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# **BOOK OF ABSTRACTS OF PUBLICATIONS**

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## TECHNICAL EFFICIENCY OF RESOURCE-POOR MAIZE FARMERS IN NORTHERN GHANA

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Farm productivity in most developing countries remains low, hence the need to enhance technical efficiency (TE) of producers. This study evaluates the TE of maize production in rural Ghana, using primary data from a survey of smallholder producers. A two-stage double bootstrap data envelopment analysis (DEA) approach was used to assess TE and its determinants. The results revealed a bias-corrected mean TE of 68% (as opposed to 81% using the traditional DEA approach). Hence, with the prevailing technology and current input levels, farmers can increase their TE of maize production by 32%. TE increased with adoption of improved varieties, weeding frequency, and herd size but decreased with producer's age, household size, educational status, and group membership. Subsequently, these factors need to be carefully considered in targeting policies for increasing maize productivity. The study observed increased adoption of improved varieties and training in efficient methods of weed control as important measures to enhance TE of maize farmers.

**Keywords:** data envelopment analysis, double bootstrap, technical efficiency, truncated regression, northern Ghana.

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## **ORGANIC AND CONVENTIONAL VEGETABLE PRODUCTION IN NORTHERN GHANA: FARMERS' DECISION MAKING AND TECHNICAL EFFICIENCY**

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Increasing consumer affluence and concerns over food safety have led to a reemergence of consumers' appetite for organic food as a way of achieving nutritional security. This research estimates the farmers' decision making into organic or conventional vegetable production and their technical efficiency. A total of 200 each of organic and conventional vegetable producers were selected through multistage sampling technique, and the data was collected through semi-structured questionnaires. A stochastic frontier model (SFM) with sample selection was employed to correct for selectivity bias in estimating the effect of organic vegetable farming on vegetable output and technical efficiency. The results show that farmers' education, ability, and ownership of resources to farm throughout the year (ARCAY), ability to make own inputs (AMOI), membership in a farmer-based organisation (FBO), access to extension services and access to external credit support (AECS) significantly explained the probability of engaging in organic vegetable production. Organic vegetable farming had a positive significant effect on the technical efficiency of vegetable farmers. The study concluded that organic farming is an important source of insurance for farmers to increase vegetable production and reduce inefficiencies. However, institutional factors such as extension delivery, group formation, and credit provision should be enhanced to promote organic agriculture among vegetable farmers in the region.

## THE INTERRELATIONSHIPS AMONG FINANCIAL DEVELOPMENT, ECONOMIC GROWTH AND ENVIRONMENTAL SUSTAINABILITY: EVIDENCE FROM GHANA

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A well established and developed financial system encourages savings and investment which stimulates economic growth. However, the link between financial development and the environment is ambiguous. In general, the role that the environment plays in the finance-growth nexus has received less attention, to the best of our knowledge. Against this backdrop, this study aims to examine the interrelationships among economic growth, financial development and carbon dioxide emissions for Ghana over the period of 1971–2018. To correct for a possible endogeneity problem, the three-stage least-square (3SLS) technique was employed. The results revealed that there is a bidirectional relationship between financial development and economic growth; and a unidirectional relationship from financial development to carbon dioxide emission. However, carbon dioxide emission has a neutral effect on economic growth and financial development. Economic growth exhibits an inverted U-shaped relationship with carbon dioxide emission, confirming the existence of the environmental Kuznets curve hypothesis in Ghana. Policymakers should consider the critical roles of financial development in achieving environmentally friendly growth in Ghana.

**Keywords:** Economic growth; Environmental sustainability; Financial development; Three-stage least-square; EKC hypothesis; Ghana

## **THE EFFECT OF ADOPTION OF IMPROVED VARIETIES ON RICE PRODUCTIVITY IN THE NORTHERN REGION OF GHANA**

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Research background: Adoption of improved rice varieties remain paramount in fighting food and nutrition insecurity across sub-Sahara Africa (SSA). A lot has been done in the space of the adoption of agricultural innovations and food and nutrition insecurity. However, studies on the drivers of improved rice variety adoption and its effect on rice output, considering time and location-specific factors, are limited. Purpose of the article: This study estimated and examined the drivers and effect of improved rice variety adoption on rice output in the northern region of Ghana. Methods: A multistage sampling technique was employed to select 404 rice farm households in the northern region of Ghana. Propensity Score Matching (PSM) approach was used to analyse the data. Findings, Value added & Novelty: This study provides literature on drivers of improved rice variety adoption and its effect on rice output, by jointly considering time and location-specific factors. The empirical results revealed that adoption of improved rice varieties has significant positive effect on rice output

of farm households. This could translate into reducing food and nutrition insecurity and the importation of rice into Ghana. Similarly, improved rice varieties adoption is positively and significantly affected by family labour, membership in FBO, farmers' perception of rainfall, awareness of government rice policy, telephone ownership, and closeness to input markets. However, the adoption of improved rice varieties bears a significant negative relationship with the age of a farmer and mechanization. To enhance rice productivity and food security outcomes, the study recommends that the development of enhanced rice varieties responsive to current climatic situation. Dissemination and promotion of the varieties should be given priority among stakeholders in the rice value chain. Farmers should be encouraged to join or form farmer-based organisations (FBOs) and support their farm work with family labour to minimize rice production costs due to external payments. Access to market by farmers should be enhanced by improving rural road networks, especially in the rural areas where rice production takes place. Government policy towards rice production should be well designed and communicated to rice farmers since awareness of government rice policy stimulates improved rice varieties adoption among rice farmers.

**Keywords:** adoption; improved rice varieties; propensity score matching; logit; Northern Ghana

## **PARTICIPATION IN “PLANTING FOR FOOD AND JOBS” PROGRAMME AND COMMERCIALIZATION AMONG MAIZE FARM HOUSEHOLDS IN SAVELUGU MUNICIPALITY, GHANA**

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Ghana's "Planting for Food and Job" programme aims to improve farmers' access to farm inputs. The idea is that through improved access to quality seed varieties, fertilisers and good agronomic practices, output would increase leading to an increased market surplus. This study sought to investigate whether engagement in 'Planting for Food and Job' (PFJ) programme influences farm households' maize commercialization level in Savelugu Municipality, in the Northern Region of Ghana. To correct for selectivity bias, unobserved endogeneity and avoid the problems associated with weak instrumentation, the conditional mixed process (CMP) method was used. The results revealed that participation in the PFJ programme and maize yield positively influenced maize commercialization. However, commercialisation was negatively influenced by gender of the farm household's head, household size and membership of community-based organisations (CBOs). Participation in the PFJ programme itself was enhanced by education, marital status, increased farm size, farm ownership, membership of farmer-based organization (FBOs) and non-farm engagement. Government and all relevant stakeholders should step up efforts at promoting the PFJ programme and maize commercialisation through access to formal education, farmland and other productivity enhancing inputs and services.

**Keywords:** Planting for Food and Job, commercialization, conditional mixed process, Ghana

## **THE COMPLEMENTARITY AND SUBSTITUTABILITY OF SUSTAINABLE AGRICULTURAL PRACTICES AMONG MAIZE FARM HOUSEHOLDS UNDER AFRINT REGIONS IN GHANA: DO THE SOCIOECONOMIC DETERMINANTS CONFIRM THESE?**

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Sustainable Agricultural Practices (SAPs) have been promoted over the years as a means of ensuring sustainable development in the agricultural sector. However, adoption has generally been low across countries. This paper explores the linkages among SAPs and adoption decisions of SAPs among smallholder maize farm households in Ghana. The study used a household-level data on 394 farmers collected by the second round of the intensification of food crops agriculture in sub-Saharan Africa (AFRINT II) in Ghana. We employed a multivariate regression model to investigate the complementarity and the substitutability among the selected elements of SAPs as well as the simultaneous determinants of the SAPs components. We found out that some elements of the SAPs are complementary, while others are substitutes. The results also suggest that access to input credit, membership of farmer-based organizations, extension contact, and formal education, as well as intercropping, lead to the adoption of SAPs. The study recommends that SAP programmes that support the application of one technology (e.g., inorganic fertilizer) must provide simultaneous support for intercropping with nitrogen-fixing plants. Also, investment in public education is crucial in boosting farmers' knowledge of agricultural practices. Lastly, the positive and significant policy variables such as FBO suggest that

focusing on strengthening community social network institutions is one other way of improving adoption decisions of SAPs.

**Keywords:** adoption; complementarity; substitutability; AFRINT II; sustainable agricultural practices; multivariate probit; Ghana

## **MANAGING SEASONALITY IN WEST AFRICAN INFORMAL URBAN VEGETABLE MARKETS: THE ROLE OF HOUSEHOLD RELATIONS**

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Seasonality influences African informal agricultural markets, but existing literature inadequately explores its interactions with market actors' social relations and livelihood outcomes. Thus, agricultural commercialisation policy ineffectively supports such actors to manage seasonality. Across Bamako, Ouagadougou and Tamale, we conducted interviews, focus group discussions, and a survey of farmer and marketer profits across seasons. Hot, dry season lettuce transactions performed by marketers are more likely to make profit. Farmers and marketers rely on household and community relations and reproduce gendered skills to optimise profit and secure future income streams. Policies supporting household reproduction, and infrastructure, may best support their marketing activity.

**KEYWORDS:** agricultural markets, Burkina Faso, Ghana, Mali, performance, seasonality, social relations, West Africa

## **GHANA'S PLANTING FOR FOOD AND JOBS PROGRAMME: A LOOK AT THE ROLE OF CAPABILITY IN FARMERS' PARTICIPATION**

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An objective interpersonal comparison of wellbeing requires that people's capabilities are considered. This paper operationalises Sen's capability concept in maize-based farming systems and assesses how it influences farmers' participation in the Planting for Food and Jobs programme in the Bunkpurugu-Yunyoo District of the Northern Region, Ghana. We used data from 315 households collected through multistage sampling procedure. Capability was quantified using factor analysis, while its determinants were identified through multiple linear regression analysis. Afterwards, an instrumental variable probit model was used to examine the effect of capability on programme participation. We identified two attributes of capability, which were labelled as human capability and institutional capability. These capability attributes are significantly enhanced by availability of markets and good roads. Our results provide evidence that the two attributes of capability influence farmers' participation in the Planting for Food and Jobs programme. The findings indicate that, for effective participation in agricultural interventions, farmers' capabilities need to be enhanced. This could be achieved through the provision of, and/or improvement in infrastructure, including roads and markets in remote production centres.

**Keywords:** Agricultural interventions, Factor analysis, Planting for Food and Jobs, Sen's capability, Northern Ghana

## FOOD DEMAND CHARACTERISTICS IN GHANA: AN APPLICATION OF THE QUADRATIC ALMOST IDEAL DEMAND SYSTEMS

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In typical developing countries, a one-size-fits-all policies often tend to hurt the poor and vulnerable. Specifically, in food demand studies different social groupings have characteristically heterogeneous demand functions which may require unique attention in terms of food policies. In this paper, we examine the food demand characteristics of three categories of consumers in Ghana based on fourteen selected food commodity groups. We use the sixth round of the Ghana Living Standard Survey in 2012/2013 data collected by the Ghana Statistical Service in collaboration with the World Bank. We apply the Quadratic Almost Ideal Demand System (QUAIDS) to estimate price and expenditure elasticities of demand for food in both rural and urban areas in Ghana. Empirically, we find that fish and cereal products take close to half (about 46%) of the food budget of the average Ghanaian household. We also report heterogeneous food expenditure patterns across the six regions considered in the study. Surprisingly, we find that female-headed households disburse a higher proportion on food budget than their male counterparts. Also, in conformity to theory, we find that the very poor households allocate the highest proportion to food budget than the non-poor. These findings suggest that food policies in Ghana should be discriminately on social and geographical lines to protect the very poor from escalating food prices. Food aid and assistance programmes should target the aged, larger and very poor households and rural dwellers.

**Keywords:** Bennet's law; Engel's law; Food demand characteristics; Quadratic almost ideal demand system; Ghana

## **ANALYSIS OF FARM HOUSEHOLDS' PERCEIVED CLIMATE CHANGE IMPACTS, VULNERABILITY AND RESILIENCE IN GHANA**

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Analysis of climate impacts, vulnerability and resilience is crucial to understand how humans relate with global environmental changes. Against the backdrop of lack of comprehensive information on assessment on these indicators within Ghana's context, this study used cross-sectional data from 300 farmers from two districts of Ghana to analyze climate change through a subjective approach. The data was analysed using ordered probit regression. The result established that, majority of the farm households perceived significantly high impacts of climate change on their livelihoods; low to very low climate vulnerability; and high to very high resilience to climate change. The factors that explained the level of climate impact were age, credit access, number of unemployed households, household per capita expenditure, and number of times of flood a farmer experienced in recent times. The estimated climate vulnerability level of the farmers was significantly influenced by education, credit, membership of farmer-based organization (FBO), unemployed household members, non-farm income, environmental warning and droughts. Also, climate resilience of the farmers was significantly influenced by the location, credit access, FBO membership, consumption expenditure, drought and source of domestic water. The result established that a broader consultation and strategy is required to address the consequences of climate change and to improve the resilience of farm households in Ghana.

**Keywords:** Climate change; Ghana; Impacts; Resilience; Vulnerability

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## **MODELLING THE DETERMINANTS OF ADOPTION OF MULTIPLE CLIMATE CHANGE COPING AND ADAPTATION STRATEGIES: A MICRO ANALYSIS OF SMALLHOLDER FARMERS IN NORTHERN GHANA**

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Climate change coping and adaptation (CCCA) mechanisms have become more relevant in the north of Ghana where there is evidence of severe impacts of climate change and poverty. In this study, we modelled the determinants of adoption of multiple CCCA strategies by smallholder farmers in northern Ghana using primary data collected from 230 households. Count data models including endogenous switch Poisson and generalized Poisson regression were estimated to account for potential endogeneity of credit, as well as dispersion errors. The credit variable did not show signs of endogeneity, neither was there evidence of significance dispersion errors in the data. Age, sex, extension visits, and farm size were significant across the various count data models and should be considered by policy makers when designing national climate change response and mitigation plans.

**Keywords:** Climate change, Adaptation, Count data, Poisson regression, Smallholder farmers

## **EFFECTS OF CLIMATE ADAPTATION ON HOUSEHOLDS' LIVELIHOOD VULNERABILITY IN SOUTH TONGU AND ZABZUGU DISTRICTS OF GHANA**

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This study analysed the effects of climate adaptation strategies on households' livelihood vulnerability, by using primary data from 300 farm households in the north (Zabzugu district) and south (South Tongu district) of Ghana. From a Livelihood Vulnerability Index (LVI) and LVI-IPCC index, the results established that the average farmer was moderately vulnerable, with farmers in the north showing significantly higher vulnerability than those in the south of Ghana. Exposure to climate change was found to contribute more to the vulnerability of the farm households. The beta regression analysis shows that row planting and use of early maturing varieties had positive significant effects on vulnerability, while refilling, strip cropping, mulching, and land rotation had negative significant effects on vulnerability. From a 2SLS, there is a positive feedback between livelihood vulnerability and climate adaptation intensity. Considering the low adoption, and the importance of strip cropping, mulching, and land rotation in reducing the vulnerability farm households, there is the need for actors in the agriculture sector to establish demonstration farms to train farmers on how to adopt as well as the benefits of these technologies. Also, credit opportunities should be made available to farmers especially those in Farmer-Based Organisations.

**Keywords:** Adaptation; climate change; livelihood vulnerability index; 2SLS; Ghana.



## **EFFECTS OF TECHNOLOGY DISSEMINATION APPROACHES ON AGRICULTURAL TECHNOLOGY UPTAKE AND UTILIZATION IN NORTHERN GHANA**

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Agricultural productivity growth is considered a key pathway to resolving poverty and food insecurity issues in developing Africa. One such pathway to improving agricultural productivity depends on technology uptake and utilization. A critical binding constraint to technology uptake and utilization is the mode of disseminating improved agricultural technologies. The selected methods of disseminating agricultural technologies to farmers are known to influence the replicative effect on productivity enhancement among target and non-target farmers. Based on activities conducted by the Agriculture Technology Transfer Project in Northern Ghana between 2017 and 2018, this paper assesses

how multiple dissemination methods influenced technology uptake and utilization by farmers. A multi-stage sampling technique was used to collect data from 1009 farmers from the (former) three northern regions, and count data and binary regression methods were further applied to assess the effects of the various dissemination approaches on technology uptake and utilization. Results indicate that a well-designed combination of technology dissemination approaches would be most effective and has long run adoption potential in Northern Ghana. Lessons from this activity may also be effective in promoting productivity-enhancing technology uptake in similar agricultural communities elsewhere.

**Keywords:** Agricultural technology; Agribusiness; Technology dissemination; Willingness to pay; Adoption; Northern Ghana

## **FARMER INNOVATIONS IN FINANCING SMALLHOLDER MAIZE PRODUCTION IN NORTHERN GHANA**

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AFR-05-2019-0059**

**Purpose** – The purpose of this paper is to explore smallholder agricultural financing in Ghana’s Northern region by identifying farmers’ preferred traditional and innovative financing methods and estimating the determinants of use of innovative financing methods. **Design/methodology/approach** – This paper presented a list of documented traditional financing methods to farmers during in-depth interviews and employed descriptive statistics to summarize choice and amounts sourced from traditional methods. Two questions from the survey revealed a felt need for extra financing sources for credit-rationed farmers. Farmers with positive responses to either or both questions were classified as “users of innovative financing”. The authors then used a probit model to examine factors that influence decisions to use innovative financing

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method. Findings – Farmers’ own savings, reinvesting past season’s profits and financing maize production with income from other commercial crops were the most popular traditional methods. The authors found complementary relations between formal and informal lending systems in the rural financial market. Smallholders also took farm and non-farm “by-day” jobs to raise income for farm investment and/or joined Village Savings and Loans Associations (VSLAs) specifically to take advantage of possible credit opportunities. These two latter methods were operationalized in this study as innovative agricultural financing. The results show that access to credit, social capital and market participation increased the likelihood of using innovative financing methods. Alternatively, farmer group membership, diversity in crop production and being a household head diminished the likelihood of innovative financing use. Practical implications – The activities of VSLAs can be regulated and expanded to spread its benefits to more farmers. Also, creating avenues for dry season labour market participation in the region could enable farmers raise capital for farm investment. Originality/value – This study explores existing practices and farmer innovations to agricultural financing and, by so doing, deviates from the vast literature focusing mainly on microcredit provisioning as the main model of smallholder agricultural financing in Africa.

**Keywords:** Probit model, Northern Ghana, Agricultural finance, Smallholder farmers, Farmer innovations

## **RICE COMMERCIALISATION AND IMPROVED AGRICULTURAL TECHNOLOGY ADOPTION IN NORTHERN GHANA: ENDOGENOUS SWITCHING POISSON APPROACH**

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This study investigated the factors that influence the commercialisation drive and the effect on the adoption of improved agricultural technologies (IATs) using data collected from 543 farm households in northern Ghana. The method of analysis involved the estimation of Endogenous Poisson model. The findings indicate that commercialisation does enhance the adoption of IATs and is driven by factors such as: off-farm activities, rice output, sex, household headship, farm size, credit, commercial centre location. The probability of adopting IATs was also influenced by age, experience, mass media information sources, and home-to-farm distance. Stakeholders should target the youth and step up efforts in supporting flagship programmes such as the “Planting for Food and Jobs” and Planting for Export”, while supporting livelihood diversification programmes.

**Keywords:** Adoption, Endogenous Poisson regression, Rice commercialisation, Improved technologies, Northern Ghana

## **PERCEIVED QUALITY CHARACTERISTICS INFLUENCING HOUSEHOLDS’ PREFERENCE FOR LOCAL AND IMPORTED RICE AND THEIR EFFECT ON PRICE IN THE NORTHERN REGION, GHANA**

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The study investigates how perceived rice quality characteristics influence household preference for local and imported rice and its effect on prices. A multi-stage sampling technique was used to select 400 rice consuming households from Tamale, Yendi and Savelugu in the northern region. A structured questionnaire was used to interview one consumer (the woman in

charge of purchasing and cooking of food) in each household on the quality characteristics that influence their demand for either local rice or imported rice. Rice quality characteristics were ranked with about 71% agreement in descending order of taste, colour, cleanness, nutrient content, safe health, aroma, grain size, texture and cooking time. The results showed that colour had the highest implicit value of Gh¢ 4.42, followed by taste (Gh¢ 2.66). The rest are cooking time (Gh¢ 1.39), grain size (Gh¢ 0.33), impurities (Gh¢-1.08) and texture (Gh¢-1.38). These results indicate the importance consumers attach to rice brands on the basis of product characteristics. To encourage the consumption of domestic rice requires that production and processing methods of local rice are improved in order to bring it, at least at par with the qualities of imported rice.

**Keywords:** Hedonic Price Model, Quality Characteristics, Rice Preferences, Implicit Value, Northern Ghana

## **GENDER PERSPECTIVES OF CLIMATE CHANGE ADAPTATION IN TWO SELECTED DISTRICTS OF GHANA**

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This study analyzed gender differences in climate adaptation by farming households in Ghana. This involved 300 farmers from two districts of Ghana and the data analyzed using descriptive statistics. The results showed severer climate impacts on the livelihoods of females than males in Ghana. On the contrary, the adaptive capacity of males was found to be higher than that of females. This was

supported by the observed differences in gender climate adaptation where both male heads and male household members had higher mean climate adaptations than both female heads and female household members. Overall, the climate adaptation strategies mostly adopted by both males and females include changing planting dates, row planting, planting early maturing and drought tolerant seed varieties, mixed farming, intercropping and refiling of farm plots. Except for zero tillage and intercropping, male farmers had high adoption levels than female farmers. It is concluded that the observed gender adaptation differences were due to the levels and intensity of adoption other than differences in the type of strategies adopted by the different gender groups. The Ministry of Food and Agriculture should consider integrating climate adaptation policies into current agricultural policies such as “planting for food and jobs” policy.

**Keywords:** Environmental science; Environmental analysis; Environmental assessment; Environmental economics; Environmental impact assessment; Environmental risk assessment; Climate change; Adaptation; Gender Ghana

## **EFFECTS OF CLIMATE CHANGE AND LIVELIHOOD DIVERSIFICATION ON THE GENDERED PRODUCTIVITY GAP IN NORTHERN GHANA**

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**Climate and Development, 12(8), 743-755, 2019**

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Gendered productivity gaps remain a major limitation to the growth of the agricultural sector of sub-Saharan Africa. The drive towards agricultural transformation must be accompanied by gender inclusive productivity growth. Therefore, this study analyses the effects of climate variables and livelihood diversification on gendered productivity gaps among maize farmers in Northern Ghana. Data were collected from 619 farmers and were analysed using an endogenously corrected Oaxaca-Blinder decomposition model. Results suggest the presence of a significant productivity gap of 58.8% between male and female

household heads, and of 44.8% between men household heads and female spouses. About 87% and 98%, respectively, of these productivity gaps were explained by the differences in resource endowment. While livelihood diversification significantly affected gendered productivity through both endowment and coefficient effects, climate variables significantly influenced gendered productivity gaps only through the coefficient component. These results suggest the potential for reducing gendered productivity gaps by providing equal diversification opportunities and by reducing women's vulnerability to climate change. Among livelihood activities, agro-processing could be prioritized and promoted in the region. While farmers should adopt on-farm climate adaptation strategies, extension services should tailor the provision of climate information and promote climate adaptation strategies.

**Keywords:** Climate change; gender; livelihood diversification; Oaxaca–Blinder decomposition; productivity gap; Ghana

## **WELFARE EFFECTS OF LIVELIHOOD DIVERSIFICATION OF FARM HOUSEHOLDS IN NORTHERN GHANA: A QUANTITATIVE APPROACH**

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The declining trends of agricultural productivity in Northern Ghana, which could be attributed in part to climate change, is pushing farm-households to add non-farm livelihood activities to their existing on-farm livelihood activities in order to survive. The extent to which this diversification is affecting the

livelihoods of farm households is not fully understood in the empirical literature. This paper therefore explores the effect of livelihood diversification on farm households' welfare. By using multistage sampling procedure, 284 farm households from 62 communities in the Northern and Upper East regions of Ghana were used for the study. The Probit model was employed to examine factors influencing farm households' decision to diversify their source of livelihoods. The Propensity Score Matching (PSM) was employed to estimate the effects of livelihood diversification on farm households' welfare. The probability of diversifying was higher for older farmers, farmers with access to extension service, male farmers, farmers who perceived that rainfall was erratic and that temperatures were high. Using household off-farm income as a proxy for welfare, the PSM results indicate that on the average, diversified farm households are better off (GH¢2,657.52 per annum) compared to non-diversified farm households (GH¢2,448.95 per annum). This study therefore recommends that farm households across Northern Ghana should diversify their sources of income to reduce liquidity constraint to enhance farm productivity via the purchase of productivity enhancing farm inputs.

**Keywords:** Diversification, Welfare, Off-farm income, Probit model, PSM, Northern Ghana

## **CORRECTING FOR SAMPLE SELECTION IN STOCHASTIC FRONTIER ANALYSIS: INSIGHTS FROM RICE FARMERS IN NORTHERN GHANA**

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This study employs stochastic frontier analysis (SFA) correcting for sample selection bias, to determine technical efficiency (TE) and technology gap using



cross-sectional data collected from 543 rice farmers in Northern Ghana. The results showed that corrected sample selection TE estimates were marginally higher. Without the appropriate corrections, inefficiency is overestimated, while the gap in performance between irrigation farmers and their rainfed counterparts is underestimated. We recommend that authorities in Ghana should work with development partners, especially in the implementation of small village-dam projects, and also to expand the existing irrigation schemes. Bunds should also be constructed around rice production valleys across northern Ghana so that farmers could expand their farm sizes to increase production. It is important also that the government's input subsidy programme be structured to cater for experienced and younger farmers who consider agriculture as a business.

**Keywords:** Rice production, Sample selection, Stochastic frontier, Technical efficiency, Northern Ghana

## **ADOPTION OF IMPROVED AGRICULTURAL TECHNOLOGIES AMONG RICE FARMERS IN GHANA: A MULTIVARIATE PROBIT APPROACH**

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The need for practising modern techniques in rice production has become increasingly important in Ghana as the per capita cultivable land continues to

shrink. This study employed a multivariate probit model to estimate the determinants of adoption of improved agricultural technologies using household data collected from 543 rice farmers in the Upper East and Northern region of Ghana. There was complementarity among all the improved rice production technologies (i.e. nursery establishment, harrowing, line planting, spacing, urea briquette, irrigation, and bunding). Among the socio-economic variables, education, household size, experience, farm size, sex, and age of the farmer play significant roles, with differing signs across technologies. Among the institutional factors, membership of farmer-based organisation, access to research service, training and credit were significant with differing signs across the improved technologies. Location also had significant and differing influence on adoption. Also, demonstration, TV, radio, video, mobile phones, and household extension methods had significant and differing influence on the adoption of improved technologies, providing significant justification for the review of the agricultural extension methods and approaches of Ghana to include new ICT and mass media approaches. To improve the output of rice, farmers are advised to jointly adopt the identified improved rice production technologies.

**Keywords:** Adoption, Agricultural Technologies, Multivariate Probit, Rice Farmers, Northern Ghana

## **PERCEPTIONS OF WEATHER VARIABILITY AND CLIMATE CHANGE ON GOAT PRODUCERS' CHOICE OF COPING AND ADAPTATION STRATEGIES: EVIDENCE FROM CLIMATE-SMART AND NON-CLIMATE-SMART VILLAGES IN THE JIRAPA AND LAWRA DISTRICTS**

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We examine how goat farmers' perceptions of weather variability and climate change condition their coping and adaptation behaviour. Through a survey, we obtain a household level data from goat producers in designated climate-smart and non-climate-smart villages of the Lawra and Jirapa districts in Upper West region of Ghana. Data are analysed using a multivariate probit model to assess how perceptions and other factors influence coping and adaptation strategy choices. Seven main coping/ adaptation strategies are used by goat farmers to deal with weather variability and climate change. Our econometric results show that goat farmers' perceptions and being located in a climate-smart village, as well as market and extension information influence the choice of coping and adaptation strategies towards climate change. The results suggest that perceptions of weather variability and climate change have significant positive influence on all adaptation strategies, and that these adaptation strategies are complementary to each other as evidenced by their high inter-correlations. The fact that farmers located in climate-smart villages are more likely to adopt strategies that enable them to cope with and adapt to weather variability and climate change signals the need for project implementers to extend the number of villages benefiting from the climate-smart village concept.

**Keywords:** Climate-smart village; climate change adaptation; goat producers; multivariate probit; Lawra and Jirapa districts

## **TECHNOLOGY ADOPTION TYPOLOGY AND RICE YIELD DIFFERENTIALS IN GHANA: PRINCIPAL COMPONENT ANALYSIS APPROACH**

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This study used primary data obtained from rice farmers in Guinea Savannah Zone (GSZ), Forest Savannah Transition Zone (FSTZ) and Coastal Savannah Zone (CSZ). Principal component analysis (PCA) was used to classify farmers into technology adopters. The study used Welch's t-test to test the statistical significant differences in yield between technology adopters. Through the use of PCA, farmers were objectively classified as non-adopters (users of indigenous farming practices, IFPs), adopters of farmer innovation systems (FISs), adopters of improved agricultural technologies (IATs), and adopters of both FISs and IATs. Comparatively, a larger proportion of farmers in CSZ adopted IATs. The lowest percentage of farmers adopted IATs in GSZ. FISs' package is highly adopted by farmers in FSTZ. With the help of Welch t-test, the study demonstrated that adopters of FISs obtained appreciable rice productivity even though it is second to IATs. The study showed that IATs are the superior technologies when considering rice productivity and hence should be highly promoted among farmers in the whole country. Concerted and co-ordinated efforts should be made for researchers in national agricultural research and academic agricultural research institutions or centres to research into rice production and farmer innovation systems, improve upon them and make them available to farmers for adoption.

**Keywords:** farmer innovation systems (FISs), improved agricultural technologies (IATs), and indigenous farming practices (IFPs)

## **AGRICULTURAL INPUT CREDIT AND THE ADOPTION OF SUSTAINABLE AGRICULTURAL PRACTICES (SAP) IN SELECTED SUB-SAHARAN AFRICA (SSA) COUNTRIES: AN ENDOGENOUS POISSON REGRESSION APPROACH**

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Smallholder farmers, mostly in sub-Saharan Africa (SSA), are the hardest hit by climate change impacts because of their over reliance on rainfall and other natural factors. This has led to the development and extension of a number of improved agricultural technologies and practices, otherwise known as sustainable agricultural practices (SAPs). The question that is often asked is whether or not agricultural credit can improve the adoption of SAPs. The objective of this study was to investigate the factors influencing access to agricultural credit and the effects on the adoption of SAPs in selected SSA countries. The Intensification of food crops agriculture in sub-Saharan Africa (AFRINT II) data set were used for the study. The sample involved about 3,000 households from nine African countries, namely; Ethiopia, Ghana, Kenya, Malawi, Nigeria, Tanzania, Uganda, Zambia and Mozambique. A Poisson regression with endogenous treatment effect was estimated to address a possible selectivity bias. In all, 47.5% of the respondents, as against 52.5%, had access to credit. The commonest technologies adopted were intercropping, integrated nutrient management, crop rotation and soil and water conservation. The estimation results suggest that access to credit and formal education as well as land ownership lead to the adoption of SAPs. However, while group membership facilitates access to credit, households headed by relatively old farmers have lower probability of accessing credit than those headed by the young. Both government institutions and the private sector must work at

upscaling credit supply to farmers in a more sustainable way while taking affirmative action in favour of female headed households. Formal education and land entitlement should also be promoted to step up adoption of the improved technologies.

**Keywords:** Adoption, Agricultural credit, Endogenous treatment, Poisson regression, Sustainable Agricultural Practices

## **FARMERS' WILLINGNESS-TO-PAY FOR WEATHER INFORMATION THROUGH MOBILE PHONES IN NORTHERN GHANA**

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Access to climate information is one of the ways by which farmers can reduce the adverse effects of climate variability and change. However, in Ghana, and in particular, Northern Ghana there is a gap between meteorological information and farming activities. This paper examined farmers' willingness-to-pay for weather forecasts provided through mobile phone messaging. A total of 391 respondents, selected through a multi-stage sampling procedure was used. Based on the contingent valuation framework, a double-hurdle model was estimated. On average, a farmer was willing to pay GH¢ 122.15 annually for weather forecasts in the form of a text message. The results of the selection equation of the double-hurdle model show that sex, education, production aim, adaptive capacity and climate information source were significant and positively influenced willingness to pay for weather forecast while age and credit access negatively influenced same. Similarly, while dependency, extension service and adaptive capacity were significant and positively influenced the amounts farmers were willing to pay, sex and climate information access, negatively influenced the same. It is concluded that although the willingness-to-pay for weather forecast is low, especially, among male farmers, there exists a market for

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weather forecast that can be harnessed by the meteorological agencies. Some of the categories of farmers that may be targeted for demand and policy formulation are the following: farmers with formal education; farmers with access to extension services; market-oriented farmers; and farmers with adaptive capacity to climate change.

**Keywords:** Contingent valuation; Double-hurdle model; Mobile phones; Weather forecast; Willingness-to-pay

## **PARTICIPATION AND YIELD EFFECT OF GHANA'S PLANTING FOR FOOD AND JOBS PROGRAMME IN BUNKPURUGU-YUNYOO DISTRICT**

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It is always important to evaluate the performance of agricultural interventions as early as possible in order that subsequent implementation could benefit from lessons learned from successes and failures. This paper examined the effect of participation in Ghana's Planting for Food and Jobs programme on maize yields in the Bunkpurugu-Yunyoo District of Northern Region. Data from a cross-section of maize farmers was analyzed using the Heckman treatment effects model. The results showed that participants of the PFJ programme obtained higher yields than the non-participants by about 4 bags per acre. However, some farmers still face the challenges of limited access to fertilizer, late delivery of inputs, and low access to extension services which tend to limit the potential outcomes to be realized from the intervention. Therefore, the programme implementers, particularly the Ministry of Food and Agriculture (MoFA) should ensure expanded access and timely delivery of inputs, to help enhance the

realization of the PFJ policy objectives as well as ensure effective extension supervision.

**Keywords:** Planting for Food and Jobs, Heckman treatment effect model, capability, Bunkpurugu-Yunyoo, northern Ghana.

## **FARMERS' LIVELIHOODS AND WELFARE IN THE WA WEST DISTRICT, UPPER WEST REGION OF GHANA**

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**Strategies for Building Resilience against Climate and Ecosystem Changes in Sub-Saharan Africa, Science for Sustainable Societies, 117-133, 2018.**  
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This paper examines the socioeconomic determinants of farmer livelihood diversification and its effects on welfare. We selected 184 farmers in the Wa West District of the Upper West Region of Ghana through a comprehensive, multi-stage process based on agro-ecological, engineering, and socioeconomic resilience/ vulnerability profiles. A simultaneous equation model was estimated using the two-stage least squares method. The results suggest that the number of livelihood activities is highest for female farmers, relatively young farmers, farmers with little or no formal education, farmers with large families, and richer/wealthier farmers. On the other hand, welfare is highest for older farmers, female farmers, farmers with little or no formal education, farmers with small family size, and farmers with higher number of livelihood activities. Thus, despite the fact that younger and large-sized families engage in more livelihood activities, they have relatively low welfare. Therefore, these categories of farmers should be targeted for policy interventions. However, in general, we recommend the promotion of more livelihood activities to increase the welfare of farmers. These livelihood activities should not be vulnerable to the adverse effects of climatic factors.

**Keywords:** Diversification • Livelihoods • Two-stage least squares • Welfare • Ghana



## **THE WELFARE IMPACT OF USAID-ADVANCE INTERVENTION PROGRAM: EVIDENCE FROM ACDEP FACILITATION IN NORTHERN GHANA**

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**Agriculture in Ghana today: Some critical topics for policy making, 57-70, 2018.**

This study used cross-sectional farm-level data collected from 673 farm households in the three northern regions of Ghana to evaluate the welfare impact of an intervention program facilitated by Agricultural Development and Value Chain Enhancement Project (ADVANCE) in partnership with Association of Church-Based Development NGOs (ACDEP). Using propensity score matching technique, the study showed that the ADVANCE project has contributed significantly to farm household productivity and income as well as consumption per capita of the beneficiaries. The study recommends an all-inclusive approach in enhancing the welfare of rural livelihoods through infrastructural, agricultural technology transfer, and agricultural marketing strategy developments. It is also essential for similar organizations such as ACDEP/ADVANCE implementing farm intervention programs extend their coverage areas to capture more farmers, since the empirical evidence presented in this study shows that such programs lead to improvement in the welfare of smallholder farmers.

**Keywords:** ADVANCE/ACDEP, GAPs, Value Chain, Household Welfare

## **ASSESSING SOCIOECONOMIC FACTORS INFLUENCING PRODUCTION AND COMMERCIALIZATION OF BAMBARA GROUNDNUT AS AN INDIGENOUS CLIMATE RESILIENT CROP IN NIGERIA**

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**Handbook of Climate Change Resilience,1-19, 2018. [https://doi.org/10.1007/978-3-319-71025-9\\_158-1](https://doi.org/10.1007/978-3-319-71025-9_158-1)**

Climate change is impacting the cropping system, landscape, livelihoods, and nutrition diversity of farming households and communities in Africa. Climate change adaptability and resilience are emerging as important criteria for setting national priorities for promoting indigenous crops to enhance food and nutrition security, especially of resource-poor smallholders. However, many climate resilient indigenous crops have been lost due to inappropriate policies that fail to prioritize climate resilience and nutritional diversity. Bambara groundnut (*Vigna subterranea*) is an indigenous crop in Africa. It is tolerant to drought, poor soils, and short spells of elevated temperatures. It, therefore, offers several advantages over other legumes as a source of nutrition, food security and improved welfare in the face of climate change. The research investigated farmers' perceptions and socioeconomic factors that influenced the cultivation and commercialization of bambara groundnut and the effect of commercialization on smallholder farmers' welfare in two local government areas (LGAs) of Benue State, Nigeria. In all, 300 smallholder farmers were sampled through a multistage sampling technique. The method of analysis involved the estimation of a fractional regression and treatment effect models. We found that older farmers who perceived that bambara groundnut is a climate-resilient and food security crop allocated more of their total farmland to its production. The perception that bambara groundnut is a climate-resilient crop also impacted positively on the commercialization of bambara groundnut. Formal education coupled with the commercialization of bambara groundnut led to increased farmers' welfare. We recommend that more sensitization and education should be given to farmers on the good characteristics of bambara groundnut as a climate-resilient and food security crop while they are also supported to upscale its production for commercialization purposes.

**Keywords:** Indigenous crop; Bambara groundnut; Commercialization; Climate resilience; Food security and nutrition; Household welfare

## **PEST MANAGEMENT AMONG SMALLHOLDER CABBAGE GROWERS**

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Vegetable production is practiced in urban and peri-urban settings in many countries, where agricultural lands are decreasing. Farmers need to understand how to manage pests when production is in close proximity to people, especially since they have adopted intensive agricultural practices where more synthetic chemicals are used to control pests. Other issues including climate change, rapid urbanization, limited access to resources – land, training, and technology influence pest management strategies. A mixed method was used to collect data which examined how farmer interactions with other actors and technologies have influenced management of pest infestations and profits. All farmers in Tamale intensively cultivate cabbage (*Brassica oleracea* var. *capitata* L.) and we

noted differences in profitability between farmers with, and without, formal training. There was a positive association between long-term farm experience and good pest management practices. Farmers with >10 years experience growing cabbage were more mindful of pre-harvest intervals in respect to pesticide application compared to those with less-farming experience. Farmer-to-farmer transfer was the most efficient way of disseminating agricultural information and creates an opportunity for sharing information on integrated pest management. There is a need for the creation of formal farmer-farmer training and education by government extension officers, building on informal opportunities provided by farmer-to-farmer knowledge transfer on safe handling, storage, and application of pesticides in peri-urban and urban farms.

**KEYWORDS:** *Brassica oleracea var. capitata*; cultivation; intensification; pesticide usage; northern Ghana; pest management; profitability

## **THE REALITY OF MARKET INEFFICIENCIES AND TECHNOLOGY ADOPTION NEXUS: EVIDENCE FROM SUB-SAHARAN AFRICA**

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Literature tells us that adoption of agricultural innovations mostly occurs when market conditions are right. Unfortunately for Sub-Saharan Africa (SSA), a wide variety of inefficiencies exists in the resource markets and constrained farmers from accessing resources for adoption of these innovations. Meanwhile, few

studies have partially incorporated these inefficiencies in analysis of agricultural technology adoption. By way of contribution in filling this gap, this study analysed the role of a variety of inefficiencies in technology adoption in SSA. Specifically, the instrumental variable Poisson is employed on a unique dataset which comes from the SSAs intensification of food crops agriculture's (Afrint) project and spans nine agrarian countries. The results indicate that the effects of market inefficiencies are mixed and location specific. Similar results are revealed by farmer/household, farm/plot and institutional characteristics. Further, the effects of spatial differentiation on adoption is presented and discussed.

**Keywords:** agricultural technologies; exponential conditional mean model; inefficient markets; Sub-Saharan Africa; SSA

## **ASSESSING THE TECHNICAL EFFICIENCY OF MAIZE PRODUCTION IN NORTHERN GHANA: THE DATA ENVELOPMENT ANALYSIS APPROACH**

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Maize is a major source of food and cash for smallholder farmers. However, average yield in Ghana is less than a third of the achievable yield and thus the need to close this gap by improving the technical efficiency of farming households through employing the right combination of productive resources to achieve food sustainability. This study used the input-oriented data envelopment analysis to examine the technical efficiency of maize production in northern Ghana<sup>1</sup> using cross-sectional data for the 2011/2012 cropping season. The mean technical efficiency was 77%, giving credence to the existence of production inefficiency. Technically, efficient farmers used an average of 395.80 kg of

chemical fertilizer, 27.04 kg of seed, 4.04 l of weedicides and hired labour of three persons to produce a yield of 2.34 tons/ha of maize. Largely, maize production exhibited increasing returns to scale. Agricultural mechanization and level of formal education did not have positive effects on technical efficiency, whereas agricultural extension had a positive effect on technical efficiency. Technical efficiency in maize production could be improved through informal and non-formal educational platforms where farmers without formal education learn improved cultivation practices. The agricultural extension department should be strengthened to provide effective extension services to farmers to improve on their technical efficiency. Animal and other non-mechanized power sources are complementary technologies and as such should be allowed to co-exist in Ghanaian agriculture.

**Keywords:** data envelopment analysis; technical efficiency; maize; northern Ghana

## **DRIVERS OF ADOPTION INTENSITY OF IMPROVED AGRICULTURAL TECHNOLOGIES AMONG RICE FARMERS: EVIDENCE FROM NORTHERN GHANA**

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Improved rice production techniques are being promoted in Ghana as a way of enhancing sustainable productivity among farmers. Despite the important role that the adoption of improved rice production technologies plays in improving output, very few studies, especially in the context of Northern Ghana, have been conducted to analyse the factors influencing their intensive adoption. In this

study, we compared the results of negative binomial, Poisson and zero inflated Poisson (ZIP) models to analyse the determinants of intensity of adoption of improved rice production techniques, using primary data collected from 543 rice farmers in the Upper East and Northern regions of Ghana. Based on model diagnostics, we accept the results of the ZIP model. The empirical results confirm the relevance of technology demonstration fields, farmers' experience, training, and sex of the farmer in enhancing and sustaining the adoption of improved agricultural technologies. Household extension method, research and extension, and farm size should also be considered in promoting the adoption of improved practices among rice farmers since these covariates had significant relationship with the intensity of adopting improved agricultural technologies.

**Keywords:** Adoption intensity, Agricultural technologies, Rice, Zero Inflated Poisson model, Northern Ghana

## **ADOPTION OF RICE CULTIVATION TECHNOLOGIES AND ITS EFFECT ON TECHNICAL EFFICIENCY IN SAGNARIGU DISTRICT OF GHANA**

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This study examined the adoption of rice cultivation technologies on farmers' technical efficiency in Sagnarigu District. The stochastic frontier model was used to estimate the determinants of output and technical inefficiency while propensity score matching was also used to analyse the average treatment effect (ATE) and the average treatment effect on the treated (ATT). A total of 120 respondents comprising 60 adopters and 60 non-adopters were randomly



selected from six communities in the district and interviewed using semi-structured questionnaires. Farm size, fertilizer, weedicides and household labour had positive and significant effect on rice output. Farmers who adopted the rice cultivation techniques were less technically inefficient than those who did not adopt. The ATT was 0.121 which implies that farmers who adopted the rice technologies increased their technical efficiency by about 12% and this was significant at 10% for the PSM with similar results obtained for the nearest neighbour matching. The ATE value of 0.102 which was also statistically significant at 10% means that farmers on the whole increased their technical efficiency by 10.2%. Moreover, the mean technical efficiency estimates for adopters and non-adopters were about 58% and 48% respectively under regression adjustment and inverse-probability weights. The existence of a technical efficiency gap of 10% between adopters and non-adopters of rice technologies emphasized the significant effect of technology adoption on farmer's technical efficiency. The study recommends that more rice farmers should be encouraged to adopt the rice production technologies in order to improve their technical efficiency levels.

**Keywords:** adoption; propensity score matching; technical efficiency; treatment effects; Sagnarigu District; Ghana

## **EFFECT OF POSTHARVEST MANAGEMENT PRACTICES ON WELFARE OF FARMERS AND TRADERS IN TAMALE METROPOLIS AND ZABZUGU DISTRICT, GHANA**

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Postharvest losses are a significant threat to the actors in the yam value chain. In this article, we examined the key postharvest management practices and its effect on the welfare of yam farmers and traders in selected towns of Northern region. We randomly sampled a cross section of farmers and traders for data collection, and analyzed the data with beta regression and linear regression models. Results show that farmers lose an average of 9.6% of stored yam in 2-month period, while traders lose 3.3% of yam stored in a month. The main postharvest storage management practices used by farmers and traders include heat-control measures, sorting-management practices, and cleaning-management practices. Our regression results verify that good storage-management practices improve postharvest management, thereby reducing storage losses and enhancing the welfare outcomes for traders. However, no statistically significant effect was detected for farmers. Therefore, we suggest that information on and availability of improved postharvest storage-management practices should be delivered and fostered among farmers and traders in the study areas to maximize efforts aimed at reducing postharvest losses and improve welfare outcomes.

**Keywords:** beta regression; postharvest management; postharvest storage losses; welfare

## **THE PERCEIVED EFFECTIVENESS OF AGRICULTURAL TECHNOLOGY TRANSFER METHODS: EVIDENCE FROM RICE FARMERS IN NORTHERN GHANA**

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This study examined the effectiveness of various agricultural technology transfer methods using primary data collected from 543 rice farmers in the Northern and Upper East regions of Ghana. We employed descriptive statistics supported by Kendall's W-test and chi-squared distribution test to identify and assess various agricultural technology transfer methods and their perceived effectiveness. In the order of importance, we found farmer-to-farmer approach, technology demonstration fields, household extension, and radio as the main agricultural extension methods in use in the study area. We found a significantly low patronage of the mass media and Information and Communication Technology (ICT) mechanisms such as video, mobile phone, posters, drama, and newspapers for communicating information to rice farmers. Demonstration, farmer-to-farmer, and household extension methods were perceived as the most effective agricultural extension methods. We recommend among others, that Ministry of Food and Agriculture of Ghana should be empowered to train farmers through both conventional (i.e. demonstration fields), and technology-led approaches using ICT and mass media such as video, mobile phones, and radio, since these methods have been found to be cost effective with significant impact on agricultural technology adoption decisions of farmers.

**Keywords:** agriculture technology; extension methods; perception; rice farmers; Northern Ghana

## **OUTPUT EFFECT OF ORGANIC VEGETABLE PRODUCTION IN THE NORTHERN REGION OF GHANA**

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The study examines the factors influencing the adoption of organic vegetable technology and the effect of adoption on vegetable output in the Northern Region of Ghana. Farm level data on vegetable production was collected from 400 farmers, consisting of 200 adopters (organic vegetable farmers) and 200 non-adopters (conventional vegetable farmers). Descriptive statistics were used to analyse farmers' perception about the benefits and problems associated with organic vegetable production. The Treatment Effect Model was used to analyse the socioeconomic factors that influence the adoption of organic farming technology and its effect on output of the farmers. The estimation results showed that the adoption of organic farming was significantly influenced by the farmers' characteristics (such as education, membership of farmer-based organisations, and knowledge of farming business), internal inputs (farmer's ability to make their own inputs, farmers' ability and resources to cultivate throughout the year and sole ownership of farm land) and some external incentives. Organic vegetable farmers had higher output than the conventional farmers. For a sustained increase in the production of organic vegetables, farmers should be supported through education and access to extension services, membership of farmers' organisations, and affiliation with agricultural research organisations.

**Keywords:** Conventional vegetables; Organic vegetables; Adoption; Treatment effect model; Vegetable output; Northern Ghana

**DO DATA ENVELOPMENT AND STOCHASTIC FRONTIER ANALYSES PRODUCE SIMILAR EFFICIENCY ESTIMATES? THE CASE OF GHANAIAN MAIZE PRODUCTION**

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This study applied stochastic frontier analysis (SFA) and data envelopment analysis (DEA) to examine the technical efficiency of maize production in northern Ghana using cross-sectional data from 360 maize farmers for the 2011/2012 cropping season. Farm size, seed, fertiliser and herbicides had a positive effect on maize output. Agricultural mechanisation, extension services, experience and gender influenced technical efficiency. The study recommends that access to tractors be expanded to increase farmers' production efficiency. Maize production could improve if less-experienced farmers learn from the accumulated knowledge of experienced farmers, including through extension. Agricultural extension services should be strengthened to disseminate improved farming practices to farmers for increased efficiency. Female farmers should be supported by removing socio-cultural barriers by raising awareness in order to correct the wrong traditions and perceptions inimical to women's full participation in farming so as to bring improvements in technical efficiency.

**Keywords:** data envelopment; stochastic frontier; efficiency

## **MANAGEMENT OF SHEA PARKLANDS IN THE WEST AFRICAN SAVANNAH**

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This research was conducted in Ghana to identify the strategies and practices used in managing shea trees. A multi-stage sampling design was used to select 540 farmers for the study. Descriptive statistics were used to analyze the relationships between socio-demographic factors and willingness to continue managing shea trees. Even though almost all the respondents expressed willingness to continue managing the shea trees, the most willing included the following: natives; those who purchased their lands; farmers with shea trees closer to their homes; those who owned their lands in addition to the shea trees and communities where the landlords or the community as a whole had authority over the lands and shea trees. The use of alternative sources of energy such as gas stoves, solar panels and locally-made stoves with high energy-use efficiency should be encouraged and made readily available and affordable to reduce dependence on shea trees as sources of energy for cooking and heating. Farmers should also be encouraged to grow fast-growing tree species such as *Luecaena leucocephala*, *Senna siamea*, *Gliricidia sepium* and *Albizzia lebeck* as woodlots to serve as alternative sources of fuelwood and fodder. Furthermore, for their willingness to conserve the trees, farmers should be compensated for carbon credits generated from their shea parklands.

**Keywords:** Shea Trees, Management Practices, Willingness to Manage, Northern Ghana

## **ECONOMIC EFFICIENCY OF SOYBEANS PRODUCTION IN THE NORTHERN REGION OF GHANA**

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Soybean is an important cash crop with the potential of reducing poverty in the Northern Region of Ghana. Knowledge on the level of economic efficiency and the factors that influence such efficiency is a good beginning for addressing its sustainability problems. The study aimed at analysing economic efficiency of soybean production in the Northern Region of Ghana. Cross-sectional data was collected from 500 soybean farmers across five districts in the region during the 2015 cropping season. The analysis was done using translog stochastic production and cost frontier models in which technical and economic inefficiency effects were specified to be a function of farm and farm-specific factors and estimated in a one-step procedure using maximum likelihood method. Results show that soybean production in the region is characterized by increasing returns to scale. Furthermore, soybean farmers in the region are 82.7% technically efficient, 49.5% economically efficient and 59.5% allocatively efficient. These results show great scope for improving efficiencies and sustainability of soybean production in the Northern Region. The study also showed that being a relatively young farmer, access to extension services and adoption of improved seed variety reduce technical and economic inefficiency among farmers. Increase in years of schooling was found to only significantly increase technical efficiency. Reduced cost of travel from farmers' residence to their homes and practicing of monocropping significantly increased economic efficiency. Inadequate capital was found to be the most pressing constraint, as most of the farmers did not have access to credit during that cropping season. For a more efficient and sustainable production of soybean, policies that would improve access to improved soybean varieties, credit, smart subsidies and extension services, among others, should be pursued.

**Keywords:** Technical efficiency; Allocative efficiency; Economic efficiency; Stochastic function model, Soybean; Northern Ghana

## **ACCOUNTING FOR RICE PRODUCTIVITY HETEROGENEITY IN GHANA: THE TWO-STEP STOCHASTIC METAFRONTIER APPROACH**

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Rice yields among agro-ecological zones are heterogeneous. Farmers, researchers and policy makers are making frantic efforts to bridge rice yield gaps between agro-ecological zones through the promotion of improved agricultural technologies (IATs). Farmers are also modifying these IATs and blending them with indigenous farming practices (IFPs) to form farmer innovation systems (FISs). Also, different metafrontier models have been used in estimating productivity performances and their drivers. This study used the two-step stochastic metafrontier model to estimate the productivity performances of rice farmers and their determining factors in GSZ, FSTZ and CSZ. The study used both primary and secondary data. Farmers in CSZ are the most technically efficient. Technical inefficiencies of farmers are negatively influenced by age, sex, household size, education years, extension visits, contract farming, access to improved seeds, access to irrigation, high rainfall amount, less lodging of rice, and well-coordinated and synergized adoption of technologies. Albeit farmers in CSZ are doing well in terms of rice yield, they still have the highest potential of increasing rice yield since they had the lowest TGR. It is recommended that



government through the ministry of food and agriculture, development partners and individual private companies promote the adoption of IATs as well as educate farmers on how to coordinate and synergize the adoption of the whole package. Contract farming concept and agricultural extension intensification should be vigorously pursued to the latter.

**Keywords**—Efficiency, farmer innovation systems, improved agricultural technologies, two-step stochastic metafrontier approach.

## **MARKETING EFFICIENCY ANALYSIS OF YAM VALUE CHAIN IN THE NORTHERN REGION OF GHANA**

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For smallholder households, yam production constitutes an important source of food and income and also plays a vital role in their socio-cultural lives. This paper sought to evaluate the marketing efficiency of key players of the value chain as well as investigate their challenges. The study used cross-sectional data of 400 key players sampled through a multi-stage technique. Gross margin and marketing efficiency analyses were employed for the computation, while the Kendall Coefficient of Concordance was used for constraint analysis. The study revealed that an average yam value chain player makes relatively good margins with an average net margin of GH¢93.05, GH¢167.63, GH¢73.80 per 100 tubers for farmers, wholesalers and retailers respectively. The marketing efficiency of the farmers, retailers, and wholesalers was estimated to be 251%, 213% and 44%,

respectively. Also, the players ranked erratic rainfall pattern, poor transportation system, high deterioration rate of yam, price fluctuation, among others as the most pressing problems hindering the smooth operation of the yam value chain. The yam value chain can be stepped-up by the provision of affordable storage facilities, development of the road network as well as organizing business and financial management training for actors.

**Keywords:** Constraints, Gross Margin, Market Efficiency, Yam, Northern Ghana

## **OFF-FARM PARTICIPATION AND TECHNICAL EFFICIENCY AMONG SMALLHOLDER FARMERS IN THE NORTHERN REGION, GHANA**

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**Applied Studies in Agribusiness and Commerce, 11(1-2), 35–43, 2017.DOI: 10.19041/APSTRACT/2017/1-2/5**

The study aimed at investigating the effects of off-farm participation on technical efficiency of maize production in the Tolon district of the Northern Region, Ghana. The Logit regression model was used to analyze the determinants of off-farm participation while the stochastic frontier production function was used to model the determinants of maize output and technical efficiency. The empirical results from the logistic regression model indicate that age of farmer, educational attainment, farming experience, farm size, and previous farm income are significant drivers of farmers' participation in off-farm activities. Farmers' average technical efficiency level was 90.7% suggesting a 9.3% potential loss to inefficiency. Moreover, participation in off-farm activities had a negative influence on farmers' technical efficiency level. The study, therefore, recommends that farm-level policy should be directed towards making the agricultural sector attractive by promoting investment and agricultural

employment opportunities in the rural areas so as to ensure full commitment to farming activities.

**Keywords:** Logit model; Northern Ghana; Off-farm participation; stochastic frontier model; Technical efficiency

## **DETERMINANTS AND INCOME EFFECT OF YAM POSTHARVEST LOSS MANAGEMENT: EVIDENCE FROM THE ZABZUGU DISTRICT OF NORTHERN GHANA**

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Globally, postharvest loss reduction has been emphasized as an effective option for improving food security and environmental sustainability. Yam production in the Zabzugu district of Northern Ghana suffers from high postharvest losses, with varying degrees of economic, social and environmental implications. Improving the welfare of farmers through postharvest loss reduction requires farmers' effective management of the losses. The purpose of this study is to examine how effectively farmers manage postharvest losses and the rewards derived from such efforts. Using a cross-section of 201 randomly selected yam farmers from major production communities in the Zabzugu district of Northern Ghana, we applied a simultaneous equation modelling approach to examine the contemporaneous correlation between postharvest loss management and income. Results provided evidence that good postharvest loss management improves welfare of yam farmers through increased income earnings and vice versa, especially for those who produce for commercial purposes. On the other hand, subsistence farmers were better at managing postharvest losses, though with lower monetary rewards. The policy implications are that interventions

should target farmer education and training to improve the skills of farmers in managing postharvest losses.

**Keywords:** Postharvest loss management; Northern Ghana; Simultaneous equation modelling; Yam; Zabzugu

## **ASSESSING THE ECONOMIC EFFICIENCY OF MAIZE PRODUCTION IN NORTHERN GHANA**

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This study used the stochastic frontier model to examine the technical, allocative and economic efficiency of maize production in northern Ghana using cross-sectional data for the 2011/2012 cropping season. Conventional inputs such as farm size, seed, fertilizer, labour and weedicides were statistically significant and had positive effects on maize output in northern Ghana using the Cobb-Douglas functional form. The mean estimates were 85.1%, 87.8% and 74.7% for technical, allocative and economic efficiencies respectively. Largely, maize production in the study area exhibited increasing returns to scale. The determinants of technical inefficiency were experience, agricultural extension service and gender. Farmers with many years of experience in maize production were more technically efficient and opportunities that bring the less experienced farmers to tap the accumulated knowledge of the more experienced ones would improve maize production. Farmers who had access to agricultural extension services were more technically efficient than those who did not have access and strengthening the extension service would further enable them improve on their technical efficiency. Male farmers were more technically efficient than females in maize cultivation and efforts that stress gender equality as regards access to

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economic resources, information and decision-making would help narrow this gap. There is allocative inefficiency relative to all the production inputs under the prevailing prices. Land, seed and weedicides would be allocatively efficient by increasing their use by 26.6%, 10.52% and 39.9% respectively. Fertilizer and labour are currently being over-used and requires 82.8% and 94.5% reductions respectively to reach their allocatively efficient points.

**Keywords:** Stochastic Frontier Analysis, Technical Efficiency, Allocative Efficiency, Economic Efficiency, Maize, Northern Ghana

## **SOCIO-ECONOMIC STUDY ON THE THREATS AND EFFECTS OF CLIMATE CHANGE ON LOCAL LIVELIHOOD IN SELECTED DISTRICTS OF THE NORTHERN REGION OF GHANA**

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The Northern Sector Action Awareness Centre (NORSAAC), a local NGO in Northern Ghana commissioned research into the threats and effects of climate change on local livelihoods of the local people, especially women and the youth in four districts of their operational area in the northern region of Ghana. In all, 320 respondents (160 males and 160 females) were selected for interview using the stratified and random sampling techniques. The method of data analysis was basically descriptive. We found that the people's livelihoods basically centre on small-scale agriculture and its related activities such as food processing (using traditional methods) and petty trading, especially for the women. Limited opportunities such as education, off-farm activities and credit as well as irrigation and extension services have meant that they are not able to cope with the negative effects of climate change. Consequently, while a significant

percentage of respondents relied on prayers and sacrifices to cope with the effects of climate change, others were simply doing nothing. As intervention measures, we propose irrigation and some improved, but affordable equipment for food processing. Also, efforts must be stepped up to increase access to education, credit and extension services in the district, especially for women.

**Keywords:** Climate change, Livelihoods, NORSAAC, Northern Ghana

## **HOUSEHOLDS' WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE MANAGEMENT IN TAMALE METROPOLITAN AREA, NORTHERN GHANA**

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This paper examined households' willingness to pay for improved solid waste management service in the Tamale Metropolitan Area in Northern Region of Ghana. The contingent valuation method (CVM) was used to identify the willingness to pay (WTP), while an ordered probit model was estimated to determine the factors influencing such willingness to pay. We found that a significant number of the respondents were willing to pay for the improved services, the amount ranging from GH¢2 to GH¢ 25 per monthly collection. Also, households' WTP were positive and significantly influenced by the sex, age, marital status and education of the household head as well as household income. A key policy implication of this result is that a flat rate cannot be charged across households. Poorer and uneducated households should be charged a lower rate than relatively rich and educated households.

**Keywords:** Ordered probit model, Contingent valuation method, Willingness to pay, Ghana, households.

## **CONTRACT FARMING AND THE ADOPTION OF CLIMATE CHANGE COPING AND ADAPTATION STRATEGIES IN THE NORTHERN REGION OF GHANA**

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**Environment, Development and Sustainability, 19, 2275–2295, 2017. DOI 10.1007/s10668-016-9854-z**

In climate change adaptation, contract farming can facilitate the adoption of coping and adaptation strategies, but such dynamics are less understood in the literature. This study uses primary data collected from a cross section of crop farmers in northern Ghana and a simultaneous equation systems approach to examine the links between contract farming and adoption of climate change coping and adaptation strategies. The major coping and adaptation strategies used by farmers include spraying of farms with chemicals, row planting, mixed farming, mixed cropping and crop rotation. Econometric results confirm that contract farming enhances the adoption of climate change adaptation strategies, but there is also a feedback effect on contract farming, such that farmers adopting more adaptation strategies have higher probabilities to get contract offer. This makes contract farming a viable policy instrument to consider in climate change adaptation. Furthermore, land ownership and extension services exert significant positive influence on adoption. As much as possible, coping and adaptation strategies should effectively be communicated to crop farmers. Policy-wise, development actors and successive governments in Ghana should encourage and facilitate contract or group farming, as was in the case of the National Block Farming, led by Ghana's Ministry of Food and Agriculture.

**Keywords:** Contract farming, Climate change, Coping and adaptation strategies, Simultaneous equation systems, Northern Ghana

## **USE PATTERNS AND PERCEPTIONS ABOUT THE ATTRIBUTES OF BAMBARA GROUNDNUT (VIGNA SUBTERRANEA (L.) VERDC.) IN NORTHERN GHANA**

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The study aimed to investigate the use patterns and perceptions about the positive and negative attributes of the underutilised legume, Bambara groundnut in northern Ghana. A multi-stage sampling procedure was adopted to select 360 respondents consisting of 240 farmers, 60 consumers and 60 marketers and the responses analysed using descriptive statistics. From the results, positive judgments about the legume included that it: can be processed into many products (1.3); requires a small amount of fertilizer (1.4); is drought-tolerant (1.7); has high protein content/ very nutritious (1.8); tastes better than other legumes (1.8); and more profitable (1.8). However, respondents' disagreements were with respect to the following: Bambara groundnut matures earlier compared with other legumes (2.3); and Bambara groundnut cooks faster than other legumes (2.7). Other challenges identified by the respondents were bloating of the stomach/constipation; irregular markets; and lack of capital and modern inputs for production and marketing. It is recommended that research be intensified around shortening the maturity period and reducing cooking time of the legume while farmers and marketers are supported with credit and modern inputs to scale up production. Lastly, farmers must be taught to take the production of the crop as a business if the crop is to be produced on a wider scale.

**Keywords:** Bambara groundnut, Perceptions, Use patterns, Northern Ghana



## TECHNICAL EFFICIENCY OF BAMBARA GROUNDNUT PRODUCTION IN NORTHERN GHANA

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Achieving food security under climate change is one of the greatest concerns of governments in developing countries. Due to favourable agronomic characteristics such as drought tolerance and an ability to produce a crop on less fertile soils, a number of underutilised crops, such as bambara groundnut offer potentials to address food insecurity problems in areas impacted by climate change. While efficiency studies have gained popularity in relation to many food crops, very little research has been carried out on the technical efficiency of bambara groundnut production. This study estimated a Translog stochastic frontier to determine the factors that influenced farmers' technical efficiency in the 2013 cropping season in Northern Ghana. It involved 120 farmers selected through a multi-stage sampling technique. Technical efficiency scores ranged from 27% to 97% with a mean of 83%. The significant positive determinants of output and efficiency were farm size, household labour, organic fertilisers as well as education and off-farm activities. The study found that bambara groundnut production can be stepped up by supporting farmers to scale up their farms, form farmer groups, diversify their livelihoods and improve the use of organic fertilizers. Improving opportunities for formal education may also have a positive impact.

**Keywords:** Bambara groundnut, Northern Ghana, Stochastic Frontier Model, Technical efficiency.

## **ADOPTION OF BAMBARA GROUNDNUT PRODUCTION AND ITS EFFECTS ON FARMERS' WELFARE IN NORTHERN GHANA**

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With the growing concerns about the likely implications of climate change, the long-term sustainability of conventional agricultural approaches and biodiversity loss have contributed to a growing interest in the potential of the so-called underutilised crops to address food, nutritional, and income security challenges. In support of their wider use, advocates of underutilised crops associate a number of benefits with them. These include agronomic and nutritional benefits such as drought tolerance and micro-nutrient content and the perceived socio-economic benefits of their wider use. It is widely suggested that the adoption of such crops can generate improved agricultural resilience and support nutrition, food and income security. Simultaneously, the adoption of underutilised crops is seen as a means of conserving biodiversity. However, scientific evidence concerning the use of such crops remains extremely limited. Crucially, little research has been undertaken concerning the contribution of such crops to the welfare of producers. This study investigates the socio-economic factors characterising the production of Bambara groundnut (*Vigna subterranea* (L.) Verdc.) in Northern Ghana and the impact of its production on farmers' welfare. Primary data was collected based on the 2013 farming season; 240 farmers were selected using a multi-stage sampling technique. A treatment effect

model, comprising an adoption and a welfare model was estimated. The probability of adopting Bambara groundnut was found to be greater for: unmarried farmers; farmers in larger households; farmers with little or no formal education; and farmers who had no access to credit. The production of Bambara groundnut led to increased household welfare, as measured by the level of household per capita expenditure/consumption. Results suggest that while further research and support for Bambara groundnut production could contribute to addressing high poverty levels in the region, many of the basic assumptions underlying current advocacy of underutilised crops need rigorous empirical verification.

**Keywords:** Adoption, underutilised crops, Bambara groundnut, Northern Ghana, treatment effect model, welfare.

## **THE EFFECT OF CREDIT CONSTRAINTS ON CROP YIELD: EVIDENCE FROM SOYBEAN FARMERS IN NORTHERN REGION OF GHANA**

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**<https://doi.org/10.47881/78.967x>**

Many farmers request for production credit to improve farm productivity, but are often denied by financial institutions. The rational questions to ask are: What factors characterize farmers who get denied of production credits? Does credit constraint lead to lower yield? This study aims to answer these important but often overlooked questions. A multistage sampling technique was used to select a cross-section of soybean farmers who applied for production credit in the Yendi Municipality and Saboba district of the Northern region of Ghana. A

binary probit model is used to examine farmers who get denied of production credit. Correcting for sample selection bias, a propensity score matching is used to examine the effect of credit denial on crop yield. Results are very conclusive, and we find that farmers who are often denied access to production credit significantly lack prior training on their enterprises. In addition to that, farmers who are not members of FBOs, have their own buyers for their produce, have low experience, have no formal education, make no savings from their farm activities and are without access to credit information are more likely to be refused credit when applied. Refusing credit to farmers constrains their farm operations and makes them less productive. Policy implications are enormous; farmers would need to participate in training programmes on crop enterprises to increase chances of receiving credit from lending institutions; governments would need to intensify extension programmes where extension agents can facilitate farmer training.

**Keywords:** Credit Constraints, Propensity Score Matching, Soybean Production, Northern Ghana

## **COMMERCIALIZING INNOVATIONS FROM AGRICULTURAL RESEARCH IN NORTHERN GHANA AND FARMERS` WILLINGNESS TO PAY**

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**African Journal of Business Management, 10(7), 140-150, 2016. DOI: 10.5897/AJBM2016.8004**

The study used contingent valuation to solicit monetary values from researchers and farmers on how much they were willing to sell and buy agricultural

innovations from research respectively. A probit model was then employed to identify the determinants of researchers' willingness to sell innovations from research. Furthermore, a multivariate (MV) probit model was estimated to explain key determinants of farmers' willingness to pay (WTP) for such innovations (technologies). Multi-stage sampling methods were used to obtain data from 360 farmers and 51 research scientists for the study. Though majority of farmers were willing to pay for agricultural innovations, the amounts they were prepared to pay (average of GH¢6.00), were far less than what the researchers wanted them to pay (average of GH¢50.00). The probability of a researcher accepting payment for innovations from research was high for the following categories of researchers: younger researchers; researchers who were members of professional bodies; and researchers with a high number of publications. The following categories of farmers also had a higher probability of paying for research output: younger farmers; farmers with high level of formal education; native farmers; farmers who had contacts with extension staff; and farmers with high income from their previous farming and non-farming activities. Considering the wide disparity between researchers' WTA payment for innovations and farmers' WTP, commercialization of research is possible but cannot be run on full cost-recovery. Government should therefore set up a statutory fund dedicated to agricultural research as a way of subsidizing agricultural innovations.

**Keywords:** Agricultural innovations, contingent valuation, multivariate probit model, willingness to pay, willingness to accept, probit model.

## **THE DETERMINANTS AND EFFECTS OF JICA RICE TECHNOLOGY ADOPTION IN THE SAGNARIGU DISTRICT OF THE NORTHERN REGION, GHANA**

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<https://doi.org/10.47740/94.UDSIJD6i>

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This study analysed the adoption of JICA rice production technologies and its effect on output in Sagnarigu District of the Northern Region. A total of 120 respondents from six communities in the Sagnarigu District were randomly selected and interviewed using semi-structured questionnaires. The logit model was used to determine the factors that influenced the adoption of JICA rice production technologies while the propensity score matching was employed to estimate the effect of treatment (adoption) on rice output. The study found that membership to farmer association and fertilizer subsidy positively and significantly influenced adoption of the rice production technologies whereas farm size, access to agricultural extension, use of other improved seed, and household size negatively affected adoption of the rice production technologies. The adoption of technologies led to a significant improvement in rice output. We recommend that farmers be supported to step up their adoption of the rice technologies through the formation of farmer groups as well as the fertilizer subsidization programme, among others.

**Keywords:** Adoption, JICA, Propensity Score Matching, Rice, Technology

## **PARTICIPATION AND OUTPUT EFFECT OF A BLOCK FARM CREDIT PROGRAMME IN SELECTED DISTRICTS OF NORTHERN GHANA**

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**Agricultural Finance Review, 76(3), 348-361, 2016.DOI 10.1108/  
AFR-01-2016-0005**

**Purpose** – The purpose of this paper is to examine the effect of the Ministry of Food and Agriculture (MoFA) Block Farm Credit Programme (BFCP) participation on crop output in four districts in the Northern region of Ghana. **Design/methodology/approach** – Structured questionnaires were used to collect data from 240 beneficiary and non-beneficiary farmers of BFCP. The treatment effect model that accounts for selectivity bias was employed to examine the

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socioeconomic determinants of farmers' decision to participate in the BFCP and the effect of BFCP participation on crop output. Findings – Even though the BFCP participation increases output, inadequacy and late delivery of BFCP inputs, low publicity about the programme and difficulty in accessing the inputs from the districts agricultural officers are factors that prevent the full realization of the benefits of the programme. Improving extension services to create more awareness and a re-introduction of the BFCP to make inputs available and affordable to farmers can help boost farm productivity. Practical implications – The positive effect of the BFCP means that the provision of low-cost production credit has the potential to increase productivity and improve incomes. Hence, MoFA should endeavour up scaling and properly managing the scheme. Originality/value – This study is the first to evaluate the BFCP in Northern region of Ghana, particularly in relation to its contribution to crop value. The findings are very useful to advise policy by taking account of the programme deficiencies and enhance effectiveness.

**Keywords:** Participation, Block Farm Credit Programme, Northern Ghana, Treatment effect model

## **ADOPTION OF DRY SEASON VEGETABLE FARMING AND ITS EFFECTS ON INCOME AT GOLINGA AND BOTANGA IRRIGATION SITES, NORTHERN GHANA**

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The study examined the factors influencing the adoption of dry season vegetable farming and its effect on income in the Golinga and Bontanga irrigation sites in the Northern Region of Ghana. It involved 240 farmers selected through multi

stage sampling procedure and the data analyzed using a switching regression and treatment effect models that corrected for sample selection bias. Farmers who had higher probability of going into dry season vegetable production were the younger farmers, farmers who had been cultivating vegetables for several years, farmers who had been in farmer groups for several years, farmers who had more contacts with extension officers and farmers who had accessed credit. While more labour, seed, fertilizer and insecticides were needed to increase income under irrigation farming, more labour and fertilizer as well as greater farm size were required to raise rain fed crop value. From the treatment effect model, dry season farming was found to have a positive effect on crop value. Other significant variables were farm size, seed, labour and insecticides. The study recommends that credit facilities should be made more available and accessible to the vegetable farmers to enhance their participation in irrigation farming, group formation should be promoted while extension service delivery should be enhanced.

**Keywords:** Adoption, Dry season farming, Irrigation, Switching Regression, Treatment Effect model, Northern Ghana

## **INSECTICIDE APPLICATION IN VEGETABLE PRODUCTION AND THE RISK OF FOOD POISONING IN NKORANZA MUNICIPALITY, GHANA**

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The application of insecticides in vegetable production has become an issue of global concern following reports of food poisoning in some countries, including Ghana. The main objective of the study was to determine incidence of insecticide related food poisoning in vegetable production in the Nkoranza Municipality in



the Brong Ahafo region. The study involved a total of 120 respondents, consisting of 40 each of producers, consumers and food vendors/vegetable traders. The commonest chemicals used in controlling insects in the study area were Confidor 2500SL [Imidacloprid (2500g soluble liquid)], Karate 2.5 [Lambda-cyhalothrin (25g emulsifiable concentrate)], Karate 5.0 [Lambda-cyhalothrin (50g emulsifiable concentrate)], Rambo 2.5EC [Deltamethrin (25g emulsifiable concentrate)] and Pawa [Lambda-cyhalothrin]. The period for the last spraying before harvesting the vegetables for the majority of the farmers was 30 minutes to 4 hours. Salt solution and water were the main solutions used in treating vegetables. However, only 7.5% of the consumers reported of illness after eating vegetables. This was confirmed by the health officials. Recommendations by vegetable farmers included: education (43.6%); use of organic insecticide (30.8%); follow instructions (20.5%); and education and follow instructions (5.2%). While the consumers suggested Treatment (54.4%); Education (34.6%); and buying from a hygienic source (9.8%). Given the level of insecticide misapplication in the study area, it is important that education on pesticide usage and regular monitoring is conducted to ensure conformance to recommended application regimes.

**Keywords:** Food poisoning, Insecticide application, Nkoranza Municipality, Vegetables

## **EXAMINING THE DETERMINANTS AND EFFECTS OF CONTRACT FARMING ON FARM INCOME IN THE NORTHERN REGION OF GHANA**

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The study sought to determine the factors that influence farmers' decision to participate in contract farming as well as the effect of contract farming on farm income in the Northern Region of Ghana. It involved 230 crop farmers selected through multi-stage sampling procedure. A treatment effect model was estimated to determine the factors that influenced farmers' participation in contract farming and its effect on farm income. The factors that positively influenced participation in contract farming were access to extension services and credit. However, farm size and off-farm income negatively influenced participation in contracting. In general, farmers who participated in contract farming had a higher income than their non-participating counterparts. Other factors that significantly influenced farm income positively were land, labour and fertilizers. Weedicide however impacted negatively on income, suggesting that it is being over-used. We recommend that farmers are supported to access the facilities that enable them to participate in contract farming such as credit and extension services. To increase their farm incomes, farmers also need support in increasing the levels of farm inputs such as land, labour and fertilizers. Farmers also need education on the accurate use of weedicides

**Keywords:** Adoption, Contract farming, Crop output, Climate Change Coping Strategies, Northern Region, Ghana, Treatment effect model

## **AGRICULTURAL CREDIT ACCESSIBILITY AND RICE PRODUCTION IN SAVELUGU-NANTON AND WALEWALE DISTRICTS OF NORTHERN GHANA**

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**Research Journal of Finance and Accounting,7(14), 126-136, 2016.**

As Ghana struggles to achieve accelerated growth in food production, increasing the output of rice has become an important goal. The main aim of this study is to find out the determinants of agricultural credit accessibility and its effect on rice

output. The study was conducted in four communities in the Savelugu-Nanton District and two communities in the Walewale District. It was aimed at ascertaining the determinants of agricultural credit accessibility and its impact on rice output. In all, a sample of 90 rice farmers was interviewed using a semi-structured questionnaire as well as focus group discussions. Data was collected on the mode of operation of existing credit institutions in the districts, the socio-economic indicators of farmers believed to influence credit accessibility and the inputs and output of farmers in the 2008/2009 farming season. Out of the 90 rice farmers interviewed, only 37 received agricultural credit from Bangmarigu Community Rural Bank and MoFA. In addition, most of the farmers were not aware of the existing credit institutions while others did not access the credit due to high interest rate, small credit size, fear of indebtedness and low educational status. From the survey, it became known that agricultural credit accessibility is positively influenced by group membership, farm size and gender. Specifically, females had greater average of credit than males. The study revealed that, agricultural credit has a significant effect on rice output hence the need to seek for credit to increase production levels. It is recommended that farmers are sensitized on the existence of credit institutions. Also, credit institutions should institute measures to reduce interest rate and also make credit acquisition processes and repayment plans simple and flexible.

**Keywords:** Credit accessibility, Determinants of credit, Cobb-douglas production function and Correlation

## **ANALYSIS OF THE MAIZE VALUE CHAIN DEVELOPMENT IN THE NORTHERN REGION, THE CASE OF THE ASSOCIATION OF CHURCH DEVELOPMENT PROGRAMME (ACDEP)**

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The study sought to investigate the extent to which the actors in the maize value chain of the Association of Church Development Projects and its partners (ACDEP/PAS) were adopting the tenets to upgrade the processes and products of the chain. Stratified and simple random sampling techniques were used to select a total of 240 maize farmers and 15 input dealers and officials of the intervention organizations. The methods of analysis involved the estimation of a probit model and the use of Kendall's coefficient of concordance as well as some descriptive statistics. The study revealed that majority of the actors; especially the farmers were not adopting the recommended strategies to upgrade the chain in terms of processes. For instance, only 2.5%, 18.3%, 0.8%, 2.5% respectively did harrow their plots after ploughing, used certified seeds for planting and carried out germination test before planting their seeds. Also, 65.8% of them applied less than the recommended 150kg of fertilizer per acre. In terms of upgrading their products, while all of them (100%) labelled and weighed their produce, none of them did grading or certification of their produce. However, 54.2% as against 45.8% dried their maize on tarpaulin. The probability of participating in the ACDEP/PAS value chain was higher for the following: older farmers, married farmers; ownership of larger farms; and the perception that participation would enhance one's market access. Credit access was the main challenge facing the categories of actors. Other critical challenges facing farmers were high cost of inputs, inadequate tractor/labour services and low price for their produce. There is the need to take a holist approach to solving the problem of inadequate credit. Also, while more actors (e.g. investors in storage facilities) must be encouraged to come on board, the chain must be supported for an effective linkage of all the actors.

**Keywords:** ACDEP, Maize, Northern Ghana, Value chain

## **STAKEHOLDERS' PERCEPTIONS OF ACTIONAID'S SOCIAL AUDIT PROCESSES IN THE NORTHERN REGION OF GHANA**

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The concept of social audit or social accountability is monitoring and evaluation from the view point of beneficiary communities. The main objective of the study was to investigate stakeholders' perceptions of the processes, benefits, challenges and prospects of social audit as practiced by Action Aid Ghana (AAG) in the northern region of Ghana. The Study employed the evaluative research design. Data was gathered from primary sources by administering semi-structured questionnaire and interview guide to a total of 109 respondents made up of Action Aid staff and partners as well as community members, selected using a multistage sampling procedure. The study found that, though AAG and partners had very elaborate accountability processes with potential benefits, their community partners were not able to practice social audit. This was because these processes were not effective in transferring the needed knowledge and skills to the communities. It is recommended that AAG and partners apply more participatory methodologies so that the community members are better equipped to hold their development partners accountable.

**KEYWORDS:** ActionAid, Ghana, Northern region, Social audit

**TOWARDS WOMEN'S EMPOWERMENT IN PERI-URBAN TAMALE:  
THE ROLE OF SUSTAINABLE MICROFINANCE**

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This study was carried out to investigate the perceptions with respect to the requirements and benefits of microfinance in peri-urban Tamale. A multi-stage sampling technique was employed to select 192 beneficiary and non-beneficiary

respondents of microfinance in peri-urban Tamale. Individual Interviews and focus group discussions were used for the study. The results revealed that the loans were inadequate. Also, while 53.7% were satisfied with the interest rate of 25% per annum, 43.2% were not. However, while 87.4% were satisfied with the repayment period, 12.6% were not. Furthermore, 56.8% and 36.8% of respondents had significant and moderate improvements in their businesses respectively. However, 6.3% said that there had not been any change in their businesses. Besides, 71.6% said that their economic status was much better than before. This also impacted positively on their social and political lives. Inadequate credit facilities emerged as the biggest challenge as identified by 52% of respondents. There is the need for governmental support with respect to the inhibiting requirements to increase accessibility without also crippling the Microcredit institutions.

**Key Words:** Microfinance, Women's Empowerment, Northern Ghana, Peri-urban Tamale

## **EFFECTS OF ORGANIC MANGO OUTGROWER SCHEME ON PARTICIPANTS' LIVELIHOOD IN SAVELUGU/NANTON MUNICIPALITY, NORTHERN REGION, GHANA**

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The study examined the effects of participation of the Integrated Tamale Fruit Company (ITFC) Organic Mango Outgrower Scheme (OMOS) on farmers' livelihood capitals. A descriptive research approach was employed using a semi-structured questionnaire and a checklist for data collection. Purposive and

stratified sampling techniques were used to select 158 outgrowers and 10 key informants for the study. Farmers generally benefited from the scheme, though not as much as they expected. For instance, participation in the scheme was offering employment opportunities for majority of farmers (81.6%), and 95.6% of the farmers had applied the good agricultural practices learned under the scheme to the cultivation of food crops in the area. Similarly, the household income level of 65.2% of the respondents had increased; average annual income from mango production had increased by 34.5% from GHC650.00 to GHC900.00 per acre. Also, 52.5% said participation in the scheme had helped to improve the educational infrastructure in their communities and that had facilitated access to education. Furthermore, 64.6% of farmers thought participation in the scheme had generally encouraged cooperation among farmer group members. Lastly, in terms of farmers' use of natural resources, 99.5% indicated a positive change. Some of the major challenges were disease and pest attacks, low yields, bushfire outbreaks, lack of cash credit, inadequate inputs, lack of irrigation, no flexible contract terms and delayed payment. It is recommended that additional facilities such as cash credit, cutlasses, pruning shears, spraying equipment, weeding machines, and irrigation facilities that were initially not envisaged should be provided for increased crop yields.

**Keywords:** ITFC, Organic Mango, Outgrower Scheme, Northern Region, Ghana

## **IMPROVED RICE VARIETY ADOPTION AND ITS EFFECTS ON FARMERS' OUTPUT IN GHANA**

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Sub-Sahara Africa and for that matter Ghana, missed out of the first Green revolution. However, with the instrumentality of the former United Nations Secretary, Kofi Annan, through the Alliance for Green revolution in Africa (AGRA) and other bodies, the revolution is being introduced in some parts of Africa, including Ghana. The extent to which the new revolution would work depends on a careful study of the socioeconomic underpinnings of technology adoption. This study sought to investigate the factors that influence the adoption of improved rice varieties and its effects on rice output in Ghana. The method of analysis involved an estimation of treatment effect model comprising a Probit equation and a production function. The empirical results show that the adoption of improved rice variety had a positive effect on farm output. Other inputs that had significant and positive impact on output were farm size, labour and fertilizer. The probability of adopting improved rice variety was high for the following: farmers who had formal education; farmers who had bigger household sizes; and farmers who had smaller farms. Contrary to our *a priori* expectation, however, farmers who had access to extension services had lower probability of adoption. The authors recommend that farmers be supported with more fertilizer subsidization. Farmers should also form farmer groups to support one another on the field. Also, the fundamental problems of illiteracy among farmers must be addressed.

**Keywords:** Ghana, improved rice seeds, technology adoption, treatment effect model.

**SMALLHOLDER ADOPTION OF SOIL AND WATER CONSERVATION  
TECHNIQUES IN GHANA**

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**African Journal of Agricultural Research, 9(5),539-546, 2014. DOI:  
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At the onset of climate change, the adoption of soil and water conservation (SWC) techniques in Africa sub of the Sahara has become even more crucial. The study aimed at estimating the determinants and effects of SWC adoption. The data was obtained from the Ghana Agriculture Production Survey (GAPS), a national level survey conducted by Ghana's Ministry of Food and Agriculture with technical and financial support from the International Food Policy Research Institute (IFPRI). A total sample size of 1,530 farm households selected from 20 districts across Ghana was used. The Poisson model was employed to estimate the determinants of adoption of SWC technology while the stochastic frontier model was used to analyze the effects of SWC technology adoption on technical efficiency. The study found that SWC adoption significantly affected technical efficiency in maize production. Significant policy variables that were found to positively influence the adoption of SWC techniques included credit, farm size, group membership and proximity to input sale points. Also, credit, education and extension services significantly influenced farmers' technical efficiency. There is the need for a holist approach to supporting farmers. In general, access to education, extension services and credit must be stepped up. Farmers must also be supported to form farm groups as a viable source of farm labour.

**Keywords:** Adoption, poisson model, technical efficiency, soil and water conservation.

## **FARMER-PERCEIVED EFFECTS OF CLIMATE CHANGE ON LIVELIHOODS IN WA WEST DISTRICT, UPPER WEST REGION OF GHANA**

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The effects of climate change on people’s livelihoods are perceived differently across various localities. It is imperative to examine how farmers understand the effects of climate change on their livelihoods. Their viewpoints can help create strategies for responding to climate and ecosystem changes in an appropriate and practical manner. Such perceptions are insufficiently understood in the Wa West District of the Upper West Region of Ghana, despite the increasing frequency and magnitude of climate change’s effects. This paper first examines farmers’ perceptions about climate change in their communities in relation to available, conventional climate information. It also assesses farmers’ livelihood activities during both the wet and dry seasons in the district and discusses the area’s proneness to floods, droughts, and other types of climate change phenomena. This assessment reveals the challenges faced by the farmers in the study area and the opportunities to enhance their livelihoods.

**Keywords:** climate change, farmers, perceptions, livelihoods, Upper West Region, Ghana

## **HOUSEHOLDS’ COPING STRATEGIES IN DROUGHT- AND FLOOD-PRONE COMMUNITIES IN NORTHERN GHANA**

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This study seeks to explore stakeholders' perceptions, causes, and effects of extreme climatic events, such as droughts and floods, in the Wa West District of Ghana's Upper West Region. A multi-stage sampling procedure is used to select 184 respondents. Data collection methods include individual questionnaire administration, focus group discussions, and a stakeholders' forum in the Wa West District Assembly. While frequencies are used to show respondents' perceptions of the severity of climate change effects, a treatment effect model is used to determine the factors influencing farmers' choices of on-farm coping strategies over off-farm activities in both periods of drought and flood. Findings are the following: farmers perceive that climate change is real and has severe consequences. Consequently, they resort to both on-farm and off-farm strategies to cope with the effects of climate change. While men mostly adopt the former, women adopt the latter. Both strategies are, however, not viable for taking them out of poverty, though off-farm activities are more effective. Education and extension services are other important factors influencing the choice of coping strategies as well as farmers' welfare. Farmers must be supported with more viable income-earning activities, ones that can take them out of poverty. Women should be given priority. Access to education and extension services must also be stepped up to facilitate the adoption of the coping strategies and to increase welfare.

**Keywords:** climate change, drought, flood, coping strategies

**DETERMINANTS OF CHOICE OF CLIMATE CHANGE ADAPTATION STRATEGIES IN NORTHERN GHANA**

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This paper used binary logistic regression model to analyze factors that affect the choice of climate change adaptation strategies of farmers in Northern Ghana. Using semi-structured questionnaires, 155 farmers were randomly sampled from purposively selected three Northern Regions in Ghana. The empirical results of the binary logistic regression models revealed different effects of the factors on farmer's choice of adaptation strategies. Farming experience, farm income, access to phones, mixed farming, farmers' perception on reduction in rainfall amount and access to weather information significantly and positively affects the choice of at least five climate change adaptation strategies. Following the findings of this study, agricultural extension service should be intensified through organization of adult education programmes or field schools for farmers to educate them on some climate change adaptation strategies. Agro climatic information centers should be established at vantage points in farming communities to enable farmers seek for information to help them revise their climate change adaptation decisions for specific time and agricultural activity. Lastly, affordable climate change adaptation technologies should be designed and made available to poor farmers to adopt.

**Keywords:** Adaptation strategies, climate change, logit regression and Northern Ghana

**EFFECTS OF RESEARCH AND DEVELOPMENT EXPENDITURE AND CLIMATE VARIABILITY ON AGRICULTURAL PRODUCTIVITY GROWTH IN GHANA**

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This paper examines the effects of agricultural research expenditure and climate change on agricultural productivity growth by region in Ghana. A panel dataset is constructed for 2000-2009 from the Food and Agriculture Organization of the United Nations; the Ministry of Food and Agriculture, Ghana; and the Agriculture Science and Technology Indicators (ASTI) database of the International Food Policy Research Institute. A Malmquist index was used to compute agricultural productivity growth, including decomposition components efficiency change and technical change. The determinants of productivity growth are examined using a fixed effects regression model. The results specify that significant causal factors impact positively on Ghana's agricultural productivity growth, include climate variability, infrastructure, and agricultural research and development expenditure. The study confirms there is a need to strengthen and develop new technological progress for sustainable agricultural production in Ghana.

**Keywords:** total factor productivity, research and development, climate variability, Ghana.

**FARMER FIELD FORA AND ADOPTION OF YAM INTEGRATED PEST AND DISEASE MANAGEMENT TECHNOLOGIES IN NORTHERN GHANA**

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Justification for the use of public funds on programmes and the determination of their effectiveness among other factors call for their evaluation. This study was therefore conducted to investigate the effectiveness of Farmer Field Fora (FFF) and adoption of yam Integrated Pest and Disease Management (IPDM) Technologies in the Nanumba North and Kpandai Districts of the Northern region of Ghana. A multi-stage sampling technique was carried out to select 240 participants and non-participants from the study area. Primary data collection was done in 2012 through individual questionnaire administration and focus group discussions. Data were analyzed using descriptive statistics, regression analysis and budgetary techniques. From the findings, the farmers' perceptions of the effectiveness of the FFF were favorable and the FFF led to a close in knowledge gap and the adoption of IPDM technologies. Factors that positively affected adoption were training such as the FFF, farm size, and research contacts. Variables that had negative effects on adoption were age and house hold size. Also, while the benefit cost ratio for project participants was 2.5 that of non-participants in project community and non-participants outside project community were 1.9 and 2.1 respectively. FFF is therefore an appropriate mechanism to transfer IPDM technologies and the process could be adopted for extension activities. However, for a rapid adoption of the technologies, farmers should be supported with credit and more contacts with researchers. Also, younger farmers and large-scale farmers should be targeted for extra support without neglecting older farmers and small-scale farmers.

**Keywords:** Farmer Field Fora, benefit cost ratio, integrated pest and disease management, participation, technology adoption, yam.

## **DEVELOPING A COMMUNITY-BASED RESILIENCE ASSESSMENT MODEL WITH REFERENCE TO NORTHERN GHANA**

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Faced with adversarial climatic and physical conditions and an inept socioeconomic development priorities, Northern Ghana remains one of the regions that are most vulnerable to climate-related shocks and disturbances in semi-arid Africa. Because of the effect of frequent floods, droughts, and bushfires, entire livelihoods in Ghana's predominantly smallholder agricultural population are under threat. In this paper, we present a model for community-based resilience assessment. This model was developed through an experiment conducted in selected rural communities in the Tolon and Wa West Districts in the Northern and Upper West Regions of Ghana. This experiment underpinned an ongoing five-year collaborative research project, Climate and Ecosystem Change Adaptation and Resilience Research in Semi-Arid Africa: An Integrated Approach (CECAR-Africa), and involved researchers and scientists from institutions in Ghana and Japan. Drawing on the findings from extensive literature review, field surveys, focus group discussions, unstructured interviews with various stakeholders, and participatory observations, we developed a matrix for assessing the different categories of community resilience (ecological, engineering, and socioeconomic). The outcome of this resilience matrix, herein

called an “integrated” assessment model, offers a mix of factors that could improve societal reorganization when faced with shocks or disturbances. The integrated model provides a workable assessment criteria and key indicators for community level resilience assessments. This experiment proved valuable and highly effective in selecting case study communities for CECAR-Africa. The next step will involve the testing and development of similar criteria and indicators to measure household level resilience.

**Keywords:** Climate and ecosystem change; Ghana; Community resilience; Integrated assessment model; Floods; Droughts

## **FOOD EXPENDITURE AND HOUSEHOLD WELFARE IN GHANA**

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**African Journal of Food Science, 8(3), 164-175, 2014. DOI:  
10.5897/AJFS2013.1120**

The main objective of this study was to investigate the determinants of household food expenditure and its effects on welfare. As a result of potential simultaneity between food expenditure and welfare, a simultaneous equations model was estimated using the two-stage least squares method. The findings confirm the theoretical and empirical evidences that households reduce the percentage share of their food expenditure as they become richer. Also, increases in the food budget share lead to a reduction in welfare. Different households which spent greater percentages of their incomes on food were as follows: female headed households; households headed by the aged; households whose heads had little or no formal education; households whose heads were married; smaller households; rural households; households in the forest and savannah belts; and households living farther from the nation’s capital. Also, welfare was greater for the following households: female headed households; households headed by the



aged, households whose heads had formal education, smaller households, households who owned assets; households living in the urban centres, as well as those living closer to the nation's capital. Households that must be targeted for support include male-headed households, households headed by the relatively young, larger households, rural households and households farther from the nation's capital, including those in the savannah belt.

**Keywords:** Food expenditure, Ghana, households, two stage least squares, welfare.

## **TECHNICAL EFFICIENCY OF MAIZE PRODUCTION IN NORTHERN GHANA**

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**African Journal of Agricultural Research, 8(43), 5251-5259, 2013. DOI:  
10.5897/AJAR2013.7753**

The ability of maize farmers in Ghana to increase yield levels and attain sustainable production depends on efficient farm practices, hence technical efficiency. This study applied the stochastic frontier methodology to examine the technical efficiency of maize production for the 2011/2012 cropping season. Multi-stage sampling procedure was used to obtain 360 maize households for the study. The determinants of maize output in northern Ghana were farm size, seed, fertilizer and weedicides. The mean technical efficiency estimate was 74% with minimum and maximum values of 12 and 98%, respectively. Agricultural mechanization, experience and gender statistically influenced technical efficiency. The Agricultural Mechanization Services Enterprise Centres programme of the Ministry of Food and Agriculture should be scaled-up to increase access to farm tractor for agricultural mechanization services in order to increase farmers' production efficiency. Similarly, maize production could improve if younger farmers learn from the accumulated knowledge of

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experienced farmers. Policies which would stress gender equality as regards access to economic resources, education, information and decision-making would help develop self-confidence in women.

**Keywords:** Stochastic Frontier, Technical Efficiency, maize production, northern Ghana.

## **ESTIMATING TECHNICAL EFFICIENCY OF COTTON PRODUCTION IN YENDI MUNICIPALITY, NORTHERN GHANA**

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**Journal of Agriculture and Sustainability, 4 (1), 115-140, 2013.**

Agriculture remains the kin pin of most African economies, including Ghana. In recent times the contribution of non-traditional export crops, including cotton, to foreign exchange earnings in Ghana has been quite significant. The aim of this study was to explore the social, economic and environmental factors influencing cotton production in Yendi Municipality in Northern Ghana. A multi-stage sampling technique was used to select 91 small holder cotton farmers in 8 communities in the Municipality. The data was collected during the 2011/12 cropping season and fitted into Translog stochastic frontier model. The one-stage maximum likelihood estimation was used to obtain the efficiency levels as well as the determinants of such efficiency levels. A SWOT analysis was carried out to assess the sustainability or otherwise of the cotton industry in the study area. Individual farm level technical efficiency ranged between 0.70 and 0.99 with a mean of 0.88. This was as a result of the agricultural intensification system made possible by the cotton company, Armajaro Ghana Ltd. However, in order to reap

the full benefits of commercializing cotton production in the region, both farmers and the cotton companies must keep to their contractual agreement; while the latter should supply the inputs timely and pay the farmers promptly, the former should use the inputs for the intended purposes and pay back promptly. Above all, there should be land reforms to make land available for the expansion of cotton farms.

**Keywords:** Cotton, Northern Ghana, SWOT Analysis, Technical efficiency

## **ESTIMATING TECHNICAL EFFICIENCY OF TOMATO PRODUCTION IN NORTHERN GHANA**

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**American Journal of Experimental Agriculture 3(1): 56-75, 2013.**

**Aim:** To investigate the factors influencing technical efficiency of tomato farmers at the Irrigation Company of Upper Region (ICOUR). **Study Design:** Cross sectional. **Place and Duration:** Kasena-Nankana District of the Upper East Region of Ghana in the 2007/2008 cropping season. **Methodology:** One-step estimation of the Cobb-Douglas Stochastic Frontier Model. **Results:** Mean technical efficiency was found to be 0.71, ranging from 0.36 and 0.99. The relatively high efficiency levels were as a result of agricultural intensification measures (such as the adoption of modern inputs) that the farmers followed as well as high levels of education and long years of experience in cultivating tomatoes. The most indentified effect of tomato influx into the country was that it drives farmers out of production. As a way out the farmers suggested that there should be a review of the country's cross border relations with its neighbors. **Conclusion:** The farmers at ICOUR are technically efficient. Their main problem however borders on the fierce competition they face from their foreign counterparts.

**Keywords:** Cobb-Douglas stochastic frontier model; ICOUR; technical efficiency; tomatoes.

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## **RETENTION OF ADMINISTRATIVE STAFF OF THE GHANA EDUCATION SERVICE IN THE NORTHERN REGION OF GHANA**

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**Educational Research, 4(2), 163-173, 2013.**

The main objective of this study was to examine the factors that influenced the retention or otherwise of administrative staff of the Ghana Education Service in the Northern Region of Ghana (ASGES). The study used the exploratory and descriptive research designs. Purposive as well as stratified and simple random sampling techniques were employed to select a sample of 63 respondents, consisting of 45 current and 18 former ASGES. Primary data for the study were obtained through focus group discussion and individual questionnaire administration, using interview guides and questionnaires respectively, while secondary data were sourced from the Statistics Department of the GES Regional Education Office. The data were analysed with the help of the Statistical Package for the Social Sciences (SPSS) Version 16. The study revealed that the main reasons why ASGES left GES were: unattractive remuneration; inadequate motivation for staff; lack of appreciation of staff efforts, inadequate working logistics; poor working conditions; and limited or no promotion. Based on the findings of the study, the following recommendations were made: the government should review the conditions of service of the administrative staff of GES; management of GES should also review the existing housing and car loan schemes to ensure that a greater number of ASGES benefit from it; and a career structure must be carefully worked out together with compensation packages, to ensure continuous loyalty of the ASGES.

**Keywords:** Administrative staff, GES, motivational and environmental factors, retention.

## **TECHNICAL EFFICIENCY OF RICE PRODUCTION AT THE TONO IRRIGATION SCHEME IN NORTHERN GHANA**

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**American Journal of Experimental Agriculture, 3(1): 25-42, 2013**

**Aim:** To investigate the determinants of technical efficiency of rice farmers at Tono Irrigation Project. **Study Design:** Cross sectional. **Place and Duration:** The Kassena-Nankana District of Upper East Region of Ghana in the 2007/2008 cropping season. **Methodology:** One-step estimation of the Stochastic Frontier Model. **Results:** The technical efficiency estimates ranged from 0.41 to 1.00 with a mean value of 0.81. The factors that determined farmers' technical efficiency included education and the adoption of modern inputs such as seeds and chemical fertilizers. **Conclusion:** The sustainability of the farmers' high efficiency will be dependent on the continuous support they receive in the areas of input supply and education, among others.

**Keywords:** Rice; stochastic frontier model; technical efficiency; Tono irrigation scheme; translog production function.

## **THE DETERMINANTS OF LONG-TERM ECONOMIC GROWTH IN GHANA FROM 1960-2007**

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**Journal of Research in Economics and International Finance, 1(5),  
141-149, 2012.**

The study sought to discover the determinants of long-term economic growth in Ghana. Co integration and an Error-correction model were used to estimate the time series data from 1960 to 2007. The study found that, there was a long run relationship between growth and inflation, government consumption, export and human resource development. While, inflation and government consumption had negative effect on growth, export and human resource development influenced economic growth positively. Government must squarely address macroeconomic imbalances through cutting back on public spending and redefining spending priorities. In addition, inflation must be further reduced, monetary policies tightened and export diversification and value addition should be encouraged. Finally, there is the need to improve the human capital capacity through education and health.

**Keywords:** Co integration, error-correction model, Ghana, long-term growth.

**CLIMATE VARIABILITY AND YIELDS OF MAJOR STAPLE FOOD  
CROPS IN NORTHERN GHANA**

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**African Crop Science Journal, 20(2), 349 – 360, 2012.**

Climate variability, the short-term fluctuations in average weather conditions and agriculture affect each other. Climate variability affects the agroecological and growing conditions of crops and livestock, and is recently believed to be the greatest impediment to the realisation of the first Millennium Development Goal of reducing poverty and food insecurity in arid and semi-arid regions of developing countries. Conversely, agriculture is a major contributor to climate variability and change by emitting greenhouse gases and reducing the

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agroecology's potential for carbon sequestration. What however, is the empirical evidence of this inter-dependence of climate variability and agriculture in Sub-Saharan Africa? In this paper, we provide some insight into the long run relationship between inter-annual variations in temperature and rainfall, and annual yields of the most important staple food crops in Northern Ghana. Applying pooled panel data of rainfall, temperature and yields of the selected crops from 1976 to 2010 to cointegration and Granger causality models, there is cogent evidence of cointegration between seasonal, total rainfall and crop yields; and causality from rainfall to crop yields in the Sudano-Guinea Savannah and Guinea Savannah zones of Northern Ghana. This suggests that inter-annual yields of the crops have been influenced by the total amounts of rainfall in the planting season. Temperature variability over the study period is however stationary, and is suspected to have minimal effect, if any, on crop yields. Overall, the results confirm the appropriateness of our attempt in modelling long-term relationships between the climate and crop yield variables.

**Key Words:** Causality, cointegration, climate variability, rainfall, yield

## **CUSTOMER SATISFACTION AND PERCEPTIONS ABOUT FOOD SERVICES ON THE UNIVERSITY FOR DEVELOPMENT STUDIES CAMPUS, GHANA**

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**African Journal of Food Science, 6(8), 216-223, 2012. DOI: 10.5897/AJFS11.078**

Customers' perceptions about food and service attributes are considered to be very crucial in influencing their satisfaction and behavioral intentions in the food and service industry. This study focused on customer satisfaction and the

general perception about food services of two restaurants on the Nyankpala Campus of the University for Development Studies, Tamale, Ghana. The study further looked at the challenges the restaurants encounter in acquiring and storing agricultural produce in the industry. The two restaurants were Alimento (A) and Lovely Sisters (B), purposively sampled, based on their high levels of patronage. A semi-structured questionnaire was designed and administered to a total of 240 respondents in both restaurants during the second session of 2009/2010 academic year. The main methods of analysis were principal component analysis and a multiple regression to find out the factors that influenced the levels of patronage so as to make recommendations for improvements. The study revealed that while only 38.8% of the customers were satisfied with the services of Restaurant A, as much as 81.7% of the customers in Restaurant B were satisfied. The principal components that influenced patrons' frequency of visits to Restaurant A were cleanliness of eating area, cleanliness of serving area, appearance of staff and relaxed atmosphere. For Restaurant B, efficiency of service, friendliness of servers and pleasing appearance of food were the principal components that influenced patrons' frequency of visit. Regression of patron's frequency of visits on the principal components confirmed the significance of the factors in influencing the dependent variable. It is important that apart from reducing the price, Restaurant A improves upon its assurance and empathy dimensions while Restaurant B also improves upon its tangibility dimensions. Also, in order to avert the seasonal shortages of produce, it may be necessary for the restaurateurs to put up simple storage structures to store their raw materials.

**Keywords:** Food service, perceptions, principal components, regression coefficients.

## **PERCEPTIONS OF DEVELOPMENT IN THE NORTHERN REGION OF GHANA**

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**Journal of Research in Economics and International Finance, 1(6),  
169-178, 2012.**

This study sought to find out beneficiaries' views about development and the qualities of a good development project, among others. The study was carried out in Tamale, Savelugu and Kpalsogu/Dundo in the Northern region of Ghana. The stratified and simple random sampling techniques were used to select the communities and 240 respondents respectively. Data collection techniques consisted of focus group discussions, individual face-to-face questionnaire administration and observations. Respondents' definition for development was; meeting one's welfare goals, such as Peace, Enough food, Good health, High income and Education, in line with the modern definitions of development. In terms of the qualities of development projects, respondents were most concerned about their usefulness, use of local resources, legality as well as conformity to culture and religious beliefs. The two main findings that did not meet our *a priori* expectations were that respondents did not place much importance on the need for their involvement in the planning, design and implementation of projects and programmes and the notion that Government alone has the responsibility of providing for the people. The community members must be sensitized and educated to appreciate their role in the planning, design and implementation of development programmes.

**Keywords:** Development, Evaluation, Northern Ghana, Perceptions.

**BORDER EFFECTS ON SPATIAL PRICE TRANSMISSION BETWEEN  
FRESH TOMATO MARKETS IN GHANA AND BURKINA-FASO: ANY  
CASE FOR PROMOTING TRANS-BORDER TRADE IN WEST  
AFRICA?**

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**Journal of International Agricultural Trade and Development, 8(1), 81-98, 2011.**

Cross-border trade in food commodities within sub-regional economic blocks in Sub-Sahara Africa (SSA) is believed to be faster, cheaper, more convenient and welfare-enhancing than overseas trade between SSA countries and the USA, EU or the BRIC countries. The difficulty of commodity arbitrage across international borders in SSA is however a fundamental constraint to price transmission, market integration and realization of the welfare-enhancing role of cross-border trade in Africa. This study examines the impact of border and distance on price transmission between tomato markets in Ghana and Burkina-Faso. The analysis applies a regime-switching vector error correction model to estimate semi-weekly, wholesale prices of tomato in four tomato markets in Ghana and a production centre in Burkina-Faso. Estimated parameters of price transmission contain evidence of border and distance effects. This is expected since high transfer costs, including cross-border tariffs are incurred by traders in moving tomato across the border. Moreover, the perishable nature of tomato, and the poor quality of roads and transportation facilities may imply additional costs of risks to arbitrageurs. The findings have both theoretical relevance and practical implications for facilitating cross-border trade in West Africa, especially for trade between landlocked countries like Burkina-Faso and coastal ones like Ghana.

**Key Words:** Price Transmission, Border, Tomato, Ghana, Burkina-Faso

**TECHNICAL EFFICIENCY OF GROUNDNUT PRODUCTION IN WEST MAMPRUSI DISTRICT OF NORTHERN GHANA**

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**Journal of Agriculture and Biological Sciences, 2(4), 071-077, 2011.**

As Ghana struggles to achieve accelerated growth in food production, increasing the output of groundnut has become an important goal. This study examined the technical efficiency of groundnut farmers in West Mamprusi District of the Northern Region of Ghana in the 2008/2009 cropping season. Cross-sectional data was collected from a sample of 123 farmers and fitted into Cobb-Douglas Stochastic Frontier Model. Mean technical efficiency estimate was 70%. The factors that were significant in increasing farmers' technical efficiency were large farm size, formal education, credit and using tractor for land preparation as opposed to bullock plough. However, the continuous cultivation of farm plots led to decreased farm efficiency. It is important that the Ministry of Food and Agriculture (MoFA), and for that matter the Savannah Accelerated Development Authority (SADA), carry out its strategies to the letter for the development of the groundnut industry in the study area, and in Ghana as a whole.

**Keywords:** Groundnut production, Technical Efficiency, Northern Ghana, West Mamprusi District.

**WHO ADOPTS GREEN REVOLUTION (GR) TECHNOLOGY  
IN GHANA?**

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**International Journal of AgriScience, 1(1), 23-44, 2011.**

Sub-Saharan Africa in general and Ghana in particular, missed out on the Green revolution. Efforts are being made to re-introduce the revolution, and this calls for more socio-economic research into the factors influencing the adoption of new technologies, hence, this study. The study sought to find out how socio-economic factors contribute to adoption of Green revolution technology in

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Ghana. The method of analysis involved a maximum likelihood estimation of a probit model. The proportion of Green revolution inputs was found to be greater for the following: households whose heads had formal education, households with higher levels of non-farm income, credit and labor supply as well as those living in urban centers. It is recommended that levels of complementary inputs such as credit, extension services and infrastructure are increased. Also, households must be encouraged to form farmer-groups as an important source of farm labor. Furthermore, the fundamental problems of illiteracy must be addressed through increasing the levels of formal and non-formal education; and the gap between the rural and urban centers must be bridged through infrastructural and rural development. However, care must be taken to ensure that small-scale farmers are not marginalized, in terms of access to these complementary inputs that go with effective adoption of new technology. With these policies well implemented, Ghana can catch up with her Asian counterparts in this re-introduction of the revolution.

**Keywords:** Green Revolution, Probit model, Small-scale farmers, Technology Adoption

## **THE DETERMINANTS OF POVERTY IN GHANA**

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**Development Spectrum, 3(1), 2010.**

Halving the proportion of poor and hungry people by the year 2015 is the first of the eight Millennium Development Goals that the world has targeted. This shows how important the goal is. If this target is to be met it is important that we know the determinants of poverty and therefore, the probability of a household becoming poor, among others, for a more precise policy formulation. This study estimates a probit model to find out the Probability of becoming poor using the Ghana Living Standards Survey (GLSS-V) data. Factors that reduce the probability of a household becoming poor are education, ownership of durable

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assets and international remittances. Others are: a household head being a female or young; a household living in an urban centre as opposed to a rural area; or in a forest as opposed to a coastal zone. Factors that increase the probability of becoming poor are a high number of dependents and remoteness from the national capital. Policy formulation should focus on: increasing access and quality of education; rural development; and decentralization as well as ensuring a regional balance in the distribution of the 'national cake.'

**KEYWORDS:** Millennium Development Goals, Poverty, Probit model.

## **THE DETERMINANTS OF HOUSEHOLD EDUCATION EXPENDITURE IN GHANA**

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**Educational Research and Reviews, 6(8), 570-579, 2011.**

The role of formal education in the socio-economic development of a country cannot be over-emphasized. It is in this light, that over the years, governments of Ghana and other organizations have supported the education sector in many ways. Despite the efforts, many people think that a lot more can be done, but resources are not unlimited. Against this backdrop, it will be helpful if stakeholders are in the known as to what sections of the populace need urgent support. This is the primary motivation for this study. A logit model was estimated to find out the socio-economic determinants of a household's probability of spending on education. The data used was the 2006/2007 Ghana Living Standards Survey Round Five (GLSS-V). We found that high education expenditure does not necessarily mean high probability of spending on education. Two categories of households with high probability of education expenditure were identified. The first category consists of households whose heads have formal education, households who own land, vehicles, and other

durable assets, as well as households living in the forest belt. The second category includes: female-headed households; households with greater number of children of school going age; rural households; and households living farther away from the nation's capital. Households in the second category are those that must be targeted for urgent support. Governments support in the form of capitation grant, free feeding and free supply of uniforms and stationery are in the right direction, but this must be stepped up in a sustainable manner.

**Keywords:** Education expenditure, households, Logit model.

## **ADOPTION OF FARM MANAGEMENT PRACTICES IN LOWLAND RICE PRODUCTION IN NORTHERN GHANA**

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**Journal of Agriculture and Biological Sciences, 2(6),183 - 192, 2011.**

The strategy of the Savannah Accelerated Development Authority (SADA) is 'based on the concept of a "Forested North" where agricultural production is modernized and oriented towards a larger market embracing the Sahelian countries, including northern Cote d'Ivoire and Togo. The modernization of agricultural production hinges on the adoption of efficient and sustainable farm management practices. The main objectives of the study were to find out: farmers' perceptions on the most important farm management practices that are relevant in increasing their output or income; and (2) the determinants of the adoption of four soil fertility management practices (improved seed varieties, inorganic fertilizers, dibbling and sowing in rows). The methods of analysis involved a Kendall's Coefficient of Concordance and the estimation of an Ordered Probit Model for the two objectives respectively. The survey covered seven districts in the Upper East and Northern Regions involving a total of 300 lowland rice farmers. In order of importance, the farmers ranked the following as relevant in increasing their output and income: Timely land preparation; Good

seed variety; Soil fertility; Water availability/irrigation; Planting time; Weed control; Harvesting time; Commodity price; and others (such as pests infestation). A Kendall's coefficient of 51% was recorded, which means that 51% of the respondents agreed on the ranking. The maximum likelihood estimation results of the probit model showed that extension visits, experience and training had a positive influence on the adoption of farm practices, while farm size, landownership and input distance had a negative effect on adoption. The farmers' field school and the extension delivery systems must be improved. More input shops must also be set up close to farmers for easy access to inputs. Also, in as much as large scale farming must be encouraged, this must not be done at the detriment of small-scale farming and the landless. Above all, it is important that whatever support that is given to the farmers must be timely so as to yield the full impact.

**Keywords:** Adoption, Farm Management Practices, Kendall's Coefficient of Concordance, Northern Ghana, Ordered Probit.

## **IMPROVING THE EFFICIENCY OF LOWLAND RICE FARMERS IN THE NORTHERN REGION OF GHANA**

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**Journal of Ghana Science Association, 12 (2) , 2010.**

In northern Ghana rice cultivation is believed to have a great potential in reducing poverty levels. Despite this, present yields are generally low due to lack of water control systems, high level of risks caused by uneven rainfall distribution, and inefficient farming practices. Against this background three interventions have been introduced in the Tamale area of the Northern Region of Ghana, namely: the Agence Francaise de Development /Ministry of Food and Agriculture Lowland Rice Development Project (AFD/MOFA-LRDP); the

Transfer of Effective Irrigation and Water Resources Management Project (TEIWRMT); and the Gollinga Irrigation Scheme of the Ghana Irrigation Development Authority (GIDA). The objective of this paper is to identify the socio-economic factors that influence the inefficiency of farmers under the three rice cultivation schemes. The method of analysis involves a one-step estimation of a stochastic frontier model. Though the average efficiency is low, it is relatively high for intensive rice cultivation with improved water harvesting schemes such as bunds and water regulating structures. Other factors that reduce farmers' inefficiency are: education; extension visits; farmers' experience and group membership. However, general inaccessibility increases farmers' inefficiency. To help bring the much needed development in northern Ghana it is important that rice cultivation be supported with more of the following: water harvesting and regulating structures; improvement in the road net-work; as well as education and extension services, among others.

## **ADOPTION OF GREEN REVOLUTION (GR) SERVICES AND POVERTY REDUCTION IN GHANA**

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In Sub-Saharan Africa (SSA) the technological advances of the Green Revolution (GR) have not been very successful. However, the efforts being made to re-introduce the revolution call for more socio-economic research into the adoption and the effects of the new technologies. The paper discusses an investigation on the effects of GR technology adoption on poverty among households in Ghana. Maximum likelihood estimation of a poverty model within the framework of Heckman's two stage method of correcting for sample selection was employed.



Technology adoption was found to have positive effects in reducing poverty. Other factors that reduce poverty include education, credit, durable assets, living in the forest belt and in the south of the country. Technology adoption itself was also facilitated by education, credit, non-farm income and household labour supply as well as living in urban centres. Inarguably, technology adoption can be taken seriously by increasing the levels of complementary inputs such as credit, extension services and infrastructure. Above all, the fundamental problems of illiteracy, inequality and lack of effective markets must be addressed through increasing the levels of formal and non-formal education, equitable distribution of the 'national cake' and a more pragmatic management of the ongoing Structural Adjustment Programme.

**KEY DESCRIPTORS:** Green Revolution, Technology Adoption, Poverty, Selectivity bias.

## **HOW EFFICIENT IS GREEN REVOLUTION TECHNOLOGY ADOPTION IN GHANA?**

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The study seeks to find out the effects of Green Revolution technology adoption on output/efficiency of agricultural households in Ghana. The method of analysis involves Battese and Coelli's (1993; 1995) one-step estimation of a stochastic frontier model. Technology adoption was found to have positive effects on output. Households' efficiency was also greater for the following: male-headed households, large households and small farms. Other factors that increase efficiency are living close to extension centres, in the rural areas and in the south of the country. It is recommended that technology adoption be taken seriously so as to realize its full impact on output. Also, households must be

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encouraged to form farmer groups as an important source of farm labour and more extension services must be provided. Above all, the problem of lack of effective markets must be addressed through a more effective management of the ongoing liberalization Programme.