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RESEARCH ARTICLE

Rural Women's Engagement in Groundnut Production in the Wa East District, Ghana

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ABSTRACT

In many rural communities, women face barriers to land ownership, access to productive resources such as finance and extension services, and participation in decision-making. These constraints result in the low productivity of women farmers. This study sought to examine the factors influencing women's engagement in groundnut production and the challenges they face in the Wa East district. The survey data that the study relied on was collected from 240 respondents and analysed using a probit model and Kendall's Coefficient of Concordance. The results revealed that socio-economic, environmental and institutional factors have impact on women's engagement in groundnut production. More specifically, the age of the farmer, marital status, household size, access to land, and motivation for income significantly influenced women's engagement in groundnut production. Furthermore, access to credit, climate change, and lack of farm inputs and machinery are the key constraints facing women farmers engaged in the groundnut production enterprise. Policies that minimize these constraints such as the provision of credit facilities, input support schemes, and farmer training on climate change need to be pursued by the department of agriculture, private companies, and non-governmental organizations working in the agricultural sector. This study contributes to the international literature by highlighting the constraints facing rural women in agricultural production and the drivers of inclusion in farming systems.

Keywords: Constraints; Determinants; Legume Cultivation; Probit Model; Women's Crop

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1. Introduction

Global food security is a critical issue that involves the availability, access and utilisation of food worldwide. Concerns about global food security stem from various factors, including population growth, climate change, economic instability, political conflicts, and environmental degradation^[1-3]. Declining soil fertility and low productivity contribute to global food insecurity^[4-7]. In 2023, an estimated 783 million people, the majority of whom were women, were reported to be suffering from chronic hunger^[2]. Achieving the Sustainable Development Goal (SDG) of eradicating hunger and poverty is a priority for the government and national-level policies such as the Coordinated Programme for Social and Economic Development is geared towards the operationalisation of this goal. Stimulating the production of both food and cash crops is one way through which hunger and poverty can be tackled in society. While food insecurity remains a challenge in Africa and other parts of the world, women are among the most affected^[8].

Groundnut is the second most important legume crop after cowpea grown by smallholder farmers in Ghana. It has high nutritional value and is a rich source of oil (35–45%), protein (25–30%), carbohydrates (9.5–19%), minerals and vitamins^[9]. The crop is also known to improve soil fertility through nitrogen fixation. Groundnuts are mostly produced for domestic consumption by subsistence farmers using traditional low-input agricultural systems^[10]. Worldwide, about 100 nations grow groundnuts, with 90% of them concentrated in Africa and Asia^[11]. A total of 35.9 million MT of groundnuts are produced annually on 25.2 million hectares of land worldwide^[12]. The leading producer countries of groundnuts are China, India, Nigeria, the United States, and Sudan^[13]. However, yields of groundnuts produced remain low (964 kg·ha⁻¹) relative to potential (3500 kg·ha⁻¹) due to the incidence of diseases, varietal-specific characteristics, climatic factors and socioeconomic constraints^[7, 14-16].

Northern Ghana is known for its extensive groundnut farming and accounts for 94% of all groundnuts produced in the country. A decent yield is possible with rainfall of between 500 mm and 600 mm spread fairly throughout the growing season^[17]. The informal sector

dominates the production process; while the formal sector is involved in processing groundnuts into a paste and other finished products^[18]. Production of the crop is still at the subsistence level and is done mainly by smallholder farmers, the majority of whom are women^[19]. Groundnut output in Ghana has also been badly influenced by unhelpful small farm policies, high cost of inputs, drought, pest and disease infestation, inefficiency in production, and unproductive lands^[16, 20, 21]. While some studies have focused on the profitability, efficiency and marketing of groundnut in the country^[20, 22-24], little is known about what drives women farmers' engagement in the production of the crop to help inform policy on ways to make their participation more inclusive for better livelihoods and for national development. This study, therefore, seeks to bridge this gap in the literature by providing empirical evidence using women farmers in the Wa East District.

This study is crucial, as women make up 60% of the food-insecure population and face restrictive gender norms and inequalities in accessing productive resources. The role of women in food production is widely recognized, and stakeholders, including national governments, are seeking innovative ways to empower women farmers and enhance their productivity. This study differs from previous research on women's involvement in agricultural production in two key ways: (1) it specifically focuses on women's cash crop (groundnut) production within a single community; and (2) it employs both regression and non-parametric approaches to empirically identify the factors driving their participation and the constraints limiting their productivity.

2. Literature Review

2.1. Groundnut Production and Drivers

Groundnut (*Arachis hypogaea*), is a significant crop globally, particularly in developing countries, where it plays a crucial role in food security, nutrition and economic stability. Groundnut production is a multifaceted area of study that encompasses agronomic practices, economic implications, and socio-cultural dynamics. Groundnuts are a vital cash crop for millions of smallholder farmers, particularly in Africa and Asia. They

contribute significantly to household income and are an important source of employment in rural areas^[25,26]. Groundnuts are rich in protein, healthy fats, and essential vitamins, making them a critical food source in regions where malnutrition is prevalent^[27]. The global trade of groundnuts also contributes significantly to the economies of producing countries, with demand driven by both domestic consumption and export markets^[28].

The crop remains a key focus of agricultural research and development efforts worldwide. Research in agronomy focuses on improving groundnut yields through better management practices, such as crop rotation, optimal planting dates, and pest and disease control. The development of high-yielding, disease-resistant, and drought-tolerant varieties is a major area of study, especially given the challenges posed by climate change^[1,25]. The literature also emphasizes the importance of extension services and farmer education in disseminating best practices and innovations in groundnut farming. Access to quality seeds, credit, and markets are identified as key factors that can enhance groundnut production and improve the livelihoods of farmers.

Ghana produced the most metric tons (MT) of groundnuts in 2010 due to the development of high-yielding groundnut cultivars, government subsidies for inputs, and the progressive acceptance of mechanisation, such as the use of tractors^[29]. Since then, groundnut output has been declining. The reasons for the poor output remain unclear despite increasing interest among women in cultivating the crop. The Upper West Region (UWR) is among the top five regions in Ghana deeply involved in groundnut production^[30]. Production trends of groundnuts in the country for the period 2009 to 2018 show that the UWR contributed about 25% to 33% of the national annual production of groundnut. A number of factors (socioeconomic, climatic, crop-specific, and institutional) have been revealed that influence farmers' engagement in groundnut production and the value chain at large. However, studies that focus on women at the production stage are few and a greater number tend to focus on processing and marketing aspects of the value chain^[22,31].

Ochieng, Ouma and Birachi^[32] looked at women's participation in farm management and the socioeco-

omic factors that affect their participation. The degree of poverty was found to be correlated with poor food and nutritional security. A high potential for productivity growth exists in the presence of active agricultural development networks. Less than half of the respondents (44%) were women and the study highlighted access to loans, extension services, social capital, and participation in non-farm activities as relevant to encouraging women's participation in groundnut production.

Ani, Rahman and Kwaghe^[33] examined the economic contribution of women to groundnut production in Nigeria where women provided 67% of the labour needs and 15% of the financial resources needed for the production of the crop. Probit regression analysis revealed that women's contribution to groundnut production was favourably influenced by cooperative membership, farming experience, and income level. Furthermore, the benefits derived from groundnut production and resource accessibility influence women's satisfaction with groundnut production. This means that enabling women's access to production resources could stimulate groundnut production. Kapopo and Assa^[34] studied the factors that influence groundnut production in Malawi and revealed that labour, farm size and seed are the most important factors that affect groundnut output.

In analysing the factors that influence farmers' groundnut commercialisation, Megersa et al.^[12] revealed that age, education level, household size, land size, access to market information, and non/off-farm income significantly influence households' decisions to participate in groundnut production and commercialisation. Favourable agroecology, access to market information, and locational trademark are driving factors for groundnut production. Abu^[22] examined groundnut production trends and farmers' participation in markets using the household commercialisation index and a Tobit model. The findings revealed a moderate commercialisation index since approximately 53% of the groundnuts produced was sold locally. Also, the main variables that impact participation decisions were marital status, output, mobile phone ownership, credit access, form of sale, and access to market information.

Adzawla et al.^[35] examined Bambara groundnut

production in Northern Ghana with a focus on smallholder farmers. To account for a potential bias in sample selection, a treatment effect model was estimated. The probit model results revealed that larger household size, level of education, and access to finance are the significant factors likely to influence the adoption of Bambara groundnut production.

The output of groundnuts is influenced by technological advancement, pest and disease control (particularly the control of the groundnut rosette virus), value addition, and aflatoxin contamination^[36, 37]. Furthermore, socioeconomic factors limit the ability of farmers to reach potential yield levels^[37]. While productivity is affected by the environment, management practices, plant characteristics, and socio-economic factors, inefficiency exists in groundnut production^[6, 20, 35, 38, 39]. For instance, a recent study in northern Ghana reported a mean technical efficiency of 73% under variable returns to scale, suggesting that there is more room for improvement^[20]. According to Patel et al.^[40], farmer practices such as delay in sowing necessitated by climatic factors reduce the pod yield of groundnuts. Various socioeconomic characteristics, including farm size and previous experience with growing the crop significantly impact output levels. This suggests that the volume of groundnut output may fluctuate if any one of these elements is altered.

2.2. Challenges of Women Engaged in Groundnut Production

Globally, women make significant contributions to the household as they work as wage earners, entrepreneurs, and caretakers of their families. Access to production resources is a challenge and women farmers are less likely to succeed in production activities relative to their male counterparts. Evidence shows that women owned less land than men and rarely owned property despite their heavy involvement in the groundnut value chain^[11]. Access to improved seeds, credit, land, extension services, and technology poses bottlenecks to improving the productivity of women farmers^[14, 16]. For instance, women are less likely to own fertile lands and only 20% of women are landowners globally^[41]. Also, the inheritance of family property by women is an issue

due to social norms and traditions^[41]. Studies on intra-household allocations and gender relations in groundnut production revealed that lineage impacts women's decision-making^[42]. Thus, women from matrilineal societies were more likely to control agricultural plots and production assets than those from patrilineal societies. Furthermore, Hossain^[43] provided evidence of how disparities in gender preferences may result from cultural or parental expectations, shifts in developmental tendencies, prejudice, and gender-based expectations for balancing work and home.

Furthermore, diseases, lack of improved seed varieties, and price volatility are key obstacles that prevent farmers from increasing their groundnut production for commercialisation^[12, 16, 44]. For instance, Banla et al.^[16] found the late leaf spot to be of economic importance in groundnut production due to the losses associated with it. The adoption rates for best groundnut production practices are low (62%); hence, it is difficult in reducing the incidence of extreme poverty levels^[24]. Access to international markets remains as production is largely targeted at the domestic market^[22]. Aflatoxin contamination also limits farmers' access to international markets and in securing good prices for the produce^[45]. The effects of climate (drought) on production are also well documented in the literature and the adoption of weather-based crop insurance schemes has been proposed^[46-48]. Nonetheless, in the context of developing nations, such insurance schemes are less developed and farmers remain vulnerable to climate change effects.

Institutional factors such as ineffective extension systems, shortage of labour, low prices of groundnut, and inadequate loans for farmers have been reported as key issues confronting groundnut production^[44, 45]. Katundu, Mhina and Mbeiyerwa^[11] assessed the causes of the decline in groundnut output among smallholder farmers in Tanzania. The results show that the amount of time spent farming, the price of groundnuts during the previous season, and the price of seeds and pesticides directly impact the area of groundnut produced.

Socioeconomic factors such as low literacy levels and the use of traditional tools for cultivation remain the

norm leading to small farm sizes and difficulty in commercialising production^[46, 49]. Furthermore, limited access to financing and insufficient labour have also been documented as key constraints hampering groundnut production^[45, 50]. Kapopo and Assa^[34] reported that low output prices and the use of unstandardised measurements are the constraints faced by farmers engaged in groundnut production. In Uganda, Aguro^[50] revealed that a lack of markets and low prices are the major marketing constraints facing groundnut farmers. Other production constraints such as difficulties in accessing high-quality seeds, high cost of labour, and poor storage facilities hamper groundnut production^[14, 29, 49]. As such, farmers often resort to using any available seed for planting leading to lower yields. However, according to agricultural experts, high-quality seeds result in increased output and plant vigour.

In summary, several factors influence the decision of women to go into groundnut production: income, food and nutrition security, and crop residues for livestock production. The cultivation of groundnut is a profitable venture as the crop is able to do well even in marginal soils. Women farmers face multiple constraints in terms of access to production resources, financing, and agricultural information which hampers their full participation in the groundnut production value chain.

3. Methodology

3.1. Study Area

The Wa East District was demarcated out of the Wa District in 2004 through a legislative instrument (L.I 1746). Currently, the district operates as a full local government Assembly with Funsu as its capital. The district is located in the South Eastern part of the Upper West Region and shares boundaries with West Gonja District to the southeast, Sissala East District to the north, and West Mamprusi District to the northwest. It has a total landmass of about 3,196.4 km and it is located between longitudes 1°10' W and 2°5' W. The district is very remote relative to other districts and lacks basic amenities for proper socioeconomic development. The district has a total population of 91,457 inhabitants, with 49% being females^[51]. Soils are generally sandy loamy, fertile,

and suitable for the cultivation of cereals, legumes, and root and tuber crops. The district also offers a huge potential for livestock rearing. However, small-scale mining is an environmental issue as gold deposits have been found in some communities (Manwe, Donyukura, Du, Bulenga, etc.). Illegal logging of rose wood is also a threat to agriculture. Average annual rainfall is about 1200mm per year but the erratic nature of the rainfall pattern coupled with lack of irrigation facilities make all year round farming impossible. As such, it is a common issue that most farmers do not produce during the dry season and migration of the youth to southern Ghana.

The district was selected for its high agricultural potential and the significant involvement of women in groundnut production. The rural nature of the district was also a factor, as urban municipalities typically engage in minimal agricultural production and largely depend on rural areas to meet their needs.

3.2. Research Design and Data

The study utilised primary data collected through a survey of women farmers engaged in groundnut production in the Wa East District. The district was chosen because of the agricultural potential it offers and the growing interest among females in the cultivation of groundnuts. Three communities (Gudayiri, Kundugu and Nahaa) were purposively selected based on the presence of identifiable women groups engaged in the groundnut production enterprise. Also, these communities are the dominant groundnut producing areas in the district, and so they fairly represent women groundnut production in the district. Next, the study used simple random sampling to select a total of 240 farmers to be interviewed. The sampling was done using the list of the identifiable women groups. Numbers were written on a sheet of paper, folded and kept in a container. After shaking the container, papers selected with 'Yes' on them were interviewed. Each group had a membership of between 25 and 30 people. Semi-structured questionnaire was used to collect the data. The information collected covers socio-economic variables, production inputs, output levels, and challenges facing women groundnut farmers. This was complemented with secondary data collected from MOFA at both the district and national levels.

3.3. Variables and Measurement

Several socioeconomic and institutional factors impact women's production activities and their decision to engage in groundnut production. The factors that influence women's engagement in groundnut production are presented in **Table 1**.

Age is relevant in farm decision-making. A study by Konja, Mabe and Oteng-Frimpong^[53] revealed that age positively impacts rural women's participation in groundnut production efficiency. Younger women would engage less in groundnut farming as they may have less responsibility and a lower dependency ratio as against older women who may have a lot of children to take care of. Asfaw^[56] found the dependency ratio to be positive and significantly influence women's labour force participation decisions. Older women will engage more in groundnut production; whilst younger women will engage less. Therefore, this study expects a positive relationship between women engaged in groundnut production and their age. Marital status (MTS) is a key factor that influences women's decision-making in groundnut market participation^[22]. The expectation is that unmarried women would engage more in groundnut production as it is believed that they have fewer responsibilities. On the other hand, married women would engage less in groundnut production due to other household activities and work on family farms.

The educational status (EDU) of women engaged in groundnut production can influence their level of participation. Adzawla et al.^[35] observed that people who had little or no formal education are more likely to adopt Bambara groundnut production. Farmer level of education also influences the profit efficiency of rural women's participation in groundnut production^[53]. Hence, the expectation is that the level of education of the respondent would negatively influence women's engagement in groundnut production. The higher the level of education, the less likely that women would engage in groundnut production. In addition, Household size (HHS) signifies the labour force available for agricultural production. Research shows that households with larger sizes are more likely to adopt groundnut production due to labour availability^[35]. Hence, we expect it to positively influence women's engagement in groundnut production

since households in northern Ghana are characterised by large sizes.

Access to land (LND) is critical to crop production and to some extent women often find it difficult to access land for crop production due to the nature of the land tenure system. Access to fertile land by rural women has a positive impact on groundnut production^[26, 57]. The expectation is that access to land would positively influence women's engagement in groundnut production. Furthermore, *Food security (FDS)* is included to measure the extent to which women are producing groundnut for subsistence. Women's engagement in groundnut production is expected to have a positive effect on household food security (availability, affordability, and accessibility).

Purpose of production (PUP): The motivation for income is a key driving factor for women's engagement in groundnut production as many see it as a cash crop. According to Ani, Rahman and Kwaghe^[33], women's contribution to groundnut production is favourably influenced by their level of income. We expect that the motivation for income would positively influence women's engagement in groundnut production. Cooperative membership (COP) serves as a collective voice for stallholder farmers with mutual benefits to members. Members of such associations are able to access inputs at lower costs and gain access to profitable markets. Cooperative membership has been found to favourably influence women's groundnut production^[33]. This study expects cooperative membership to positively influence women's engagement in groundnut production.

Access to credit (CRD) is vital in boosting groundnut production with positive effects on farmers' livelihoods. The availability of financial assistance impact positively on the profitability of groundnut production as well as participation decisions^[45, 56]. This study expects a positive correlation between access to credit and women's engagement in groundnut production.

Food security: FAO (1996)^[58] conceptualised food security as the availability and accessibility of affordable, quality food that consistently meets people's dietary needs and preferences. In this study, we used groundnut production to represent food security. This is because groundnut contains the relevant nutrients in

Table 1. Variables and their measurement.

Variable	Symbol	Measurement	Expected Sign	Supportive Literature
Age of farmer	AGE	years	+/-	Abubakari et al. (2019) ^[52] ; Konja, Mabe and Oteng-Frimpong (2019) ^[53]
Marital status	MTS	1 if married, 0 otherwise	-	Abu (2015) ^[22]
Educational status	EDC	Number of years in school	+/-	Adzawla et al (2016) ^[35] ; Shuaibu et al. (2018) ^[54] ;
Household size	HHS	Number of people in the household	+	Adzawla et al. (2016) ^[35]
Access to land	LND	1 if a woman has access to land, 0 otherwise	+	George, Winrose and Philip (2022) ^[49]
Food security	FSE	1 if the household produces groundnut for food security, 0 otherwise	+	Lokossou et al. (2022) ^[55]
Purpose of production	PUP	1 if a farmer produces groundnut purposely for income, 0 otherwise	+	Ani, Rahman and Kwaghe (2019) ^[33]
Cooperative membership	COP	1 if a farmer belongs to a cooperative organization, 0 otherwise	+	Ani, Rahman and Kwaghe (2019) ^[33] ; Konja, Mabe, and Oteng-Frimpong (2019) ^[53]
Access to credit	CRD	1 if the farmer has access to credit, 0 otherwise	+	Katema et al. (2020) ^[45]

Source: Various literature.

the right proportions when consumed. Secondly, it is the main crop that women sell to buy other household foods that they do not produce. So even if women do not have all the crops needed to ensure food security, they rely on the income from groundnut sales to meet other household food and nutritional needs.

3.4. Analytical Framework and Model Estimation

This study relied on the probit model in establishing the factors that drive women engagement in groundnut production. The approach is superior to the other static models due to the assumption of normal distribution and other properties. Theoretically, the decision to engage in groundnut production is a function of environmental/climatic, socioeconomic, institutional, and technically-related variables. Suppose the latent variable, y_i represents the decision of a farmer to engage in groundnut production and X_i is a vector of independent predictor variables, the response model can be written quantitatively as:

$$y_i = \beta'X_i + \varepsilon_i; \varepsilon \sim N(0, \sigma^2) \quad (1)$$

Where: β is the coefficients of parameter estimates and ε_i is the error term. Evidently, the logit model could also be applied to estimate Equation (1), but the probit model has superior performance even in smaller samples relative to the logit model^[59]. Furthermore, most recent studies have utilised the probit model^[12, 15, 33]; hence, it

is applied in the current study.

$$y_i = \begin{cases} 1 & \text{if } y^*_i \geq 0 \\ 0 & \text{if } y^*_i \leq 0 \end{cases} \quad (2)$$

Where:

y^*_i values are positive; $y_i = 1$ for all those cases; y^*_i assumes zero or negative values; $y_i = 0$ for all those cases.

$$P_r(y_i = 1/X_i) = \varnothing(\beta'X_i) \quad (3)$$

Where:

y_i = farmer engagement in groundnut production with observed values constrained between 0 and 1^[59];

\varnothing = the cumulative distribution function (cdf) of the standard normal distribution, normal cdf^[60];

ε_i = error term assumed to have a normal distribution.

$$P_r(y_i = 1/X_i) = \varnothing(\beta'X_i) = \int_{-\infty}^{\beta'X_i} \varnothing(t) \partial t \quad (4)$$

Where $\varnothing(t)$ denotes the standard normal distribution. Following Greene^[60], the marginal effects of change in X_i on y_i are computed as:

$$\frac{\partial E(y_i/x_i)}{\partial x_i} = \frac{\partial E(\varnothing(\beta'x_i))}{\partial x_i} = \varnothing(\beta'X_i) \beta \quad (5)$$

The empirical model used to establish the factors that influence women engagement in groundnut production is given as:

$$\Pr(y_i = 1) = \beta_0 + \beta_1AGE_i + \beta_2MTS_i + \beta_3EDC_i + \beta_4HHS_i + \beta_5LND_i + \beta_6FSE_i + \beta_7INC_i + \beta_8COP_i + \beta_9CRD_i + \varepsilon_i \quad (6)$$

Kendall's Coefficient of Concordance, a non-parametric method was used to analyse and rank the various challenges facing women's groundnut farming in the study area. The challenges were measured based on the level of agreement or disagreement among the respondents on each constraint ranked as well as the overall score of all the constraints analysed. Key constraints identified through interaction with farmers and the literature review considered in the study were access to credit, access to land, farm input, marketing, climate change, lack of machinery, pest and diseases and harvesting. These challenges were ranked from one (most pressing challenge) to eight (least pressing challenge) and farmers were asked to score each constraint. Kendall's Coefficient of Concordance (W) was then used to compute the mean ranks using the relation below:

$$W = \frac{12S}{p^2(n^3 - n)} - pT \tag{7}$$

$$S = \sum_{i=1}^n R = SSR \tag{8}$$

$$T = \sum_{k=1}^n \left(r \frac{3}{k} - tk \right) \tag{9}$$

Where:

S = the sum of squares from row sum of ranks;

R = the number of challenges ranked;

p = number of respondents;

T = number of tied ranks.

4. Results and Discussions

4.1. Descriptive Facts

Table 2 presents a summary statistic of the variables used in the analysis. The average age of the women was 42 years and about 76% of them were married. The average years of schooling achieved were low (3.5 years) with the highest being 12 years. This suggests that women farmers in the community have low levels of education. The average household size was 7 members and about 84% of the women had access to land for cultivation. Access to credit was low (48%) and only 66% of the sampled women were members of a cooperative group. About 89% of women produce groundnuts for income and the mean yield obtained was 10 bags. About

84% of the women have access to land. However, this ranges from 0.86 hectare to 3 hectares. This indicates that the women are indeed smallholder farmers with production oriented towards markets for income.

4.2. Correlation Analysis

A correlation analysis was conducted involving all the independent variables used in the regression model. The results revealed that there is no correlation among the variables and this paved the way for the detailed probit analysis to be done (**Table 3**).

4.3. Factors Influencing Women's Engagement in Groundnut Production

A probit regression analysis of the factors influencing women's participation in groundnut production is shown in **Table 4**. The R² value (0.329) shows that the independent variables jointly explain about 33% of the variation in the decision of females to produce groundnuts. Out of the eight variables modelled, five were significant. Age, marital status, family size, land availability, and the desire for income were shown to be positive and significant factors influencing women's engagement in groundnut production.

Age: Age is significant and positively associated with women's participation in groundnut production at a 1% level (**Table 4**). This suggests that the likelihood of women growing groundnuts improves by 0.048 times as they get a year older. This may be due to the fact that as young women get older, they gain strength and are able to perform labour-intensive tasks on the farm. Also, ageing increases the obligation and necessity for women to gain access to money so that they can meet other needs. This outcome supports the findings of Konja, Mabe and Oteng-Frimpong^[53] that age had a positive impact on rural women's participation in groundnut production. Additionally, age squared had a negative coefficient and it is statistically significant at 1%. The marginal effect shows that as woman farmers get to a certain age, their likelihood of producing groundnuts decreases by 0.001. This could be attributed to the fact that as women farmers age, they lose the strength to carry out farming activities. This implies that as a woman farmer's age in-

Table 2. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Women engagement	240	0.742	0.440	0	1
Age	240	42.142	14.622	18	75
Age squared	240	1987.942	1269.964	324	5625
Marital status	240	0.767	0.425	0	1
Education	240	3.500	3.928	0	12
Household size	240	7.192	3.118	2	18
Access to land	240	0.842	0.367	0	1
Access to credit	240	0.483	0.502	0	1
Food security	240	0.358	0.482	0	1
Co-operative membership	240	0.667	0.501	0	1
Purpose of production	240	0.892	0.312	0	1

Source: Field survey, 2022.

Table 3. Correlation matrix of women engaged in groundnut production.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	1.000								
(2)	0.087	1.000							
(3)	-0.048	-0.293	1.000						
(4)	-0.264	-0.257	0.050	1.000					
(5)	0.049	0.032	-0.061	-0.085	1.000				
(6)	0.089	0.094	0.031	-0.090	0.064	1.000			
(7)	-0.054	-0.051	-0.040	-0.002	0.144	-0.009	1.000		
(8)	0.108	0.105	0.061	-0.010	0.099	-0.151	-0.075	1.000	
(9)	0.001	-0.018	0.121	0.004	-0.052	0.085	-0.107	-0.211	1.000

Note: 1 = Age of respondent; 2 = Age of respondent squared; 3 = Marital status; 4 = Level of education; 5 = Household size; 6 = Access to land; 7 = Food security; 8 = Purpose of production; 9 = Co-operative membership.

creases, initially, it increases the likelihood of her engagement in groundnut production but in the long run, as age increases the woman farmer is likely not to produce groundnut.

Marital status: The coefficient is positive and significant at the 5% level. The marginal effect shows that married women are 0.258 times more likely to engage in groundnut production than other categories of women. This could be attributed to the fact that women only have the right to cultivate on lands that belong to their husbands as they do not own land by themselves. This result supports the findings of Abu^[22] and Asfaw^[56] that marital status is a key determinant of women’s participation in groundnut production and marketing.

Household size: This was significant at 1% and the marginal effect indicates that women farmers with larger household sizes are 0.05 times more likely to engage in groundnut production (**Table 4**). This could be due to the fact that as the size of a household increases, the demand for basic necessities increases, resulting

in the engagement of women in groundnut production. This confirms earlier reports by Adzawla, Rahman and Kwaghe^[33] that farmers who had larger households were more likely to adopt the production of groundnuts. Household size has also been shown to influence profitability^[49, 54]. Since groundnuts are considered a cash crop, household size plays a significant role in generating income to meet the financial needs of the family.

Access to Land: This was also significant at a 10% level and the marginal effect shows that women are 0.206 times more likely to engage in groundnut production when they have access to land. Ownership of land in the Gudayiri community is by inheritance. The patrilineal system of inheritance is practised and as such land ownership is vested in the hands of men. Thus, for women to have access to land, they need the support of men to facilitate their access to land for production. Chikobola^[38] showed that land tenure significantly influences the profit efficiency of groundnut production in Zambia. Access to land also affects groundnut market

Table 4. Probit analysis of factors influencing women’s engagement in groundnut production.

Variable	Coefficients (Std. Err.)	Marginal Effects (Std. Err.)
Age	0.186*** (0.062)	0.048 (0.016)
Age square	-0.002*** (0.001)	-0.001 (0.0002)
Marital status	0.843** (0.344)	0.258 (0.117)
Education	-0.054 (0.038)	-0.014 (0.001)
Household size	0.195*** (0.064)	0.050 (0.016)
Access to land	0.668* (0.374)	0.206 (0.127)
Food security	-0.496 (0.314)	-0.136 (0.095)
Purpose of production	1.165*** (0.411)	0.398 (0.151)
Cooperative membership	-0.303 (0.311)	-0.079 (0.082)
Constant	-5.515*** (1.429)	
Wald Chi ²	40.56	
Number of obs.	240	
Pseudo R-Square	0.329	

Note: ***, **, and * indicate statistical significance at $p < 0.01$, $p < 0.05$ and $p < 0.10$ respectively.

Source: Estimation, 2022.

supply since it is directly linked to production^[31].

Purpose of Production: The desire for income was statistically significant at 1%. Results of the marginal effects indicate that women whose purpose of production was to increase income were 0.398 times more likely to engage in groundnut production (**Table 4**). This is attributed to the fact that even though women cultivate other crops, groundnut cultivation is done largely for income to meet other household expenditures such as payment of school fees, medical expenses, clothing and the like. As noted by Abu^[22] groundnut is produced basically as a cash crop for the market to enhance household income. The results are supportive of an earlier finding by Ani, Rahman and Kwaghe^[33] that income level positively influences women’s involvement in groundnut production.

4.4. Constraints Facing Women Farmers Engaged in Groundnut Production

Constraints analysis revealed that there are several identified challenges hindering women’s engagement in groundnut production (**Table 5**). From the analysis, Kendall’s Coefficient of Concordance (W) is 0.573 at a 1% level of significance. This indicates that there is a high level of agreement among the respondents regarding the constraints ranked.

Access to credit was identified as the most pressing challenge facing women farmers engaged in groundnut production with a mean rank of 2.38 (**Table 5**). The

absence of financial institutions in the community or around its environment to provide financial assistance to farmers could account for this. Also, the absence of donor-supported projects that could make funding support facilities available to farmers’ especially resource-poor and vulnerable groups including women makes access to credit acute. Nonetheless, two women groups were seen engaged in Village Savings and Loans Association (VSLAs) as a way to accumulate savings so that they can provide financial assistance to their members to support their production activities. However, the amount of loans members could access was limited due to low savings mobilisation. The majority of the respondents did not have access to credit and this remains a hurdle in the effective engagement of women in production. Taphee et al.^[44] found inadequate loans as a key challenge facing groundnut farmers. In Uganda, Aguro^[50] investigated the economics of groundnut production under rain-fed conditions and revealed that lack of credit facilities was a major challenge facing groundnut farmers. Access to credit also influences the profitability and efficiency of groundnut farming as well as supply^[31, 38, 49].

Climate change was ranked as the second most pressing challenge facing farmers with a mean rank of 2.99 (**Table 5**). According to the women, the unpredictable nature of rainfall affected crop yields, outputs, and profits. Excessive rainfall led to poor pod formation and increased vegetative growth during the production year. Furthermore, the early stop of rains during the latter part of the year led to the drying up of soils, poor pod

Table 5. Challenges women face in groundnut production.

Challenges	Mean Rank	Rank
Access to credit	2.38	1st
Climate change	2.99	2nd
Farm inputs	3.72	3rd
Lack of machinery	3.79	4th
Harvesting	4.94	5th
Access to land	5.62	6th
Marketing	6.23	7th
Pest and diseases	6.33	8th

Note: N = 240; Kendall's W = 0.573; Chi-square = 229.772; df = 7; Asymptotic. Sig. = 0.000.

formation, and wilting of the groundnut plants. The nature of the rainfall pattern thus contributes to poor soil fertility. Oppong-Sekyere^[46] assessed groundnut production in northern Ghana and revealed that drought was a key constraint facing farmers. Kumar and Babu^[48] reported improvements in technical efficiency production among smallholder groundnut farmers that participate in weather-based crop insurance schemes due to reductions in farmers' vulnerability to climate change. Changing minimum temperature coupled with increasing rainfall has mixed effects (positive and negative) on groundnut production^[7]. Previously, Ezihe, Agbugba and Idang^[5] found the mixed effects of climatic parameters (temperature and rainfall) on groundnut output in Nigeria. For instance, a marginal decrease in mean temperature and rainfall between the years 1991–2000 did not translate into a reduction in groundnut output while an increase in mean temperature and rainfall from 2001–2010 led to an increase in output. Government involvement through MOFA to train groundnut farmers on climate-related issues that affect production is key to increasing output.

Lack of farm inputs was ranked the third most pressing challenge (**Table 5**). This included inputs such as improved groundnut seeds, fertilizers, and weedicides. It was revealed that the lack of farm inputs is directly related to the limited access to credit which makes it difficult for farmers to purchase farm inputs. Closely related to the farm inputs is the lack of machinery (tractor services) for ploughing and other multi-purpose equipment. Access to tractor services especially during the peak ploughing season is a challenge for women. This often results in late ploughing of fields and planting culminating in lower yields. The high cost of multi-crop

threshers facilitates harvesting and shelling of produce which is bulky and difficult to store. Asekenya et al.^[6] called for increased investment in improved groundnut varieties so as to enhance productivity. Inadequate capital, high cost of farm inputs, as well as high cost of labour, have been reported as key constraints affecting groundnut production^[21, 49, 54]. In Togo, the unavailability of groundnut seeds coupled with limited improved varieties are the identified constraints hampering the growth of the groundnut subsector^[16].

Difficulties in harvesting groundnut were ranked as the fifth most pressing challenge with a mean score of 4.94. According to the women, it is difficult to access labour services during harvesting time because of other competing farm operations. Currently, there is no machinery developed and available in Ghana that supports smallholder farmers to harvest groundnuts. Harvesting is therefore done manually which is labour-intensive and time-consuming. This is compounded by the dry soil which makes harvesting difficult. As such, the high cost of labour has been reported as a limiting factor to groundnut production^[49].

Access to land was ranked the sixth most pressing challenge (**Table 5**). Clearly, access to land is not a critical constraint as women farmers are able to access land for production without any difficulties. However, there were gender disparities in terms of land ownership as women cannot own land in the study area. Other constraints such as marketing and pest and disease infestation were among the least pressing issues confronting groundnut production. Pest and disease infestation as well as marketing have been revealed as constraints facing groundnut farmers^[44, 46]. More specifically, leaf spot disease, rosette, and peanut bud necrosis have been re-

ported as the most critical diseases limiting groundnut production^[16]. These diseases affect both pod yield and pod size, hence, reducing the profits of groundnuts.

This study has certain limitations. First, the data was collected from a single community, focusing specifically on women involved in groundnut production. Consequently, the perspectives captured may not fully represent a broader, more diverse population. Additionally, the sample was limited to farmers, excluding other key stakeholders within the groundnut value chain.

5. Conclusions and Recommendations

The main objective of this study was to determine the factors that influence women's engagement in groundnut production and the challenges that they face in the Wa East District which is noted to be a major producer of groundnut. A probit model and non-parametric approach were employed to analyse data collected from 240 women farmers sampled from the district.

Descriptive statistics showed that about 74.2% of women are engaged in groundnut production with income as the main motive for production. Both institutional and socio-economic factors drive women's engagement in groundnut production. More specifically, the age of the farmer, marital status, household size, access to land, and the motivation for income significantly influences women's decisions to participate in groundnut production. Furthermore, constraints analysis revealed that access to credit, climate change, lack of farm inputs and machinery, and shortage of labour during harvesting are among the key challenges hindering groundnut production. There is gender disparity in the ownership of land in favour of men due to the patrilineal system of inheritance practised in northern Ghana. However, women who are widowed, single or divorced had difficulties accessing land for production.

These findings have policy implications both at domestic and international levels. At the national level, ensuring that vulnerable and marginalised groups especially women farmers have access to production resources for increased productivity. Deliberate agricultural policies that target women resource-poor farmers

operating in rural areas need to be supported by the government to enhance food security and national development. At the international level, fostering collaborations and coordination with international development agencies to invest in the agricultural sector and ameliorate the production constraints facing farmers, is key to driving integration.

Food and income security remains the main priority of government policy, especially in developing nations, and more attention should to be paid to women farmers and vulnerable groups who are efficient but lack access to productive resources. Konja, Mabe and Oteng-Frimpong^[53] emphasised the need to incentivise and build the capacity of smallholder farmers for profitable and efficient groundnut production. Commercialisation of smallholder production could enhance food and income security of farmers, and facilitate the use of modern inputs^[49]. Based on the findings, the following recommendations are made:

- Groundnut is a cash crop and its production is profitable and accessible to women farmers. There is a need to increase investment in the groundnut production value chains for increased productivity. Provision of subsidised farm inputs such as improved seeds, fertilisers, weedicides and spraying machines by the government and NGOs could minimise the constraints facing women farmers. Also, the agricultural mechanisation centres concept introduced by the government of Ghana should be strengthened and expanded to make timely ploughing services available to farmers. This could possibly bring down the cost of ploughing through competition.
- Access to land for vulnerable groups (widowed, single and divorced women) requires the attention and engagement of various stakeholders (traditional authorities, NGOs, private organisations, and government Ministries) for inclusive production. This could help transform the current farming system and make it more inclusive.
- Credit facilities should be made available to women engaged in groundnut production. NGOs and private organisations involved in agriculture can play a lead role in this regard to help address the challenges women farmers face in accessing farm inputs and ma-

chinery. Furthermore, strengthening the Village Savings and Loan Associations (VSLAs) and expanding the concept has greater potential in overcoming liquidity constraints that characterize production activities.

- Farmer education and training on the effects of climate change, coping strategies and mitigation measures need to be vigorously pursued by the Ministry of Food and Agriculture. Information on weather should be made available in a timely manner to guide the activities of farmers.

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Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the farmers to publish this paper.

Data Availability Statement

The questionnaire used in gathering the data as well as the data sets used in the analysis that support the research findings are available with the author.

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Conflict of Interest

There is no conflict of interest regarding this submission.

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