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COMPARISON OF THE PROFITABILITY OF GROUNDNUT PRODUCTION IN WEST MAMPRUSI AND BUNKPURUGU-YUYOO DISTRICTS IN NORTHERN GHANA

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Abstract
The study compared the profitability of groundnut production between Bunkpurugu-Yunyoo and West-Mamprusi districts in Northern Ghana. A Cobb -Douglas production function and gross income analysis were used in the analysis to determine the effect of "VAPAP" project on the profits of farmers in the two districts. It revealed that land size, capital, labour, experience and gender significantly influenced the output of groundnuts in the study area. The mean output per acre in Bunkpurugu-Yunyoo was 456.86kg of unshelled groundnuts whilst West-Mamprusi was 412.98kg with a mean difference of 43.89kg higher output in Bunkpurugu than West-Mamprusi at 1% significance level. A mean amount of Gh¢ 52.47 and Gh¢ 59.52 per acre were the cost of production in Bunkpurugu-Yunyoo and West-Mamprusi respectively. There was a mean difference of Gh¢7.0 higher cost of production per acre in West-Mamprusi than Bunkpurugu-Yunyoo at 1% significant level. A mean profit of Gh ¢ 77.25 and Gh¢ 42.50 were realized from Bunkpurugu-Yunyoo and West-Mamprusi respectively. The mean difference of the profit was Gh¢ 34.71 at 1% significance level.

Keywords: profitability, gross income, inventory credit, groundnut production.

1. Introduction
Groundnut (*Arachis hypogaea L.*) originated from Latin America and the Portuguese introduced it into Africa from Brazil in the 16th century (Gibbon and Pain, 1985; Abalu and Etuk, 1986). The word Arachis is derived from the Greek word 'arachos' meaning a weed and hypogaea meaning underground chamber (a weed with fruits produced below the soil surface). It is also known as peanut, earthnut, monkey nut, and goobers (Beghin *et al* 2003). Groundnut is produced in over 100 countries (both tropical and sub-tropical countries). China is the world's largest groundnut producer, with 40 percent of world's production, followed by India (23 percent), a group of Sub-Saharan African (SSA) countries (8.4 percent) and the United States (5.6 percent). It is the 13th most important food crop in the world, and contributes 20-50% vegetable protein, 40-50% fat and 10-20% carbohydrates (Vijaya *et al* 1997, Waliyar, 2006). Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons and an average yield of 1520 kg/ha in 2009. It was reported that between 2000 and 2009, the annual global production increased marginally by 0.4%, the area by 0.3% and yield by 0.1% (FAOSTAT 2011).

Ghana is among the least world producers of groundnut. In 2012 for instance, Ghanaian farmers produced 73,871.70 tons of groundnuts from 84,910 ha with an average yield of 0.87tons per ha even though 2.5tons per ha was achievable under rainfed condition (MoFA, 2012). ICRISAT (2001) states that groundnut yield in Africa has generally been poor due to a combination of factors, including unreliable rains, little technology available to small scale farmers, poor seed varieties, and increased cultivation on marginal land. Groundnuts are an important crop throughout Sub-Saharan Africa which comprises 40% of the world's groundnut harvested area, but only contributes 26% of the world's groundnut production (ICRISAT 2012).

Groundnut is grown throughout Ghana, but it is mostly produced in the north where about 92% of the national production comes from in Ghana (Wumbei *et al*, 2000). The majority of groundnuts production is made by small-scale farmers with less than two hectares of arable land (MOFA, 1997). Groundnuts production is continued as a strategic crop given the positive effect that growth of this sector generates in terms of poverty reduction in the northern region of Ghana. It also provide a valuable source of protein, fats, energy, and minerals, and generate cash income to many poor farmers in the developing world, especially in SSA and Asia (Diop, Beghin and Sewadeh, 2004). According to Awuah (2000), the national per capita groundnut consumption was estimated at 0.61kg per week and 80% of Ghanaians consume groundnuts or its products at least once a week.

Following the pivotal role groundnut production plays in the life of Ghanaians particularly in the northern sector of the country, a project called Value Added Pro-Poor Agribusiness Project (VAPAP) began in 2005 in Bunkpurugu-Yunyoo and West-Mamprusi Districts in the Navrongo-Bolgatanga Catholic Diocese (NABOCAD). It was a project that the Bishop of the Diocese initiated to help groundnuts farmers increase income and ultimately reduce poverty for rural-based farmers in the Diocese. Those two districts were chosen because they had the potential to produce groundnuts in large quantities to earn cash income and reduce poverty

Unfortunately, farmers in those two Districts produce groundnuts as a way of life instead as a business. The Bishop then initiated VAPAP funded by Catholic Relief Services (CRS) in Tamale to help change this mind-set of the farmers towards taking groundnuts farming as a business. With VAPAP, farmers were supported to produce groundnuts in large quantities for storage and to sell in the lean season under a collective marketing strategy.The implementing partner for West-Mamprusi District was the Farmer Training Centre (F.T.C) and Bunkpurugu-Yunyoo District was the Bimoba

Literacy Farmers' Cooperative Union (BILFACU). This study compared the profitability of groundnut farming in West Mamprusi and Bunkpurugu-Yunyoo Districts.

2. Materials and Methods

2.1 The study area

The focus of the research was the Bunkpurugu – Yunyoo and the West – Mamprusi Districts (**Figure 1 below**) located in the Northern Region but are under the Navrongo-Bolgatanga Catholic Diocese base on the Ghana Catholic Diocesan demarcation. The Bunkpurugu-Yunyoo District was carved out of the East-Mamprusi District in 2004 as part of the government decentralization process. Bunkpurugu-Yunyoo District is bounded by Garu-Tempane to the north, the republic of Togo to the east and the East –Mamprusi District to the west. Also, West-Mamprusi District is bounded by Talensi-Namdam and Builsa Districts to the north, West-Gonja to the west and Gushigu-Karaga and East-Mamprusi to the east.

The vegetation of the two Districts is that of the guinea savannah with pockets of small forest reserves. The major economic trees are dawadawa, cashew, mangoes, and shea trees which were either planted or established naturally. The climate is generally dry with two seasons; that is the dry and wet seasons. The rainfall lasts for an average of four months with peak in the months of August/September. The soil in the Districts is generally loamy with few areas of clay soils especially at the valley areas. There are several water bodies that "criss-cross" the area, notably the White and Black Volta at the west part of the West-Mamprusi District which makes that part quite inaccessible especially in the rainy season. As agrarian districts, a great percentage of its populace engaged in farming as an occupation. Farmers cultivate staples such as maize, rice, guinea corn, and millet. Crops like cotton, groundnuts, cowpea, and soybean can however, be grown extensively for cash. The farmers do keep livestock such as cattle, goats, sheep, and local poultry as well as donkeys and bullocks for traction. Specifically the research targets groundnut farmers who benefited from VAPAP in the two Districts. VAPAP operated in five communities in Bunkpurugu -Yunyoo and two communities in West – Mamprusi Districts.

The study was conducted in Bunkpurugu-Yunyoo and West Mamprusi Districts of the Northern Region of Ghana. It is located roughly within longitude O^{o}35'W and 1^{o}45'W and latitude 9^{o}55'N and 10^{o}35'N.The District is characterized by a single rainy season, which starts in late April with little rainfall, rising to its peak in July/August and declining sharply and coming to a complete halt in October/ November. Mean annual rainfall ranges between 950mm – 1200mm. Agriculture is the main activity of the people in the Districts absorbing over 80% of the economically active population. The District is rural, with more than 75% of the population in rural settlements. Population estimates in percentages in 2010 put males at 49.4% and that of females at 50.6% in West Mamprusi and 49.1% male and 50.9% females in Bunkpurugu-Yunyoo districts in northern region of Ghana with an annual regional growth rate of 2.9%.

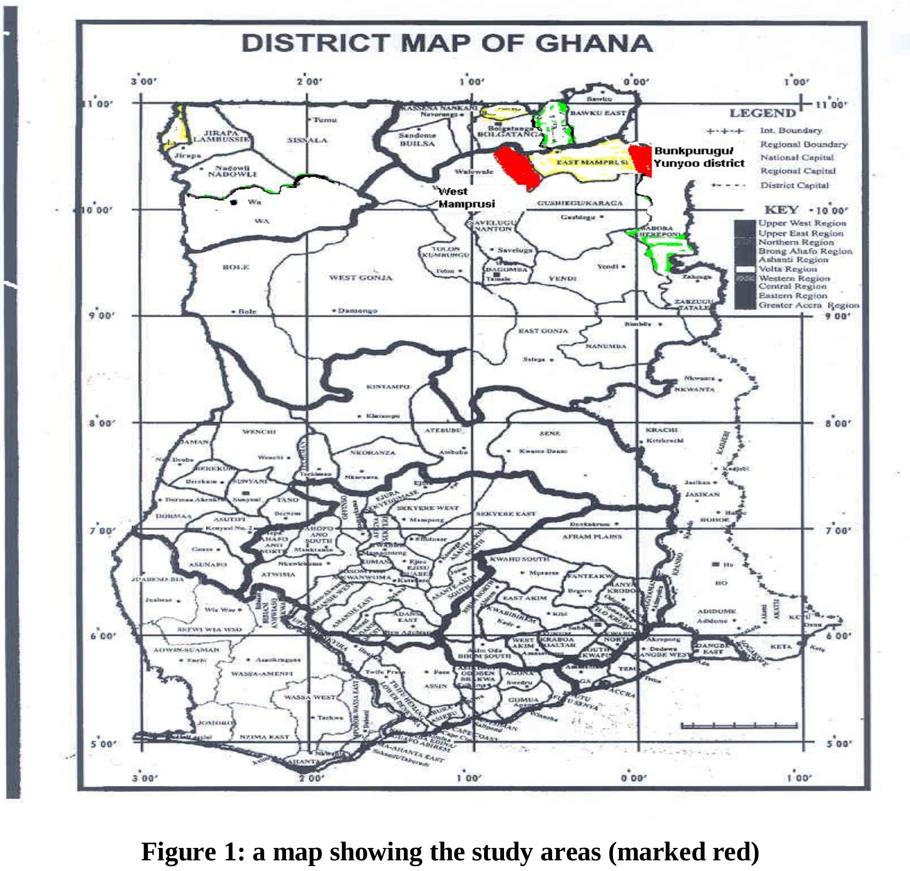

Figure 1: a map showing the study areas (marked red)

2.2 Sources of Data and Sampling

Data source: The data was mainly from primary source. Two sets of questionnaires were used for the survey. One set of questionnaire was answered by the implementing partners (NABOCADO, CRS, BILFACU and FTC) and the other set by the farmers. Data collected from farmers covered 2007/2008 cropping season. The questionnaires were pre-tested in West-Mamprusi before they were administered in the two Districts. Focus group discussions were also conducted.

Out of a total number of 680 beneficiary farmers in West-Mamprusi and 700 Bunkpurugu-Yunyoo, purposive sampling method was used to identify two communities in West-Mamprusi and five communities in Bunkpurugu-Yunyoo Districts. Similarly, a purposive sampling method was again employed to sample two farmer groups in two communities in West-Mamprusi and five farmer groups in five communities in Bunkpurugu-Yunyoo. Within the two farmer groups in West Mamprusi and the five farmer groups in Bunkpurugu-Yunyoo, a simple random sampling method was then applied to sample 50 farmers from each of the two Districts making a total of 100 (sample size) was used for the study.

2.3 Method of Data Analysis

A production function analysis was carried out to explore the contribution and productivity of individual inputs. Cobb-Douglas production model was used because of the best fit of the sample data. The functional form of the Cobb-Douglas multiple regression equation was as follows:

$X = AL_i^{\alpha} K_i^{\beta} e$ $(A > 0, \alpha, \beta < 1)$ (Maddala 1983) (2.1)

However, in order to take care of heteroskedasitity problems, the Cobb-Douglas production function can sometimes be written in a double- logarithm form like:

$$\log X = A + \alpha_1 \log_e L + \alpha_2 \log_e K + e \quad (2.2)$$

Where X is the quantity of the total yield of groundnuts a farmer obtains from the farm land (acres), K is the amount of capital while L is the labour (man days).
A method proposed by Barnard and Nix (1994) was applied to determine farm profit in each of the two districts under study.

Empirical Model: The factors which affect the production of groundnuts include; land, labour, capital, gender, extension education, years of experience in farming groundnuts, amount of input credit received from VAPAP.
Hence the model is defined as:

$$GOUTP = \alpha_0 + \alpha_1 \log_e Ldsize + \alpha_2 \log_e Cap + \alpha_3 \log_e Mdays + \alpha_4 \log_e Tedu + \alpha_5 \log Exp + \alpha_6 \log Gder + \varepsilon$$

(2.3)

Where the α 's are the coefficients of regression and the ε ' is the error term for the equation. The coefficients are the input elasticities of the production.
The a-priori expectations of the effect of all the variables are positive, that is

$$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 > 0$$

Where
GOUTP = total output (in kg.) of unshelled groundnut produced by the farmer
Ldsize = land size in acres that the farmer put to groundnut cultivation
Cap = the absolute amount of capital in Ghana cedi (which includes both input credit and equity capital for farmers in Bunkpurugu and only equity capital for farmers in Walewale) that the farmer spent on the farm
Mdays = the total man days (both hired and opportunity cost of family labour) the famer used for the production
Tedu = the number of extension education visit a farmer received from VAPAP in a year
Exp = the absolute number of years the farmer has been cultivating groundnuts
Gder = the sex of the farmer (used as a dummy which is 1 if man and 0 if woman)

2.4 Statement of hypothesis

N_O = There are no differences in profit between West Mamprusi and Bunkpurugu Yunyoo Districts

N_1 =There are differences in profit between West Mamprusi and Bunkpurugu Yunyoo Districts

Thus, the effect of factors that contribute to output of groundnuts is deduced from equations (2.3) as follows:
The elasticity of $Goutp$ (total groundnut output) with respect to $Ldsize$ (land size) is

$$\frac{\partial Goutp_i}{\partial Ldsize_i} \bullet \frac{Ldsize_i}{Goutp_i} = \alpha_i \; \frac{\partial \log Goutp_i}{\partial \log Ldsize_i} \bullet \frac{\partial \log Ldsize_i}{\partial \log Goutp_i} = \alpha_i \quad (2.4)$$

Thus, the elasticity of $Goutp$ with respect to $Ldsize_1$ is the constant α_1 which is also the regression coefficient of $Ldsize_1$. Similar results were derived for Cap_1 (capital) as well as the other variables.

Farm Income Estimation

A) Gross income (GI) estimation

$$GI_i = \sum Q_i P_i \quad (2.5)$$

$$GI_{ii} = \sum Q_{ii} P_{ii} \quad (2.6)$$

$$GI_{\theta} = \sum GI_i + GI_{ii} \quad (2.7)$$

Where GI_{θ} = grand total income (sale of groundnuts)

GI_i = Gross Income from groundnuts consumed and sold by farmer without ICP

GI_{ii} = Gross Income from groundnuts sold through the ICP marketing arrangement introduced by VAPAP

P_i = average selling price per kg of groundnuts consumed and sold by farmer without ICP (normally immediately after harvest)

P_{ii} = average selling price per kg of unshelled groundnut through the ICP collective marketing strategy (at lean season).

Estimation of cost of production (CofP)

The major costs associated with groundnuts production are

1. Costs of input ie. Equity capital spent and or input credit obtained from VAPAP for seeds and land ploughing services
2. Costs for on-farm activities ie. Sowing, weeding, harvesting, drying, sorting, and bagging
3. Cost for off-farm activities ie. Cost for storage through ICP and transportation to marketing area. The cost of storage of groundnuts by the farmer was, however, not valued in the analysis since it was free.

$$CofP_{input(wa)} = \sum(eqcap_{seed} + eqcap_{tillage} + credit_{seed} + credit_{tillage}) \quad (2.8)$$

$$CofP_{onfarm(wa)} = \sum(CS_i + CW_i + CH_i + CD_i + CST_i + CB_i) \quad (2.9)$$

$$CofP_{onfarm(wa)} = \sum(CTOR_i + CTR_i) \quad (2.10)$$

$$TCofP_{wa} = \sum(CofP_{input} + CofP_{offarm} + CofP_{offarm}) \quad (2.11)$$

Similarly, total cost of production is computed for Bunkpurugu-Yunyoo District (with the subscript wa (West-Mamprusi) replaced by bu (Bunkpurugu-yunyoo) where:

$CofP_{input(wa)}$ = value of input used

$eqcap_{iseed}$ = value of equity capital spent on seed

$credit_{iseed}$ = value of input credit obtained from VAPAP for seed

$credit_{itillage}$ = value of input credit obtained from VAPAP for land ploughing

$CofP_{onfarmi}$ = value of cost of on-farm activities

CS_i = cost for sowing

CW_i = cost for weeding

CH_i = cost for harvesting

CD_i = cost for drying

CST_i = cost for sorting

CB_i = cost for bagging

$CofP_{offarm}$ = value for cost of off-farm activities

$CTOR_i$ = value for the cost of storage under ICP

CTR_i = value for the cost of transportation to marketing area

It must be noted that the input credit for seed and ploughing was not received by farmers in West Mamprusi because their facility was not available at the time of sowing.

B) *Estimation of profit (P)*

$$P_i = GI_\theta - TCofP \quad (2.13)$$

From equation (3.11), total cost of production was determined considering the value of input cost (for both seed and ploughing).(2.8), the value of on- farm labour cost (both hired and opportunity cost of family labour) use for farm work (2.9), and cost of storage and transportation (off-farm operations) (2.10). Again, from equation (2.7) the gross income was obtained by adding the incomes that would otherwise have been obtained from groundnuts sold and consumed by farm family (2.5) as well as the income from produce sold through ICP (2.6). The profit was obtained by subtracting total cost of production from grand total income (2.13).

Estimation of the means

The mean output per acre = $\frac{\Sigma Q_i}{N}$ (2.14)

The mean income per acre $\frac{\Sigma GI_i}{N}$ (2.15)

Cost of production per acre = $\frac{\Sigma TCofP_i}{N}$ (2.16)

The mean profit per acre = $\frac{\Sigma P_i}{N}$ (2.17)

N= the number of acres put to groundnuts cultivation by a farmer.

Paired samples T-test
A paired sample T-test ($P < 0.05$) was used to determine the differences between the mean income per acre, cost per acre and profit per acre in the two Districts for the 2007 season groundnut production. The statistic follows the t-distribution and its value was calculated from the following formula:

$$t = \frac{\tilde{d}}{s_d / \sqrt{n}} \quad (2.18)$$

There are n-1 degrees of freedom and $\tilde{d}$ is the mean of the difference between the paired or related observations.

s_d is the standard deviation of the differences between the paired or related observations which was calculated with the formula:

$$s_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}\delta y}{n-1}} \quad (2.19)$$

n is the number of paired observations.

In testing for difference between the means of output per acre, production cost per acre and profit per acre from both Districts, the following hypothesis was formulated.
Ho: $\mu_1 = \mu_2$ (means output per acre, production cost per acre and profit per acre among farmers in the two Districts do not differ significantly)
H1:$\mu_1 \neq \mu_2$ (means output per acre, production cost per acre and profit per acre differ significantly between both Districts) Where H_0 is the null hypothesis and H_1 is the alternative hypothesis.

3. Results and Discussion

3.1Yields of Groundnut

Table 1 shows the yield of groundnuts in the study area. A total of 47,043kg from 114.5 acres and 71,067kg from 160 acres were obtained from West-Mamprusi and Bunkpurugu-Yunyoo Districts respectively. Each farmer cultivated an average land size of 2.9 acres and harvested averagely 412.98kg groundnuts per acre in West-Mamprusi District whilst a farmer cultivated averagely 3.2 acres and obtained averagely 456.86kg of groundnuts per acre in Bunkpurugu-Yunyoo District. A total of 940.86 and 1421.34kg of unshelled groundnuts were realized per farmer in West-Mamprusi and Bunkpurugu-Yunyoo respectively. As shown in table 1, there was a marginal increase in yield per farmer obtained in Bunkpurugu-Yunyoo as compared to their West-Mamprusi counterpart perhaps due to the input credit in the form of seed and ploughing services the farmers received from VAPAP in Bunkpurugu-Yunyoo. The credit given to the farmers in Bunkpurugu-Yunyoo perhaps made them to expand farms since machinery like bullocks and tractor services help remove the drudgery associated with large land size cultivation.

Table 1 Summary of Yields from groundnut production

	West-Mamprusi District	Bunkpururgu-Yunyoo District
Total land (acre)	114.5	160.0
Total yield (kg)	47,043	71,067
Land per farmer (acre)	2.29	3.2
Output per farmer (kg)	940.86	1421.34
Yield per acre (kg)	412.98	456.86
Bags per acre	9.13	9.87

Source: Field survey, 2008 NB: Weight per bag is 45kg of unshelled groundnut

3.2 Factors Affecting Productivity of Groundnut

Table 2, presents results of a double- logarithm model employed to estimate the effect of factors that influence output of groundnuts of farmers in the study area. The R-squared and the adjusted R- squared of 0.91 and 0.90 respectively implies that 90% of the dependent variable (total groundnut output) is explained by the independent variables. Additionally, the F-statistic at a 1% significant level implies that the explanatory variables included in the model indeed jointly influence total output of groundnuts. The coefficients all have the expected theoretical signs and six out of the seven variables were highly significant. Using the sample of 100 farmers (ie both West-Mamprusi and Bunkpurugu-Yunyoo output combined), the direct production elasticities were estimated. The estimates (table 2) show that the elasticity of groundnuts output is highest with respect to labour (0.48), followed by land (0.45), experience (0.29) capital (0.18), gender (0.11) and extension education (0.011). An increase of labour use by 10% will increase groundnut output by 4.8%.

Similarly, a 10% increase in land, years in groundnuts cultivation (experience), capital, gender and extension education is expected to lead to 4.5%, 2.9%, 1.8%, 1.1%, and 0.11% increases in groundnuts output

The highly inelastic response to land and capital may reflect the presence of other technological, infrastructural and weather constraints that limit groundnuts productivity. The 2007 season flood in the north was a typical example of how the weather could be a constraint to output in the study area. From the results, it showed that labour is the most limiting factor in groundnut production, suggesting that technologies that enhance the productivity of labour are likely to achieve significant effect on groundnuts production in the study area.

Similarly, results in regression estimate for each of the Districts with R-squared of 0.97 indicates that 97% of the independent variables explained the groundnut output in West-Mamprusi District. The overall significance (F-statistic) of 1% explains the fitness of the model. For the groundnuts farmers in West-Mamprusi, land and extension education, all had the required theoretical signs and have positively and significantly influenced groundnuts output at 1% level. Additionally, farmer years in cultivation (experience) and gender also had positive theoretical signs and were significant at 5% level. The other variables such as labour, and capital even though had positive theoretical signs, they were not significant. The estimates showed that the elasticity of groundnuts output is highest with respect to land (0.8), followed by extension expenditure (0.13), education (0.12), gender (0.7). An increase of land cultivated by 10% will increase groundnut output by 8%. Similarly, a 10% increase in farmer years in groundnuts cultivation (experience), extension education, gender is expected to lead to 1.3%, 1.2%, 7.0%, increases in groundnuts output

For groundnut farmers in Bunkpurugu-Yunyoo, land, extension education, all conform to theory and have positively and significantly increased groundnut output at 1% significance level consistent with Weir (1999) and Seidu, (2008). Similarly, farmers years in groundnuts cultivation (experience), and gender positively influence groundnuts output at 5% significant level while labour (man days) positively influence groundnuts output at 10% significant level. The 0.97 R-squared obtained showed that 97% of the independent variables explain the groundnuts output. The overall significance (F-statistic) of the model is at 1% level. The estimates showed elasticity of groundnuts output in Bunkpurugu-yunyoo is highest with respect to land (0.8), followed by experience (0.13), extension education (0.13), capital (0.12), labour (0.12), and gender (0.07). An increase of land cultivated by 10% will increase groundnut output by 8%. Similarly, a 10% increase in farmer years in groundnuts cultivation (experience), extension education, capital, labour, and gender is expected to lead to 1.3%, 1.3%, 1.2%, 1.2%, and 0.7% increases in groundnuts output.

Table 2 Summary of pooled data results of relative productivity effects of production factors used by groundnuts farmers under VAPAP

Variable	Coefficient Both Districts (Goutp)	Coefficient West-Mamprusi (Goutp)	Coefficient Bunkpurugu-Yunyoo (Goutp)
Constant	3.519347 (0.496369)	4. 0.327460 (810502)	4.776064 (0.323510)
Land Size	0.445790*** (0.113483)	0.808371*** (0.067073)	0.801286*** (0.066966)
Capital	0.175817*** (0.069740)	0.116414 (0.077852)	0.123319* (0.074176)
Labour	0.479399*** (0.123478)	0.122625 (0.074023)	0.124350* (0.073222)
Extension Education	0.011316 (0.045494)	0.125969*** (0.034678)	0.127050*** (0.034062)
Years in Groundnuts Cultivation	0.286990*** (0.066795)	0.133304** (0.060074)	0.134573** (0.059366)
Gender	0.110460*** (0.027640)	0.070747** (0.031368)	0.067754** (0.031340)
N (Sample Size)	100	50	50
R-Squared	0.914597	0.977441	0.977707
Adjusted R-Squared	0.908099	0.973681	0.973992
F-Statistic)	140.7490***	259.9684***	263.1430***

(***) significant at 1% (**) significant at 5% (*) significant at 10% .Values in parentheses are standard errors.

Following Samuelson, and Nordhaus, (1992), recall from equation 2.4 that:

$$\frac{\partial \log(output)}{\partial \log(input)} = \frac{\partial \log(GoutP)}{\partial \log(ldsize)} \bullet \frac{\partial \log(ldsize)}{\partial \log(GoutP)}$$
$$+ \frac{\partial \log(GoutP)}{\partial \log(cap)} \bullet \frac{\partial \log(cap)}{\partial \log(GoutP)}$$
$$+ \frac{\partial \log(GoutP)}{\partial \log(mdays)} \bullet \frac{\partial \log(mdays)}{\partial \log(GoutP)}$$
$$+ \frac{\partial \log(GoutP)}{\partial \log(tedu)} \bullet \frac{\partial \log(tedu)}{\partial \log(GoutP)}$$
$$+ \frac{\partial \log(GoutP)}{\partial (\exp)} \bullet \frac{\partial (\exp)}{\partial \log(GoutP)}$$
$$+ \frac{\partial \log(GoutP)}{\partial (gender)} \bullet \frac{\partial (gender)}{\partial \log(GoutP)}$$

From table 2, we compute the elasticities as:

$$\frac{\partial \log(GoutP)}{\partial \log(ldsize)} = 0.45$$

$$\frac{\partial \log(GoutP)}{\partial \log(cap)} = 0.18$$

$$\frac{\partial \log(GoutP)}{\partial \log(mdays)} = 0.48$$

$$\frac{\partial \log(GoutP)}{\partial \log(tedu)} = 0.011$$

$$\frac{\partial \log(GoutP)}{\partial (\exp)} = 0.29$$

$$\frac{\partial \log(GoutP)}{\partial (gender)} = 0.11$$

Therefore, the effect of factors on total groundnuts output (GoutP) is obtained as:

$$\frac{\partial \log(output)}{\partial \log(input)} = 0.45 + 0.18 + 0.48 + 0.011 + 0.29 + 0.11$$

$$= 1.521$$

Thus, in the study area, a 10% change in the socio-economic factors affecting groundnut production increases total groundnut output by 15.21%. That is, it is an increasing return to scale.

3.3 Comparison of Mean Output

Table 3 presents the paired t-test (sig.2-tailed) results of the output per acre, cost of production per acre, total output stored under ICP per farmer and profit per acre for the two Districts. While the mean output per acre in Bunkpurugu-Yunyoo was 456.86kg of unshelled groundnuts, that for West-Mamprusi was 412.98kg which led to a mean difference of 43.89kg higher output obtained in Bunkpurugu than West-Mamprusi at a 1% significance level. A mean amount of Gh ¢ 52.47 and Gh ¢ 59.52 were the estimated cost of production per acre in Bunkpurugu-Yunyoo and West-Mamprusi respectively. This gave a mean difference of Gh ¢ 7.0 higher in cost of production per acre in West-Mamprusi than Bunkpurugu-Yunyoo with a 1% significant level as shown in table 3. A mean profit of Gh ¢ 77.25 and Gh ¢ 42.50 were realized from Bunkpurugu-Yunyoo and West-Mamprusi respectively. The mean difference of the profit was Gh ¢ 34.71 at 1% significance level. That is, farmers in Bunkpurugu received a mean profit of Gh ¢ 34.71 (36.7%) higher per acre than farmers in West-Mamprusi. This confirms the statement by Barnard and Nix (1994), that profit is affected by output and cost of production. The lower profit in West-Mamprusi was attributed partly to the higher cost of production incurred by farmers and the lower output obtained per acre. On the other hand, the good marketing strategies of farmers in Bunkpurugu-Yunyoo resulting from the higher quantities of groundnuts stored under ICP and the high output obtained per acre contributed to their higher profit. While farmers in Bunkpurugu had a mean of 149.28kg of groundnuts per farmer stored under ICP and sold at a high price, the farmers in West-Mamprusi had a mean of 63.2kg of groundnuts per farmer stored under ICP. The mean difference of the groundnut stored was quite substantial (86.0 kg) at 1% significance level and therefore led to the higher profits for the farmers in Bunkpurugu-Yunyoo.

Table 3 Summary of the Mean Income Comparisons in Both Districts

Mean comparisons	Mean	Mean diff	Std.dev.	Std. error mean	T	df	Sig (2-tailed)
Output/acre in kg (Bunkpurugu-Yunyoo)	456.86	43.89	114.56	16.20	2.7	49	0.009
Output/ha in kg (West-Mamprusi)	412.98						
Production cost/acre in Gh¢ ((Bunkpurugu-Yunyoo)	52.47	-7.0	18.69	2.64	2.67	49	0.010
Production cost/acre in Gh¢ (West-Mamprusi)	59.52						
Total output ICP per farmer in kg ((Bunkpurugu-Yunyoo)	149.28	86	98.1	13.87	6.2	49	0.000
Total output ICP per farmer in kg (West-Mamprusi)	63.2						
Profit/acre in Gh¢ ((Bunkpurugu-Yunyoo)	77.25	34.71	45.73	6.47	5.37	49	0.000
Profit/acre in Gh ¢ (West-Mamprusi)	42.5						

Source: Field survey, 2008

Conclusion

The study revealed that beneficiaries cultivated an average of 2.9 acre and 3.2 acre in West- Mamprusi and Bunkpurugu-Yunyoo respectively. Averagely, a farmer obtained 940.86 kg (20.9 bags) and 1421.34 kg (31.6 bags) of unshelled groundnuts of 45kg per bag. The output/ha were estimated to be 412.98 kg (9.13 bags) and 456.86 kg (9.87 bags) in West- Mamprusi and Bunkpurugu-Yunyoo respectively. This lead to the realization of Gh ¢77.25 and Gh ¢ 42.50 profit per acre for farmers in Bunkpururgu-Yunyoo and West-Mamprusi Districts respectively. The farmers in Bunkpurugu-Yunyoo obtained Gh ¢ 34.71 representing about 36.7% higher profit per acre than farmers West- Mamprusi.

Land size, capital, labour, experience and gender are the factors that positively and significantly influenced groundnuts output when output from both Districts was taken as the dependent variable. Extension education was positive even though not statistically significantly. On other hand, land size, extension education, experience, and gender positively and significantly influence groundnuts output when individual Districts outputs was used as the dependent variable. Labour and capital were not positive but not significantly affect output.

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