommendations

Findings from the study recommend that government should provide financial assistance and incentive in the form of strong subsidy policies to make farm resources adequately accessible and to aid in the expansion of existing scale of production. Planners and policymakers should use this study as an aid in their planning and decision making, to place a greater emphasis in supporting and developing agriculture in the study area for a course of creating recognition and to welcome more investments from public and private investors. NGOs and Financial institutions whose interest is in agriculture should offer credit facilities to pepper farmers to expand their farms in the study area. Further research should be conducted to investigate some factors that contribute to high productivity other than farm size in the study area.

## 6. Conclusions

The study examined the economic potential of smallholder pepper production in n Kumbungu District, where 200 respondents were randomly selected to be interview for data regarding the profitability, level of productivity and various constraints they face in the production of pepper in the study area. Pepper production is predominantly a male activity engaged mostly by the youth

in the kumbungu district. In addition, pepper production is a profitable venture with higher return on investment. Pepper production is also on small scale basis as farm holdings range 1.1-2.0 acres to 4.1 acres and above, nonetheless, producers record high level of productivity. However, this falls below the world and national productivities of 19.100Mt/ha and 9.694 Mt/ha, respectively in 2019, which is still less than the achievable yield of 32.30Mt/ha FOASTAT (2021).

The productivity of pepper production in the study area is not only measured by farm sizes, but there are however other factors such as access to adequate farm inputs, intensive labour, post-harvest handling techniques, etc.Pepper producers face a number of constraints. Insufficient working capital which can be attributed to low income earning and inaccessibility to credit facilities from financial institutions has been the most critical challenge in the Kumbungu district.



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