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Influence of Women on Crop Choice Decision Making among Farm Households in Northern Ghana

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Abstract

This paper investigates the effect of women's involvement in intra-household decision making on crop choice decisions, relative to indigenous food crops combinations by farm households. The study draws on choice theory and estimates a multinomial logit regression model using a survey data of 271 farm households in three districts in Northern Ghana. The paper finds that women's involvement in crop production decisions at the household level promotes the production of more diverse indigenous food crop mix (pulses, vegetables and oilseeds with cereals). Other factors such as larger land holdings; awareness of the nutritional significance of indigenous food crops in household diets; household size; presence of children; educational status and age of the household head; engaging in nonfarm activities; and distance away from the nearest market affect households' crop choice decisions relative to indigenous food crop combinations. The paper concludes that women's involvement in intra-household decisions promotes production of a more diverse indigenous food crop mix in northern Ghana and recommends that women's participation in intra-household decision making should be supported and promoted, since that could help Ghana accelerate its attainment of food and nutrition security (SDG2).

Keywords: Women, Decision Making, Crop Choice, Farm Households, Northern Ghana

1. Introduction

In sub Saharan Africa, especially in rural communities, women constitute a major group of smallholder farmers and contribute immensely to food security through food crop production (Sraboni et al., 2014). Women's role goes far beyond actively participating (through provision of their labour input) in major agricultural activities such as planting, weed control, harvesting, processing and marketing of agricultural products(Patel et al., 2016). Women contribute up to 80 percent of agriculture in Africa (Denton, 2002)in the areas of workforce, food production; processing of basic foodstuffs and marketing of agricultural output. Yet, women are usually the poorest; they are voiceless and lack power. The lack of power and voice are often occasioned by their lack of formal education or poor educational achievement, less control over productive resources including household income, and less participation in household decision making (Hossain and Jaim, 2011; Osondu, 2019; Sraboni et al., 2014).In the gender analysis framework of Moser (2012)Moser (1993), these are strategic needs of women. Socio cultural and economic factors constrain their effective involvement in mainstream agriculture and therefore hamper their efforts to better their lives(Denton, 2002; Omotesho et al., 2018). As Yngstrom (2002) notes, women frequently face difficulties in building up sustainable farming enterprises as they rarely command the same kind of control over productive resources as men.

The situation of women in northern Ghana, whose major source of livelihood is agriculture, is no different from that of their counterparts in other parts of the developing world, where women are often less empowered to act due to several structural

constraints. Indeed, Rahman (2008)notes that while women make significant contributions to food production and processing (practical women's needs), men seem to take more of the farm decisions and control the productive resources; a situation that needs to change for increased agricultural productivity and improved household wellbeing. It is important to note that due to the numerous and diverse roles they play in food production, women are often repositories of knowledge on the cultivation, processing and preservation of nutritious and locally adapted crop types, especially indigenous food crops. In semi-subsistence farming systems such as practised in Northern Ghana, production of indigenous crops has several benefits. Indeed they serve the practical needs of women in their reproductive roles of ensuring the adequacy of nutrition. In addition to contributing to dietary diversity and food and nutrition security, production of indigenous crops can be used as a tool for risk management, soil fertility management, biodiversity conservation, and preservation of culture and identity. Indeed, indigenous crops may be the pillar of resilience of many a subsistence farm household through the lean seasons.

Being largely horticultural crops, indigenous crops contribute to famers' food and nutrition security through direct consumption (as they serve as good sources of vitamins, minerals and dietary fibre) and as an important source of income (MoFA, 2017). In terms of utilization, indigenous crops, particularly pulses, vegetables and oil seeds, are used as food ingredients and/or sold for income to procure meal ingredients and so are often referred to as women's crops (Carr, 2008; Doss, 2002; Orr et al., 2016). Carletto et al. (2015) observe that household agricultural production has direct and important linkages with dietary patterns and nutrition. More recently, Ecker (2018) noted that in Ghana farm production diversification and household income growth are the main factors strongly associated with increased household dietary diversity. Also, Kumar et al. (2015) document positive association between production diversity and dietary diversity as well as other anthropometric indicators for children of different age groups. Similarly, Shively and Sununtnasuk (2015) emphasize the importance of specific crop groups, and the consumption of own production to long term nutrition outcomes among children. Production of indigenous crops can help improve household nutrition, increase incomes and preserve local cultures and ultimately empower women.

Previous studies suggest that gender based roles in crop production activities may vary across farming systems, cultural settings and geographical location(Ogato et al., 2009). In fact, in some cultures, production of certain types of crops is dominated by women while in others women play a more or less supportive role. In particular, indigenous or underutilized crops are said to be inferior and so are largely cultivated by women for home consumption(Mayes et al., 2012). Production of indigenous crops by women for home consumption is practised in some parts of northern Ghana. In such cases women may hold the power to preserve biodiversity and resilience of the agricultural systems. However, women's limited access to resources such as land and their little voice in decision making may limit the ability of households to benefit fully from these indigenous crops.

In situations where women are involved in the production of food crops, there is more likely to be improvement in household nutrition as some studies have found (Bjornlund et al., 2019; Malapit et al., 2015; Mikalitsa, 2015; Schmidt, 2012)and the general family welfare(Acosta et al., 2019; Willis-Núñez, 2016). In households where women assume active roles in decision making either as heads of the household or as co-decision-makers with their men counterparts, the nutritional status of children tend to be better than otherwise (Mikalitsa, 2015). As home managers, women have useful knowledge of domestic and family needs and by their involvement in the production process, they are able to meet family needs more easily and efficiently. It has been argued that in some societies and cultures, a woman's role in family decision making is limited (Ajadi et al., 2015; Schmidt, 2012). However, with regards to indigenous food crop production in the study area, women tend to have more autonomy and decision making capabilities since such crops are largely produced for domestic consumption. Household headship has a direct bearing on decision making on key aspects of the household such as expenditure, control and access to productive assets, and therefore affects children's welfare too. The extent to which women have access to productive resources and the level of their involvement in household decision making(Mikalitsa, 2015) therefore may vary directly with household headship.

In spite of the association of indigenous food crops with women as espoused above, empirical assessment on the subject and its effect on women's welfare (and hence household welfare) is lacking in the context of northern Ghana. As a key feature running through agricultural policies of governments in sub Saharan Africa, the major objectives in Ghana's Medium Term Agriculture Sector Investment Plan (METASIP) are improved nutrition and enhanced incomes of both men and women(MoFA, 2010); therefore assessing the effect

of women's involvement in crop production decision making on choice of indigenous crop combinations may help identify strategies that could contribute to the overall achievement of these policy objectives. Also, in the Food and Agricultural Sector Development policy II (FASDEP II), strategies aimed at farm production diversity target indigenous staple crops for the achievement of food security and increased incomes for farmers with policy targeting increased production and commercialization of selected indigenous cereals, pulses and vegetables/oilseeds based on the comparative and competitive advantage of agroecological zones and availability of markets(GoG, 2007). This paper assesses the link between participation of women in decision making in agricultural production, and the choice of indigenous food crops for integration into the household crop mix and by implication, the dietary diversity of households in northern Ghana. Specifically, the paper seeks to investigate the level of participation of women in the production of indigenous food crops and to identify the determinants of choice of indigenous crop combinations of farm households. The rest of the paper are sections on review of related literature, materials and methods, results and discussion, and ends with, conclusion and policy recommendations.

Related Literature

Making crop production decisions regarding the choice of crops and control over income and resource use may signal the balance of power between men and women in the family, whilst the respective roles played by men and women in farm production activities may indicate their levels of involvement in the agricultural sector. Related to the decision making structure and levels of involvement in agricultural activities by men and women within the context of the farm household are the respective roles of men and women(Acosta et al., 2019; Fischer et al., 2017; Jones et al., 2014; Malapit et al., 2015; Rajendran et al., 2014).

Moser's gender in development framework (Moser, 1993) specifies three types of roles of women as productive, reproductive and community development. Related to these roles are two types of needs – practical needs (reducing inadequacies in living conditions such as employment or agricultural production) and strategic needs (related to gender divisions of labour, power, control such as decision making for agricultural production).Partly based on these is the Women's Empowerment in Agriculture Index (WEAI), developed byAlkire et al. (2013) for purposes of measuring women's empowerment in terms of decision making and their level of inclusion in the agricultural sector. The approach has been adopted in related areas such as women empowerment and rural household food security studies (Ahuja, 2016; Muhammad-Lawal et al., 2018). How involved women are in making these decisions may affect households' decisions on which crops to include in their cropping mix. This approach has been adopted to assess the effectiveness of women's empowerment levels in projects aimed at promoting farm entrepreneurial capacities of women in Bangladesh (Hossain and Jaim, 2011). Where women assume active roles in decision making either as heads of household or as co-decisionmakers with their men counterparts, there's a high tendency for the inclusion of indigenous crops, particularly those in the oil seed and vegetable groups(Acosta et al., 2019; Meijer et al., 2015).

Literature suggests that the involvement level of men and women in decision-making can range from no involvement, to sole decision-making (Acosta et al., 2019; Hossain and Jaim, 2011; Meijer et al., 2015; Patel et al., 2016; Willis-Núñez, 2016), with varying degrees of influence on household welfare. According to Willis-Núñez (2016), the joint control of household assets and joint decision- making by men and women could result in improved livelihoods for farm households. Studies on gender roles in general agricultural activities and decision making involving women have found their active involvement in agricultural production but the degree of involvement of men and women varied according to different activities (Gasson and Winter, 1992; Meijer et al., 2015; Okonya et al., 2019). For example, Meijer et al. (2015) found that decisions were either made jointly by the husband and wife or solely by the husband for most agricultural activities in Malawi. But the study, which investigated the role of gender and kinship structure in agriculture and tree planting, also found that in tree planting and tree management, decisions were made by the household head alone.

2. Materials and methods

2.1 Indigenous Food Crops: Types and Combinations Planted by Farm Households

Broadly, indigenous food crops in the Northern Region can be classified as cereals, pulses, vegetables and oil seeds. Indigenous cereal crops include millet, sorghum and fonio; the pulses group consists of Bambara nuts, pigeonpea, cowpea and lentils. Those in the indigenous vegetables group include amaranth/Roselle/hibiscus, okro and pepper, whilst those of oil seeds include sesame and melon seeds. The production of these crops is common among women, especially the pulses, vegetables and oil seeds, due to their use as ingredients inmeal preparation. Melon seeds and sesame are reliable sources of oil and protein. Furthermore, some traditions and customs in parts of northern Ghana

require women to contribute to household food provisioning in the form of soup/sauce ingredients from their own resources; therefore these crops can be described as women's crops as their production and control are largely by women.

For various reasons, farm households in northern Ghana perceive combining crops (which is more or less intercropping) as beneficial in several respects. Key among them are the need to meet household requirements for food and income, and for soil and production risk management. For example, legumes have the ability to withstand soil erosion and improve soil fertility when combined with cereals (Akibode, 2011; Hillocks, 2011; Hillocks et al., 2012) and hence improve and/ or stabilize crop yields.

2.2 Method of Data Analysis

Preliminary field visits revealed that farm households combined one or more indigenous food crop groups from across four broad crop groups of cereals, pulses, vegetables and oil seeds during the season preceding the survey year (2016). However, for purposes of data analysis, oilseeds and vegetables were grouped into one, bringing the crop groups to three. Subsequently the following four indigenous crop combinations were identified: (1) indigenous cereal(s) with indigenous legume crops only; (2) indigenous cereal crops with indigenous vegetable & oil seeds only; (3) indigenous legume crops with indigenous vegetables &oilseeds only; and (4) crops from each of indigenous cereal, pulses and vegetables &oilseeds crop species simultaneously. Based on this, households were classified into four categories according to how they combined the various indigenous food crop types they cultivated. Households were categorized as those adopting Cereal-Pulses Strategy (CPS) if they produced at least one cereal crop in combination with at least one crop in the pulses group but not any crop in the vegetables &oilseed crop species; Cereals-Vegetables &Oilseeds Strategy (CVS) if they produced at least one cereal crop in combination with at least one vegetables &oilseed crop but not any crop from the pulses group; Pulses-Vegetable &Oilseeds (PVS) if households produced at least one pulses/legume crop in combination with at least one crop of the vegetables &oilseed species; and Cereal-Pulses-Vegetable & Oil seeds Strategy (CPVS) if households produced at least one crop from each of the three broad crop groups of cereals, pulses and vegetables &oilseeds in combination.

Choice theory in economics suggests that individuals are rational in making decisions and are therefore expectedto choose alternatives that provide them with the maximum level of utility. Following this, farm households engaged in indigenous food crop production are expected to choose an indigenous crop combination, out of available alternatives, so as to maximize expected utility from production. This choice of the household is assumed to be made based on the maximization of expected utility subject to personal characteristics, household and farm production characteristics as well as peculiar characteristics associated with the combination of indigenous crops chosen(Benin et al., 2003). Therefore, the adoption of a given combination of indigenous crops by households can be considered as a function of the expected utility derived from combining indigenous crops.

For studies involving adoption, the probit, logit and Tobit models can be used depending on the probability distribution of the error term. Where the dependent variable is censored and discrete, categorical dependent variable models are usually used. These models are classified based on whether the outcome is a choice between two or more alternatives(Combary, 2015; Greene, 2008). Multiple outcome decisions are assessed using multinomial models. With reference to how farm households combined indigenous crops in this study, the dependent variable, Indigenous Crop Combination (ICC), is an unordered categorical variable ranging from 1 to 4 with CPS =1; CVS =2; PVS =3 and CPVS = 4.Thus, the dependent variable is ICC_j, with $j = 1,2,\dots,4$ if the indigenous crops combination chosen is CPS, CVS, PVS or CPVS, respectively. In situations of unordered categorical dependent variables, unordered logistic regression techniques are the most appropriate(Combary, 2015; Gebru et al., 2018). We explore the determinants of indigenous food crop combination choices of farm households in this paper using multinomial logit regression analysis with women's participation level in decisions on agricultural production activities as the primary independent variable of interest.

The multinomial logit model captures how the proposed independent variables affect the probability that a household in the sample chooses one of the J-1 possible indigenous crop combinations relative to the base outcome, CPor $ICC_i = 1$. The multinomial logit model for the j discrete alternatives, j = 1, 2, …, J-1, has an odds ratioZ_{ij}, if the first outcome of $ICC_i = 1$ serves as the reference point as:

$$Pr_{ij} = Pr(ICC_{ij})\ \forall\ j = 1,2,\dots,J-1 \quad \dots\dots\dots\dots 1$$

$$Z_{ij} = \ln\left(\frac{Pr(ICC_{ij=1,2,\dots J}/X_i)}{Pr(ICC_{ij=1}/X_i)}\right) = \ln\left(\frac{ICC_{ij=1,2,\dots J}}{ICC_{ij=1}}\right) = \alpha_{ij} + \sum_{J=1}^{K}\beta_{ij}X_{ij} \quad \dots\dots\dots\dots 2$$

$$Pr(ICC_{ij=1,2,\dots,J}) = \frac{\exp(Z_{ij})}{1+\sum_{j=1}^{4}\exp(Z_{ij})} \quad \dots\dots\dots\dots 3$$

$$\Pr\left(\mathrm{ICC}_{ij=1,2,\ldots,4}\right) = \frac{1}{1+\sum_{j=1}^{4}\exp\left(Z_{ij}\right)} \ldots\ldots\ldots\ldots\ldots\ldots 4$$

where, $\Pr_{ij}$ is the probability indicator for the i^{th} household with j the indigenous crops combination; Z_{ij} is the odds ratio of households doing J-1 crop combinations relative to the cereals-pulses combination, that is households in the$j = 1$or $\mathrm{ICC}_i = 1$, $ln$is the natural logarithm; X is a vector of independent variables including our exogenous variable of interest, women's participation level in agricultural activities, households' socioeconomic and other relevant variables hypothesized to explain household's choice of indigenous crop combinations and β is a vector of parameters to be estimated.

Parameter estimates of the multinomial logit model do not represent actual magnitudes of change or probabilities; they provide only the direction of the effect of the independent variables on the dependent variable(Greene, 2008). The marginal effects therefore are derived as illustrated in Equation 5 to explain the effects of the independent variables on the dependent variable in terms of probabilities.

$$\frac{\partial \mathrm{P_j}}{\partial \mathrm{X_i}} = \mathrm{P_j}\left[\beta_j - \sum_{K=1}^{J} \mathrm{P_K}\,\beta_j\right] = \mathrm{P_j}\left(\beta_j - \bar{\beta}\right) \ldots\ldots\ldots\ldots 5$$

2.3 The Empirical Model

The empirical model of the relationship between households' choice of indigenous crop combinations and their determinants in this study is presented in Equation 6.

$$\mathrm{ICC_j} = \beta_1 + \beta_2\mathrm{WICPI} + \beta_3\mathrm{NAW} + \beta_4\mathrm{AHH} + \beta_5\mathrm{GHH} + \beta_6\mathrm{HHFE} + \beta_7\mathrm{HS} + \beta_8\mathrm{NYHM} + \beta_9\mathrm{ANVIC} + \beta_{10}\mathrm{TLS} + \beta_{11}\mathrm{PFSP} + \beta_{12}\mathrm{NFW} + \beta_{13}\mathrm{MD} + \beta_{14}\mathrm{KDD} + \beta_{15}\mathrm{WMDD} \ldots\ldots\ldots\ldots\ldots 6$$

where $\mathrm{ICC_j}$ indicates indigenous crop combination; WPCPAIis Women's Participation in Crop Production Activities Index; NAW is the number of adult women in the household; AHHis the age of household head in years; GHH is gender of household head; HHFE is household head's formal education status; HS is household size; NYHM is number of young household members; ANVIC is awareness of the nutritional importance of indigenous crops; TLS is total size of landholding of the household; PFSPis participation ofhousehold in NGO food security related projects; NFWis nonfarm work; MDis market distance in km; KDDis the Karaga District Dummy; $WMDD$ is the West Mamprusi District Dummy and β_i are the parameters to be estimated. The analysis proceeds with the indigenous cereal-pulses combination as base indigenous crop combination scenario.

2.4 Description and Measurement of Explanatory Variables

Women's Participation in Crop Production Activities Index (WPCPAI)

Following Alkire et al. (2013), and Hossain and Jaim (2011), 'Women's Participation in Crop Production Activities Index' (WPCPAI) was constructed as the exogenous variable of interest and used in the analysis. The WPCPAI was constructed using three dimensions of crop production activities. These included women's household decision-making roles, women's control and power in the utilization of farm income, and women's participation in agricultural activities at the household level. The first area of decision making roles considered responses to questions regarding women's participation in decision-making as to whether the household had sole or joint decisions on households' choices about which types of crops to grow. Specifically, households' responses to questions on decisions made concerning the choice of crops and the choice of indigenous crop types such as indigenous cereal crops, pulses/legume and/or vegetables and oilseed crops that they produced. The second part considered whether crop income of the household was controlled by men only, women only or jointly by men and their spouses and this was expected to measure the level of women's control and utilization of households' income earned from crop production. The dimension on the level of women's participation in indigenous crops production took into consideration all six categories of activities related to the production of indigenous food crops.

The activity categories included land preparation, planting, weeding, harvesting, processing and marketing of crop produce. Based on the responses to questions on whether these activities were solely or jointly performed by men and women in the household, sub-indices were calculated for each of the three areas of women's participation and an average of all three indices obtained as WPCPAI. A 3-point rating scale was used with the scores of 2, 1 and 0 assigned respectively if answers to the survey questions indicated that decisions and activities were taken solely by women, jointly by men and women or solely by men, respectively. For each household, the frequency count of responses for each area was divided by the number of questions to obtain an average score. Thus, the average scores for, involvement in crop choice decisions, income control and level of involvement of women in crop production activities were summed and divided by 3 to obtain WPCPAI, a proxy for women's level of participation in food crop production (Alkire et al., 2013; Hossain and Jaim, 2011). Households' socioeconomic and demographic characteristics, farm related and institutional factors were included as control variables in the model. The explanatory variables used in the analysis are summarised in Table 1.

Table 1. Description and Measurement of Explanatory Variables

Variable Description	Measurement	Mean/Percent
Women's participation in crop production index	Number	0.923
Household head had formal education	Dummy: 1= yes; 0=no	22.1%
Male household head	Dummy: 1= yes; 0=no	80.4%
Age of household head	Number of years	43.8
Household size	Number of persons	8.0
Number of adult women in household	Number of persons	2.0
Household members under 15 years of age	Number of persons	4.0
Awareness of the nutritional relevance	Dummy: 1=yes; 0=no	58.3%
Total land holding	Hectares	8.5
Number of fields	Number	2.4
Household engaged in non-farm work	Dummy: 1=yes; 0=no	32.1%
NGO food security related projects	Dummy: 1=yes; 0=no	12.2%
Mean market distance	Continuous: km	7.9
District Dummy-Karaga	Dummy: 1=yes; 0=no	33.2%
District Dummy- West Mamprusi	Dummy: 1=yes; 0=no	33.2%

NB: Base reference-Chereponi

2.5 Sampling Procedure and Data

The sample selection followed a multistage sampling procedure. Three districts in the Northern Region were purposively selected because they were identified as areas where indigenous food crops were being promoted; the Chereponi, Karaga and West Mamprusi Districts.

In each of the districts, five communities were randomly selected except in the West Mamprusi District where six communities were selected. From each community, between 25 and 30 households were randomly selected depending on the size of the community. However, not all sample households were engaged in indigenous food crop production, and as a result, between 10 and 27 completed questionnaires were deemed appropriate for inclusion in the data for analysis. In all, the analysis in this paper is based on data from a sample of 271 farm households drawn from 16 farming communities with 90 households each from the Chereponi and Karaga Districts and 91 from the West Mamprusi District.

Datafor this study was obtained through questionnaire, administered to respondents at the household and community levels. The household level questionnaire sought information on socioeconomic and demographic characteristics, and agricultural production profiles. Data on household crop production decision making roles of men and women; the participation in crop production activities by men and women, household's farm income utilization and respondent's awareness about nutritional relevance of indigenous food crops was collected. Community Focus Group Discussions (FGDs) involved community opinion leaders, youth leaders and experienced farmers. Such discussions included types of indigenous food crops commonly cultivated in the community and their production management strategies.

3. Results and discussion

3.1 Patterns of Indigenous Crop Combinations Practised by Farm Households

Table 2 shows four indigenous crop combinations identified in the study area and the distribution of sampled households across these crop combinations. Thirty-five percent of the sampled households combined crops from all the four indigenous crop groups of cereals, pulses, vegetables and oilseeds. This combination of crops is most popular probably because households would want to diversify their crop production to meet their food needs, conserve and improve soil structure and fertility, as well as reduce the risks associated with total crop failure. Theresults reflect the intuition that smallholder farmers may engage in multiple crop production for varied reasons including, profit maximization, risk minimization, soil conservation and improvement of soil fertility, weed, pests and diseases control and balanced nutrition.

The cereal-vegetable-oilseed combination strategy is next important form of indigenous crops combination with about 24 percent of the sample combining crops from the cereals, vegetables and/oilseeds groups. This result is consistent with the hypothesis that where women are involved in matters of crop selection for cultivation, households would more likely include vegetables and oilseeds mainly for probably food preparation. Anecdotal evidence suggests that the main purpose of the production of vegetables and oilseeds is use in food preparation as relishes and as ingredients in soups/stews. Twenty-one percent of households combined cereal crops with pulses whilst 20 percent produced pulses in

combination with vegetables & oilseed crops. A combination of cereal and legume crops improves soil texture besides the fact that some legume crops serve as cover crops and so farmers being aware of this, would normally adopt such combinations.

Further analysis of the patterns of households' indigenous food crop combinations showed that, of the households that produced indigenous cereal crops, 26 percent of them also cultivated pulses;27 percent vegetables &oilseed crops and close to half(47%) produced pulses& vegetables & oilseeds simultaneously (Figure 1). Among indigenous pulses producers, the data show that about half grew crops from the cereals, vegetables & oilseeds crops in combination with 28 percent and 22 percent adopting the cereal-pulses and pulses, vegetables & oilseeds combination strategies respectively.

Table 2. Farm Households by Indigenous Crop Combination

Crop Group Combination	List of Crops	Number of Households	% of Sample
Cereals-Pulses Crop Combination	Sorghum, Millet, Fonio Bambara Nuts, Cowpea, Pigeonpea, Lentils	58	21.4
Cereals-Vegetables&Oilseed Crop Combination	Sorghum, Millet, Fonio Roselle, Melon seeds, sesame	64	23.6
Pulses-Vegetables&Oilseed Crop Combination	Bambara Nuts, Cowpea, Pigeonpea, Lentils Roselle, Melon seeds, sesame	54	19.9
Cereals-Pulses-Vegetables&oilseed Crop Combination	Sorghum, Millet, Fonio, Bambara Nuts, Cowpea, Pigeonpea, Lentils, Roselle, Melon seeds, sesame	95	35.1
Total		271	100.0

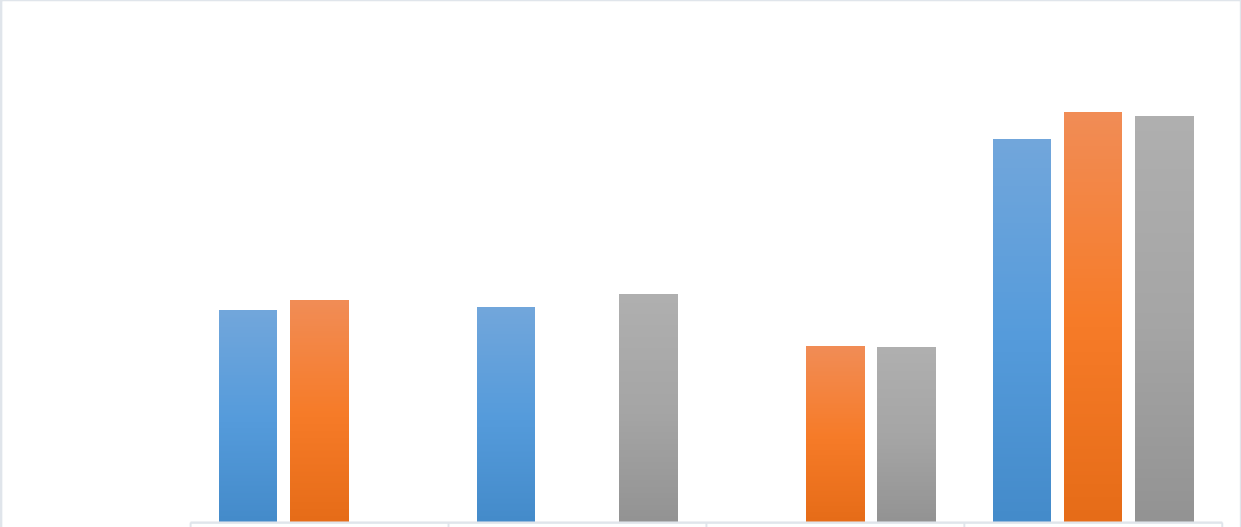

Figure 1. Distribution of Households by Indigenous Crop Combinations.

Up to 28 percent of households growing vegetables & oilseed crops also grew cereal crops and about half cultivated crops from all three crop groups (cereals, pulses and vegetables & oilseeds). The results show that majority of farm households in the Northern Region are more inclined to include, in their cropping mix, crops from across all the three major crop groups (that is cereals, pulses and vegetables/oil seeds). Combining crops in this manner may be a strategy employed by farmers to mitigate production losses.

3.2 Factors Influencing Choice of Indigenous Food Crops Combinations by Farm Households

From the results of a Suest-based Hausman test of the Independence of Irrelevant Alternatives (IIA) assumption (Table 3) we failed to reject the null hypothesis that the coefficients that affect choice of an indigenous food crop combination strategies were independent of other alternatives; the multinomial model is therefore appropriate for our analysis.

Table 3. Suest-Based Hausman Tests of Independence of Irrelevant Alternatives

Omitted	Chi2	df	P>chi2	Evidence
2	14.989	32	0.995	for H0
3	17.443	32	0.983	for H0
4	18.869	32	0.968	for H0

NB: Ho: Odds (Outcome J vs Outcome K) are independent of other alternatives. A significant test is evidence against Ho and if chi2<0, the estimated model does not meet asymptotic assumptions.

Summary diagnostic statistics of the estimated model also indicate the general appropriateness of the use of the multinomial logit approach as presented in Table 4. With a Likelihood Ratio (LR) test statistic of 164.52 and a corresponding Chi-Square value of 45 on the assumption that the coefficients of all independent variables are jointly equal to zero, we failed to accept the null hypothesis since the probability of the LR test statistic, 164.52, is virtually zero (Prob > chi2 = 0.0000). With an R2 value of 0.2279, the independent variables included in the model, explain about 23 percent of the variations in the outcomes of the dependent variable and this may be satisfactory in the context of cross sectional surveys and discrete choice models as the present study. The marginal effects of the factors that influence farm households' choice of indigenous food crop combinations in the Northern Region are presented in Table 5. The combination strategy involving indigenous cereal and pulses/legume crops is the base outcome in the model.

Women's participation in crop production, our primary variable of interest is a significant factor influencing households' choice of crop combinations of cereals-vegetables/oilseed crops and a combination involving crops from all four crop classes of cereals, pulses and vegetables and oilseeds. Whilst a higher level of women's participation in indigenous food crop production activities encourages the combination of cereals, pulses and vegetables and oil seed crops by about 68 percent, it tends to reduce the probability of households adopting the combination of cereals and vegetables by about 50 percent. The results imply that rather than limiting households' crop production mix to indigenous food crops from only two crop classes, a higher level of involvement of women in agricultural production may lead to the adoption of a more diverse crop production mix that includes crops from the three broad crop classes. The finding is in line with previous studies that a higher level of women in household decision making could result in enhanced access of the household to nutritious food that could translate into better health and wellbeing (Bjornlund et al., 2019; Fischer et al., 2017). The positive influence of women's participation in crop production on households' choice of a wider crop combination could also be attributed to the fact that pulses such as Bambara nuts, cowpea and oilseeds such as sesame and melon seeds have multiple uses as cash crops and for the preparation of soups and stews for family consumption. For example, young leaves of cowpea are used in the preparation of soups and a lean season relish, and this practice is common in the study area. This has implication for households' access to, and utilization of diversified diets which may translate to improved household nutrition. This on-farm diversification could also be a strategy to stabilize household income(Vernimmen et al., 2002)since surplus output could be sold and the income used to procure other household needs especially where both men and women have joint control and use of household income.

The study finds that the presence of more adult women in the household positively influences households' choice of indigenous food crop combinations of cereals, vegetables & oilseeds and pulses, vegetables & oilseeds but reduces the likelihood of the adoption of the strategy that combines crops from all the three crop groups (cereals, pulses, vegetables & oilseeds). This is in line with intuition that pulses and vegetables & oilseeds are women's crops and a higher number of adult women in the household is indicative of the relative influence that women can exert in the choice of crops and control of household resources in general.

Table 4. Determinants of Choice of Indigenous Crop Combination by Farm Households: A Multinomial Logit Regression Results

Indigenous Crop Combination Strategies	Cereal-Veg&Oilseeds		Pulses-Veg&Oilseed		Cereal-Pulses-Veg&Oilseeds	
Variables	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Women's participation in crop production	-2.067**	0.974	2.058**	0.875	3.887***	0.794
Household head had formal education	-0.574	0.549	0.345	0.558	-0.573	0.475
Male household head	0.455	0.643	1.134*	0.649	1.159**	0.539
Age of household head	-.0195	0.021	0.028	0.019	0.0007	0.017
Household size	0.115	0.142	-0.622***	0.202	0.115	0.118
Number of adult women in household	-0.633**	0.319	0549	0.367	-0.458*	0.252
Household members under 15 years of age	-0.067	0.173	0.551**	0.221	-0.173	0.139
Awareness of the nutritional relevance	-1.254**	0.531	-0.708	0.533	-0.155	0.449
Total land holding	0.066	0.067	-0.009	0.069	0.102*	0.057
Number of fields	-0.269	0.311	0.025	0.319	0.069	0.266
Household engaged in nonfarm work	1.252**	0.502	0.453	0.531	0.492	0.433
NGO food security related projects	-0.252	0.704	-1.460*	0.855	-0.374	0.557
Market distance in km	-0.142***	0.045	-0.075**	0.036	0.008	0.020
District Dummy_Karaga	-1.827**	0.765	0.487	0708	-0.386	0.572
District Dummy_West Mamprusi	-1.732***	0.619	-1.292**	0.625	-0.701	0.508
Constant	5.192***	1.605	-1.294	1.657	-3.949***	1.409
Base Outcome: Cereals-Pulses Combination						

LR chi2(42)=164.52, Prob > chi2=0.0000, Log likelihood=-278.65, Pseudo R^2 =0.23,
***, ** and * imply statistical significance at 1%, 5% and 10% respectively. Base District_Chereponi

Table 5. Marginal Effects of the Determinants of Households' Choice of Indigenous Crop Combination Strategies in Northern Ghana

Variable	Cereal-Veg&Oilseeds	Pulses-Veg&Oilseeds	Cereal-Pulses-Veg&Oilseeds
Women's participation in crop production	-0.501***	0.094	0.682***
Household head had formal education	-0.052	0.093*	-0.095
Male household head	-0.039	0.056	0.122
Age of household head	-0.003*	0.004**	-0.0005
Household size	0.028**	-0.086***	0.051***
Number of adult women in household	0.0271**	0.113***	-0.084**
Householdmembers under 15 years of age	-0.018	0.079***	-0.059***
Awareness of the nutritional relevance	-0.119**	-0.036	0.073
Total land holding	0.003	-0.009	0.016**
Number of fields	-0.036	0.008	0.024
Household engaged in nonfarm work	0.111**	-0.014	0.002
NGO food security related projects	0.036	-0.141	0.029
Market distance in km	-0.015***	-0.005	0.013***
District Dummy_Karaga	-0.215***	0.141**	-0.009
District Dummy_West Mamprusi	-0.130**	-0.059	0.031
Observations	271	271	271

***, ** and * imply statistical significance at 1, 5 and 10% respectively. Base District_Chereponi

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Older women (wives) also enjoy higher status, and autonomy compared to younger wives in parts of the Northern region (Warner et al., 1997) and in the household.Naturally, crops that are more useful and profitable to women would find their way into the family crop portfolio compared to other crops.

Land size has also been identified as a significant factor influencing households' choices of

indigenous crop combinations. The results show that households with larger land parcels are more likely to combine indigenous crops from all three crop classes and this is consistent with earlier empirical findings (Zivanomoyo and Mukarati, 2013). Households with larger croplands are able to include more crops in theircrop mixesas households with larger land holdings tend to have comparative advantage in diverse crop food production. Land holding indicates the resource base of the household and economic theory considers it a key factor of production. Availability of land to a household means that women who tend to have residual access to land in the study area will also have more land to grow their crops.

Other significant determinants of households' indigenous food crop combination choices include being aware of the importance of indigenous food crops in nutrition of household diets; higher formal education status and age of the household head; engaging in nonfarm activities; being closer to or farther away from the nearest local market; household size and the presence of young household members less than 15 years of age. These factors influence the choice of crop combinations in different ways that are consistent with available empirical findings (Rahman and Chima, 2016).

4. Conclusion and Recommendations

Women's involvement in crop production activities in farm households is a key factor influencing crop combination choices as strategies for indigenous food crop production in northern Ghana. Taking part in household decision making, having control in the utilization of farm income, and assuming active roles in crop production activities make women major stakeholders in food crop production at the household level. Policies on promoting women empowerment should target increasingwomen's participation in decision making at the household levelsince this can increase their access to and use of household resources which in turn promotes the production of women's crops such as indigenous food crops. As part of strategies for improved nutrition security in farm households throughdiverse crop production mixes that could ultimately translate to diversified household diets, policy should target providing women with information on the production and utilization of these crops.

References

1. Acosta, M., van Wessel, M., Van Bommel, S., Ampaire, E. L., Twyman, J., Jassogne, L.and Feindt, P. H. (2019). What does it mean to make a 'joint'decision? Unpacking intra-household decision making in agriculture: implications for policy and practice. The journal of development studies, 1-20.

2. Ahuja, U. (2016). Participation of Farm Women in Decision Making: A Case Study of Sonipat District of Haryana, India. International Journal of Current Research, 8 (03), 28766-28771.

3. Ajadi, A. A., Oladele, O. I., Ikegami, K.and Tsuruta, T. (2015). Rural women's farmers access to productive resources: the moderating effect of culture among Nupe and Yoruba in Nigeria. Agriculture & Food Security, 4(1), 26.

4. Akibode, C. S. (2011). Trends in the Production, Trade, and Consumption of Food-Legume Crops in Sub-Saharan Africa. (Msc Thesis), Michigan State University, Michigan, USA. Retrieved from https://scholar.google.com/scholar?cluster=10324535 6088576278&hl=en&as_sdt=0,5 on 23rd September 2018

5. Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G.and Vaz, A. (2013). The women's empowerment in agriculture index. World Development, 52, 71-91.

6. Benin, S., Smale, M., Gebremedhin, B., Pender, J.and Ehui, S. K. (2003). The Determinants of Cereal Crop Diversity on Farms in The Ethiopian Highlands/доклад на 25 конференции IAAE, Reshaping Agriculture's Contribution to Society, International Convention Centre, Durban, South Africa, 16-23 August 2003.

7. Bjornlund, H., Zuo, A., Wheeler, S. A., Parry, K., Pittock, J., Mdemu, M.and Moyo, M. (2019). The dynamics of the relationship between household decision-making and farm household income in small-scale irrigation schemes in southern Africa. Agricultural water management, 213, 135-145.

8. Carletto, G., Ruel, M., Winters, P.and Zezza, A. (2015). Farm-Level Pathways to Improved Nutritional Status: Introduction to the Special Issue. Journal of Development Studies, 51(8), 945-957.

9. Carr, E. R. (2008). Men's crops and women's crops: The importance of gender to the understanding of agricultural and development outcomes in Ghana's central region. World Development, 36(5), 900-915.

10. Combary, O. S. (2015). Determining factors of the strategies for diversifying sources of income for rural households in Burkina Faso. Journal of Development and Agricultural Economics, 7(1), 20-28.

11. Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter? Gender & Development, 10(2), 10-20.

12. Doss, C. R. (2002). Men's crops? Women's crops? The gender patterns of cropping in Ghana. World Development, 30(11), 1987-2000.

13. Fischer, G., Gramzow, A.and Laizer, A. (2017). Gender, vegetable value chains, income distribution and access to resources: insights from surveys in Tanzania. Eur. J. Hortic. Sci, 82, 319-327.

14. Gasson, R.and Winter, M. (1992). Gender Relations and Farm Household Pluriactivity. Journal of rural studies, 8(4), 387-397.

15. Gebru, G. W., Ichoku, H. E.and Phil-Eze, P. O. (2018). Determinants of livelihood diversification strategies in Eastern Tigray Region of Ethiopia. Agriculture & Food Security, 7(1), 62.

16. Government of Ghana (GoG). (2007). Food and Agriculture Sector Development Policy (FASDEP II). Accra, Ghana Retrieved from https://www.acu.ac.uk/publication/download?publication=748. on 13 January 2016.

17. Greene, W. H. (2008). Econometric analysis: Granite Hill Publishers.

18. Hillocks, R. (2011). Farming for balanced nutrition: an agricultural approach to addressing micronutrient deficiency among the vulnerable poor in Africa. African Journal of Food, Agriculture, Nutrition and Development, 11(2).

19. Hillocks, R., Bennett, C.and Mponda, O. (2012). Bambara nut: A review of utilisation, market potential and crop improvement. African Crop Science Journal, 20(1).

20. Hossain, M.and Jaim, W. (2011). Empowering women to become farmer entrepreneur; Retrieved from https://www.researchgate.net/profile/Mahabub_Hossain2/publication/265028979_Empowering_Women_to_Become_Farmer_Entrepreneur/links/551c0d870cf2fe6cbf762b8f/Empowering-Women-to-Become-Farmer-Entrepreneur.pdf on 23rd September 2018. Paper presented at the Conference on New Directions for Smallholder Agriculture; 24-25 January 2011, Rome, IFAD HQ.

21. Jones, A. D., Shrinivas, A.and Bezner-Kerr, R. (2014). Farm production diversity is associated with greater household dietary diversity in Malawi: Findings from nationally representative data. Food Policy, 46, 1-12.

22. Kumar, N., Harris, J.and Rawat, R. (2015). If they grow it, will they eat and grow? Evidence from Zambia on agricultural diversity and child undernutrition. The journal of development studies, 51(8), 1060-1077.

23. Malapit, H. J. L., Kadiyala, S.and Quisumbing, A. R. (2015). Women's Empowerment Mitigates the Negative Effects of Low Production Diversity on Maternal and Child Nutrition in Nepal. Development, 51(8), 1097-1123.

24. Mayes, S., Massawe, F., Alderson, P., Roberts, J., Azam-Ali, S.and Hermann, M. (2012). The potential for underutilized crops to improve security of food production. Journal of experimental botany, 63(3), 1075-1079.

25. Meijer, S. S., Sileshi, G. W., Kundhlande, G., Catacutan, D.and Nieuwenhuis, M. (2015). The role of gender and kinship structure in household decision-making for agriculture and tree planting in Malawi. Journal of Gender, Agriculture and Food Security, 1(1), 54-76.

26. Mikalitsa, S. M. (2015). Intrahousehold allocation, household headship and nutrition of under-fives: a study of western Kenya. African Journal of Food, Agriculture, Nutrition and Development, 15(1), 9708-9721.

27. Ministry of Food and Agriculture(MoFA). (2010). Medium Term Agriculture Sector Investment Plan (METASIP)—2011–2015.

28. Ministry of Food and Agriculture(MoFA). (2017). Planting for Food and Jobs Strategic Plan for Implementation (2017–2020). Accra, Ghana: Ministry of Food and Agriculture. Accra, Ghana.

29. Moser, C. O. (2012). Gender planning and development: Theory, practice and training: Routledge.

30. Muhammad-Lawal, A., Omotesho, K. F., Jimoh, O., Abdulraheem, N. M.and Olaghere, I. L. (2018). Impact of Women Empowerment on Food Security among Rural Households in Kwara State, Nigeria. International Journal of Agricultural Science, Research and Technology (IJASRT) in Extension and Education Systems Technology in Extension and Education Systems (IJASRT in EESs), 8(4), 221-230.

31. Ogato, G., Boon, E.and Subramani, J. (2009). Gender roles in crop production and management practices: a case study of three rural communities in Ambo district, Ethiopia. Journal of human ecology, 27(1), 1-20.

32. Okonya, J. S., Mudege, N. N., Rietveld, A. M., Nduwayezu, A., Kantungeko, D., Hakizimana, B. M., Nyaga, J. N., Blomme, G., Legg, J. P.and Kroschel, J. (2019). The role of women in production and management of RTB crops in Rwanda and Burundi: Do men decide, and women work? Sustainability, 11(16), 4304.

33. Omotesho, K. F., Adesiji, G. B., Akinrinde, A. F.and Aluko, O. E. (2018). Factors Associated with Women Farmers' Level of Control in Farmer-Groups in Kwara State, Nigeria. International Journal of Agricultural Science, Research and Technology in Extension and Education Systems, 8(3), 95-100.

34. Orr, A., Tsusaka, T., Kee- Tui, S. H.and Msere, H. (2016). What do we mean by 'women's crops'? Commercialisation, gender and the power to name. Journal of International Development, 28(6), 919-937.

35. Osondu, K. C. (2019). Analysis of Factors Influencing Food Security Status of Female Headed Farm Households in Abia State, Nigeria. International Journal of Agricultural Science, Research and Technology (IJASRT) in Extension and Education Systems, 9(1), 0-0.

36. Patel, T., Chaudhary, K., Parmar, K., Chaudhari, D.and Dhandhukia, R. (2016). Decision making pattern of farm women in relation to selected different agriculture actvities. Ecology Environment and Conservation, 22, S1-S4.

37. Rahman, S. (2008). The economic determinants of crop diversity on farms in rural Bangladesh. Journal of International Agricultural Trade and Development, 5(1), 51-70.

38. Rahman, S.and Chima, C. D. (2016). Determinants of food crop diversity and profitability in Southeastern Nigeria: A multivariate Tobit approach. Agriculture, 6(2), 14.

39. Rajendran, S., Afari-Sefa, V., Bekunda, M., Dominick, I.and Lukumay, P. J. (2014). Does crop diversity contribute to dietary diversity? Evidence from integration of vegetables into maize based farming systems in Tanzania. Paper presented at the 88th Annual Conference, April 9-11, 2014, AgroParisTech, Paris, France.

40. Schmidt, E. M. (2012). The effect of women's intrahousehold bargaining power on child health outcomes in Bangladesh. Undergraduate Economic Review, 9(1), 4.

41. Shively, G.and Sununtnasuk, C. (2015). Agricultural diversity and child stunting in Nepal. The journal of development studies, 51(8), 1078-1096.

42. Sraboni, E., Malapit, H. J., Quisumbing, A. R.and Ahmed, A. U. (2014). Women's Empowerment in Agriculture: What Role for Food Security in Bangladesh? World Development, 61, 11-52.

43. Vernimmen, T., Bourgeois, M., Van Huylenbroeck, G., Meert, H.and Van Hecke, E. (2002, 28-31 August 2002). Diversification as a Survival Strategy for Marginal Farms An Exploratory Research. Paper presented at the X th EAAE Congress Exploring Diversity in the European Agri–Food System.

44. Warner, M. W., Al- Hassan, R.and Kydd, J. (1997). Beyond gender roles? Conceptualizing the social and economic lives of rural peoples in sub Saharan Africa. Development and Change, 28(1), 143-168.

45. Willis-Núñez, F. (2016). Measuring power and decision-making within the household. Paper presented at the Conference of European Statisticians, Vilnius, Lithuania.

46. Yngstrom, I. (2002). Women, wives and land rights in Africa: Situating gender beyond the household in the debate over land policy and changing tenure systems. Oxford Development Studies, 30(1), 21-40.

47. Zivanomoyo, J.and Mukarati, J. (2013). Determinants of choice of crop variety as climate change adaptation option in arid regions of Zimbabwe. Russian Journal of Agricultural and Socio-Economic Sciences, 15(3), 54-62.