Food Crop Production Function and Farmers Agricultural Training in Cameroon

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Abstract

This study attempt to analyze the effects of farmers Agricultural Training on Food Crop Production in Cameroon; the contribution of professional, workshop and on the field training is important in explaining agricultural production. The objectives of this study are: examine the impact of agricultural training on food crop production; determine the factors influencing agricultural training, decompose the effect of farmer's agricultural training on food crop production by type of agricultural training (professional training, workshop and on the farm training) in Cameroon and to recommend relevant economic policies on the basis of our analysis. Using data from the 2007 MINADER and data from 2007 Household Consumption Survey, we used the control function model to estimate our result from STATA 13.0. We observed that the 2SLS, Control Function without interaction and Control Function with interaction results revealed that household agricultural training strongly correlates with food crop production. Also professional, workshop and on the farm training strongly affects agricultural production. There are considerable opportunities to take advantage of agricultural training in terms of increase cereal productivity. The decision makers, civil society organizations and stake holders operating in agriculture should multiply agricultural training in both former and informer training, through the creation of agricultural schools, workshop/seminars and on the field training.

Keywords: *Farmers, Agricultural Training, Food Crop Production, Cameroon*

1.0 Introduction

The place of agricultural training in determining agricultural production in Cameroon is indisputable in this era of population growth. Training in agriculture can take many forms such as: professional training, seminar and workshop training as well as on the farm training, depending upon the type of training farmers received will determine the way they manage their agricultural farms and hence the quantity of produce a farmer will received. Agricultural training goes beyond the use of farm tools such as hoes, cutlass, diggers, wheel-barrows and or tractors, to cultivate farms or raise animals for local consumption or commercial purposes. Training nowadays includes the transformation of agricultural products into many other forms, to create variety, make more money and feed the masses of the fast growing world population. Cereal crops such as maize, rice, sorghum are widely consumed by almost all households in Cameroon and most African countries, they are equally the most derivate products, for example maize can be derivate as well as consumed in many other forms, such as corn fufu, pap, corn beer, Koki, dried or roasted maize; it can also be consumed alongside many other foods such as beans, vegetables, etc. This means that agricultural training is an important element of food security and poverty alleviation in Cameroon.

We are attempting to investigate the contribution of different agricultural training, households have received and their effects on cereal crops production in Cameroon. Cereal crops (rice, maize) are most consume by almost all people across the world, they are equally most derivate products in the agricultural family in Cameroon, therefore the cereal crop capture in

our study is maize production. Maize is produce in large quantities in all the ten regions of Cameroon, maize is among the six most widely grown crops in the world and the most affordable in terms of market price and cost of seeds and widely grown crop in Africa and Cameroon (Epule and Bryant, 2015), this justify why we prefer to use maize as our cereal of concern. In this perspective, Enoh-Tanjong (2008) unveiled that (IRAD) activities and research on food crop production in Cameroon shows that Cameroon is dominated by small scale farmers' food crop producers. He noted that a majority of farming operations are carried out by using trading cropping systems and traditional crop varieties. In all these, knowledge on what to plant and where to plant for maximum productivity and cooperation by the community is very important, for instance to encourage Manyu people to plant groundnuts has potential for failure because the people rarely eats groundnuts, the same is true for the domestication of snails in Bamenda.

In order to increase incomes and improve livelihoods, the farmer needs to have a good mastery of the market situation and system of production, Noor and Dola (2011) revealed that education is a factor which has an impact on agricultural productivity while Närman (1991) complemented that farmers with some years of basic schooling are more likely to adopt and correctly apply agricultural innovations and also that training offered at various agricultural service institutions requires that applicants have an appropriate background in formal education to be efficient as training for farmers has been proven to yield variety of results. Considering the case of Bangladeshi small farmers, Murshed and Pemsl (2011) concluded that building the capacity of farmers through training is more valuable than the provision of financial support in terms of raising production and income. A study by Tripp and Hiroshimil (2005) confirms that training is important in the enhancement of farmers 'skills in agricultural works while studies on the effectiveness of training for farmers showed that only training programs carefully revised and designed to address particular farm needs can increase productivity in farms. They also reported that some success stories were related to using non-formal education and focusing on learning-discovery approach and filling in the gaps in farmer's knowledge misconceptions (Sligo and Massey, 2007).

Närman (1991) intimated that there is a strong relationship between post-secondary education and technological development, thus a skilled agricultural manpower is needed for research and for the extension of innovations and consequently agricultural production, meaning that the basic requirement for mass agricultural production is an efficient educational structure that includes both general schooling and more specialised vocational training. In addition, Närman (1991) noted that education is a factor which has an impact on agricultural productivity, firstly, if farmers with some years of basic schooling are more likely to adopt and correctly apply agricultural innovations and secondly, training offered at various agricultural service institutions require that applicants have an appropriate background in formal education to be efficient. Agricultural education produces both cognitive outputs of schooling (the transmission of specific information and formation of general skills and proficiencies) and non cognitive changes (attitudes, beliefs and habits). Following Appleton and Balihuta (1996) and Cotlear (1990), increase literacy and numeracy may help farmers to acquire and understand information and to calculate appropriate input quantities in to farms. It equally, leads to greater willingness to accept risk, adopt innovations, save for investment and generally to embrace productive practices. Further, Rosenzweig (1995) reveals that schooling enables farmers to learn on the job more efficiently.

Ashby et al (2009) noted that the demand for agricultural commodities is changing and new opportunities are challenging farmers, for instance increase demand for higher value products, introduction of advanced agricultural technology as well as new variety of seeds. Based on

this, Närman (1991) affirms the assumption that farmers without education may remain outside technical evolution in agriculture, meaning that if the entire farming community is to be concerned by a process of change, the extension personnel must pay special attention to non-educated farmers, while Lovell (1993) assume that education instead affect the efficiency of the farmer in transforming inputs into output but do not affect the process by which production occurs. In all these the conclusion is that agricultural training is a strong determinant of agricultural production and sustainability in the world at large.

Following MINADER (2013), agricultural training in Cameroon may either take the form of professional training, workshop or seminar, on the farm training and or no training. From table one below; we observed that in Cameroon, 77.9 percent of agricultural households had no training meaning that until date agricultural training is still an issue to be discovered and understand in Cameroon. The table reveals that considering the national territory, only 1.6 percent of farmers received professional training; 8.7 percent had workshop/seminar training while 11.8 percent of household farmers received on the farm training. The reasons for low agricultural training can be many:

- Culturally, most rural dwellers in Cameroon belief that one doesn't need to be trained in other to do agriculture, with this idea in mind, it becomes difficult to acquire training as a farmer.
- Lack of knowledge and ignorance has caused many agricultural workers to be indifferent so far as agricultural training is concern.
- Government intervention and policy, the government has not yet taken it as a priority to emphasis on the training of agricultural workers. It's a profession that require just manpower; it's difficult to find people sacrificing to learn except government impose on them.
- Aid from support institutions like international bodies (FAO, WFP, World Bank) to Cameroon agriculture is oriented towards cash and kind (agricultural tools, i.e. hoes, machetes…,).
- Elites from local communities have also failed to explain the necessity of this exercise to their local environment.
- Many farmers are still resistant to the adoption of new technology or practices in their methods. This resistant has hindered agricultural training and education. The different types of training available in the agricultural sector in Cameroon is shown in table below:

Table 1: Percentage Distribution of Household according to agricultural training in 2011

Region	Type of Agricultural Training				
	Professional School	Workshop/ Seminar	On the farm training	No Training	Total
Adamawa	1,0	6,5	4,3	88,3	100
Centre	3,3	18,3	22,4	56,0	100
East	0,8	12	11,1	76,0	100
Far North	0,8	4,2	1,7	93,3	100
Littoral	2,1	14,3	28,9	54,8	100
North	1,5	1,8	26,7	70,0	100
North West	3,4	16,3	4,8	75,6	100
West	1,2	7,7	24,6	66,4	100
South	3,7	8	14,8	73,4	100
South West	1,9	24,3	11,3	62,5	100
Total	**1,6**	**8,7**	**11,8**	**77,9**	**100**

Source: MINADER (2013)

Agricultural training is therefore important in poverty alleviation, food security and consequently economic growth however, in Cameroon emphasis in increasing agricultural productivity by 2035 is more on improved seeds, increasing the quantity of seeds planted, increase in arable land and increase in farm use equipments as well as creation of available markets for the sales of agricultural products. The government has not yet consider agricultural training to be a priority and there are practically countable number of institutions and faculty conducting training in agriculture. Most NGOs in this domain have caught the spirit of training, yet they are so few and mostly located in the urban centres meaning the great number of farmers in the rural community do not benefit in the training.

In terms of gap in literature, we have not come across any study that has attempted to quantify the effect of training on agriculture in Cameroon. Enoh-Tanjong (2008) demonstrated in an analytical way the role of higher education on sustainable growth, however, this study failed in using actual data to demonstrate this empirically. Out of Cameroon, many studies have approach this study (Närman, 1991; Lovell, 1993; Noor and Dola, 2011) with controversy in result. Most of these studies failed to handle the endogeneity problem that may arise as a result of simultaneously determining factors of education and farm productivity or performance and so most of the results are understated. The previous studies also failed in estimating the type of training farmers actually received before determining their global effects. This study attempts to not only handle the problem of endogeneity but we shall also estimate the impact of the type of training on agricultural production in Cameroon.

The principal objective of this study is to explore the effects of farmer's participation in agricultural training and the type of agricultural training on food Crop Production in Cameroon, specifically;

- Examine the impact of agricultural training on cereal crop production in Cameroon;
- Determine the factors influencing agricultural training,
- Decompose the effect of farmer's participation in agricultural training on cereal crop production by type of agricultural training (professional training, workshop/seminar, on the farm training and/or no training) in Cameroon
- To recommend relevant economic policies on the basis of the result of this study.

2.0 Related Literature

The approached of authors to the idea of agricultural training and farmers productivity has yield different result depending on the level (primary, secondary or tertiary training), type (professional, seminar, on the farm training) and place of the training. It's was based on the controversy of results in training-agricultural relationship that Weir (1999) challenges the hypothesis that demand for schooling in rural Ethiopia is constrained by the traditional nature of farm technology and lack of visible benefits of schooling in terms of farmer productivity. To clarify this, Noor and Dola (2011) summarized the impact of training on farmers into six major benefits according to priority: (a) increased in work quality, (b) increased in farm products, (c) cost savings, (d) time savings, (e) increased in income and finally (f) increase in networking. They concluded that training provided to the farmers has not only helped them improved their individual capabilities, boost their morale, but it also acts as a motivation that contribute to their positive performance level.

Appleton and Balihuta (2010) analysis confirms that the impact of education on agricultural productivity in Africa is mixed, analysing the national household survey data of Uganda, principally shows that no relationship exist between them, decomposing the result by level of

education, shows that household primary schooling has impacted crop production comparable to the developing country average. Not-with-standing, they concluded that the usual Cobb-Douglas production function that includes other inputs understates the importance of education in explaining output. Mirotchie (1994) investigates technical efficiency in cereal crop production in Ethiopia using aggregate data for the period 1980/1986 and reported that primary schooling tends to increase productivity, while secondary schooling has no effect. Weir (1999) has examined the effects of schooling upon farmer productivity and efficiency by employing average production functions and two-stage stochastic frontier production functions in 14 cereal producing villages. The result revealed substantial internal private benefits of schooling for farmer productivity, particularly in terms of efficiency gains. Weir (1999) identified a threshold effect in which at least four years of primary schooling are required to have a significant effect upon farm productivity. He uncovered strong social benefits of schooling on agricultural productivity, suggesting that there may be considerable opportunities to take advantage of external benefits of schooling in terms of increased farm productivity if school enrolments in rural areas are increased.

Croppenstedt and Muller (1998) examine the effects of various forms of human capital upon agricultural productivity using data from the first round of the Ethiopia Rural Household Survey and found no relationship between their measure of education and agricultural output. In another study, Croppenstedt et (1998), using data from a 1994 USAID fertiliser marketing survey, found that literate farmers are more likely to adopt better use of fertiliser than those who are illiterate. Still in another study, Croppenstedt and Demeke (1997) estimated efficiency using a mixed fixed-random coefficients regression model and found that literacy has a positive effect upon productivity and that education is weakly correlated with farm efficiency. While Hussain and Byerlee (1995) clarified that agricultural training increase farm productivity in two ways: (1) general skills acquired in school reduce technical and allocative inefficiencies in production; and (2) attitudes acquired in school encourage the adoption of new technologies which cause the production frontier to shift outward.

Psacharopoulos and Woodhall (1985) adapted four stages of agricultural technology adoption vis-à-vis the role of education as originally formulated by Heyneman (1983). According to them, stage one is the traditional farming, where information is passed from father to son, and where little or no schooling is needed. Stage 2 is considered to be a single input adoption, where basic literacy and numeracy are very useful to farmers for understanding instructions and adjusting quantities of the new input. Stage 3 is the adoption of multiple inputs simultaneously, in this case more than literacy and numeracy are necessary, where basic science knowledge is helpful and lastly, stage 4 is irrigation based farming. In this stage the farmer is required to make complex calculations of effects of changes in crops and weather. This stage needs more education for efficient production, education also help to determine whether a farmer decides to be an early adopter of innovations and the extent to which the new innovation will be used. From this formulation Psacharopoulos and Woodhall (1985) accounted that there are at least three reasons agricultural stages: (1) those with schooling tend to be more affluent and are in less danger of starvation if a prospective innovation is unsuccessful; (2) educated farmers may be more likely to be contacted by agricultural extension workers looking for model farmers to test innovations and (c) literate farmers are better able to acquire information about potential innovations and to make rational evaluations of the risks involved in trying new inputs, crops or methods.

In view of investigating the impact of training on Malaysian livestock farmers' capabilities and performance level in farm practice, Noor and Dola (2011) uses a total of 323 farmers and with trained personnel participating as respondents, and observed that a positive trend

emerged, indicating the effectiveness of training programs although with range of variations of benefits gained by the farmers. In their study, a majority of the respondents agreed that the program have been useful and had made them become better farmers. With life evidences from Ethiopia, Weir (1999) underscored that education has enhance farm productivity directly by improving the quality of labour, by increasing the ability to adjust to disequilibria and through its effect upon the propensity to successfully adopt innovations. Hence, in his analysis, education is thought to be most important to farm production in a rapidly changing technological or economic environment (Shultz, 1975). Another evidenced from Bangladeshi small farmers as revealed by Murshed-E-Jahan and Pemsl (2011) concluded that building the capacity of farmers through training is more valuable than the provision of financial support in terms of raising production and income.

Following the inconsistency in the result of the above literature, we observed that the central effect of agricultural training on farm performance is positive. The issue is just a matter of approach, the quality of training, the talent and skill of the people trained; the resources use to train them and the type and quality of the trainers. Meaning the effect of agricultural training on agricultural productivity is a matter of empirical investigation.

3.0 Theoretical Framework

We shall make use of the household production model of time allocation as latter revisited by Gronau (1977); this theory is similar though different from that originally proposed by Becker (1965). In Gronau's model, we suppose that agricultural household produce and purchase goods are perfect substitutes. So a household consumes and obtain utility from two goods leisure (χ) and a good (λ_1) such as agricultural food crop, such as maize, which can be produced at home by households or λ_2 purchase in the market. Assuming that λ_1 and λ_2 are perfect substitutes, the household only value total λ rather than individual quantities of household produced and purchased λ. Where λ is given as: $\lambda = \lambda_1 + \lambda_2$ in which the agricultural household utility function is strictly concave, this can be represented as follows:

$$U = U(\chi, \lambda; \sigma) \quad \text{.....} \quad (1)$$

Where σ is a taste factor, affecting the conversation of χ and λ into utility; the demands for leisure, agricultural food purchases and non agricultural food purchases are shown to be determined by the opportunity cost of time or the price of leisure which is the wage rate (WR), the price of purchased food (F_P), the price of non agricultural food purchases (NF_P), error term (θ), income (V or F) and taste (σ). Taking into considering the optimal choice of χ and time constraint (T), we can obtain our general form of the household's agricultural production equation, where hours of work (h_2) or agricultural training is determined by a set of variables as those that determine; the demand for χ, F_P and NF_P. This can be presented as follows:

$$h_2 = T - \chi^* - H_1^* = S_{H_2}(WR, F_P, V, \sigma, \theta) = S_{H_2}(WR, F_P, F, \sigma, \theta) \quad \text{.....} \quad (2)$$

This model predicts that if increase in non income V makes the household acts optimally by keeping the quantity of household agricultural produced goods (λ_1) unchanged, but allocate the additional income to purchased unit of λ in the market (λ_2) and leisure (χ). However, a rise in NF_P reduces the real wage rate (WR / NF_P) and hence motivates an increase in the

amount of T allocated to λ_1. The net impact on χ, hours of work and total quantity of λ produced will be determined by resulting substitution and income effects.

4.0 Methodology of Study

Farmers professional training, seminar/workshop and on the farm training, known as agricultural training (AT) as revealed in the literature is associated with agricultural performance such as cereal crop production (CP) as noted earlier we are interested in maize, rice, beans and groundnuts production. The hypothetical mechanism linking agricultural training to cereal production may be express in the following production function:

$$CP_i = w_1 \pi_b + \sum_i v_i AT_i + \varepsilon_1 \quad \text{...} \quad (3)$$

$$AT_i = w_2 \pi_{ATi} + w_2 \Omega_{ATi} + \varepsilon_{2i} \quad \text{...} \quad (4)$$

This equation (3) is our principal equation presenting the causal relationship between agricultural training and cereal production. The estimation of the parameter v_i would show the effect of AT on cereal crop production. From this equation; w_1 represent a vector of exogenous covariates; as noted earlier v is the parameter of the potentially endogenous explanatory variable in the cereal production function, π_b is the vector of parameters to be estimated and ε_1 is the error term that captures both random effects and unobservable variables.

For the fact that (a) we are going to simultaneously determine the determinants of cereal crop production and agricultural training, there is a possibility that a bias will occur in our estimates, (b) considering that there can be omission in the data to be estimated, perhaps omitting a major determinant factor in our regression may also bias our results, (c) it may also be possible that our variable of interest interact positively with the error term. All these possibilities have the potential of engineering endogeneity problem, which is what principally most former studies have ignored.

To resolve this endogeneity bias, we shall apply the instrumental variable (IV) method as indicated in equation (2). This equation is the reduced form equation for agricultural training, thus, based on equation (1) and (2) we can estimated for the determinants of cereal crop production as motivated by agricultural training using the econometric software STATA 11.0. From equation 2 therefore, w_2 is a vector of exogenous IVs affecting agricultural training but have no direct influence on cereal crop production while π_{ATi} and Ω_{ATi} are vectors of parameters of exogenous explanatory variables in the reduced form AT function to be estimated; further, ε_{2i} is the error term that captures both the random effects and other relevant but unobservable characteristics or complementary inputs and i is 1, 2, ….N. In this study we shall use the cluster mean of household ownership of radio and television as our instruments. To take care of potential endogeneity bias and non-linear interactions of unobservable variables with the observed regressors as specified in the cereal crop production function regressors simultaneously, equation (1) can be upgraded to equation (3) as:

$$CP_i = w_1 \pi + vAT_I + \gamma_1 \hat{\varepsilon}_2 + \gamma_2 (\hat{\varepsilon}_2 * AT) + u \quad \text{...} \quad (5)$$

Equation (5) is known as control function specification, from which $\hat{\varepsilon}_2$ is a fitted residual of agricultural financing, derived from the reduced form linear probability model of agricultural training, $\hat{\varepsilon}_2 * AT$ is interaction of the fitted AT residual with the actual value of agricultural training; u is a composite error term comprising ε_1 and the unpredicted part of ε_2, under the assumption that $E(u) = 0$ and $\pi, \nu, \lambda, \gamma$ are parameters to be estimated. Control function variables will purge the structural estimates of potential simultaneity bias and unobserved heterogeneity. Given the set of instruments for agricultural training is absent from equation (5), we imposed the exclusion restriction on the equation so as to include the instruments. The reason for imposing the instruments is for our equitation/regression to be exactly identified.

The terms $\hat{\varepsilon}_2$ and $\hat{\varepsilon}_2 * AT$ are the control function variables because they control for the effects of unobserved factors that would otherwise contaminate the estimates of structural parameters. The reduced form AT residual, $\hat{\varepsilon}_2$ serves as the control for unobservable variables that correlate with AF. If the unobserved variable is linear in $\hat{\varepsilon}_2$, then it will only be the constant term that will be affected by the unobservable, meaning the IV estimates of equation (5) will be consistent even without the inclusion of the interaction term. Considering that the expected value of $\hat{\varepsilon}_2 * AT$ is zero or is linear and supposing there is no sample selection problem, the instrumental variable estimate of equation (5) will be unbiased and consistent. In any case, if the correlation is non-linear, then the control function approach is required and the inclusion of $\hat{\varepsilon}_2 * AT$ in equation (5) will purge the estimated coefficients of the effects of unobservable variables (see, Wooldrige 2002 and Card, 2001).

Data Presentation

We used data from Ministry of Agriculture and Rural Development (MINADER) and the data from Household Consumption Survey of 2007 to analyze our data in STATA 13.0. Variables such as food crop production and farm size are imported from the Ministry of Agriculture and Rural Development of 2007 in to the 2007 Household Consumption Survey. The Household Consumption Survey was aimed at a national representative sample of about 11391 households, with women of reproductive age, alive and living within the selected zones of sample as well as a sub sample of about 50 percent of households for the men. The results of these surveys were presented for Cameroon, other towns, urban and rural zones and each of the 12 areas of study constituting the 10 regions. Data from the 2007 MINADER and data from 2007 Household Consumption Survey, we used the control function model to estimate our result from STATA 13.0.

Our variable of interest is food crop production captured by rice, yams, maize, and cocoyam… production in tons. The principal endogenous variable is agricultural training; the instruments for endogenous variable are cluster mean of household ownership of radio and television. The exogenous demographics are: household head education such as primary, secondary and higher education, farm experience, number of workers' in agricultural sector, male household head, household size, banking financial support, non poor households, farm size and farm input such as seeds and fertilizers geographical location of household.

6.0 Empirical Results

In this section, we present a description of the characteristics of Food Crop Production (FCP) including other factors impacting on agricultural food crop production, the results of determinants of agricultural training, control function of food crop production and training effect by professional, workshop and on-the-farm training.

6.1 Characteristics of Food Crop Production and other Factors Impacting FCP

In Cameroon according to the descriptive statistics table, most people working in the agricultural sector are primary education leavers, with only 6.68 percent from higher education. Among the workers in this sector; 73 percent receive on the farm training, 59 percent workshop training and 45 percent professional training. In relation to education, this means that the government still need to step up the educational level of citizens involve in this sector being in terms of circular, technical or vocational education. It should be noted that this is a general tendency with agriculture in most developing countries, whereas, Croppenstedt et (1998), using data from a 1994 USAID fertiliser marketing survey, found that literate farmers are more likely to adopt better use of fertiliser than those who are illiterate.

Food crop production is an important activity in Cameroon, with important crops such as: maize, rice, yams, sorghum, Irish, sweet potatoes, cassava and cocoyam widely produce in the entire territory; these crops are essential contributors to alleviating the food security problem. In this process, about 75.6 percent of workers involve in crop production are working full time, but with only 7.6 percent using modern agricultural tools. This implies that the prevalence of manual work is still very high considering that farmer's farm land size ranges from 8 to 10 hectare. This may also mean the farm land are still highly being under used, most farmers producing below capacity as confirm by the low use of agricultural input such as fertilizer.

Other reasons for inadequate farm produced can be the high cost of improve seeds and fertilizer. Couple with the fact that financial institution's credit is low due to perhaps inadequate collateral security, the tendency is that farm produce will be low. The detail of our discussion is summarised in table two.

Table 2: Characteristics of Food Crop Production and other Factors Impacting FCP

Variables	Mean	Std. Dev.	Min	Max
Cereal Crop Production	11.2476	0.5897181	10.56518	12.59952
HH Agricultural Training	1006.001	412.5168	223	1510
HH ownership of Radio_MPU	0.4942351	0.4999887	0	1
HH ownership of Television_MPU	0.3070396	0.4612862	0	1
Farmer Use Modern Farm Technology	0.0766127	0.2659877	0	1
Rainfall Variability	470.2544	235.7421	216.3562	941.0812
Number of Agricultural workers in HH	0.7562125	0.7329732	0	1
HH Male Sex	0.7437664	0.4365715	0	1
Log of cost of seeds	1.806159	1.165779	0	8.294049
Log of farm size	9.68209	0.602148	8.825098	10.59167
Log of cost of fertilizer	2.816562	1.140972	0	9.510445
HH Size	4.393024	3.025335	1	43
Primary Education	0.3360917	0.4723914	0	1
Secondary Education	0.3210247	0.4668907	0	1
Higher Education	0.0668798	0.2498248	0	1
Farming Experience	42.00609	15.43327	0	95
Non poor HH	0.7090716	0.4542105	0	1
Banking Financial Support	0.1748524	0.3798575	0	1
Urban Residence	0.3701806	0.4828741	0	1

Farmer Professional Training	201.4504	100.466	80	370
Farmer Workshop Training	1106.596	701.191	180	2430
Farmer On the Farm Training	1710.733	958.517	170	2890
Observations	**11,391**	**11,391**	**11,391**	**11,391**

Source: Author from 2007 Cameroon Consumption Survey

6.2 Determinants of Agricultural Training in Cameroon

Training in agriculture is strongly and positively correlating with farmers used of modern technology, male household head, cost of fertilizer, household size, higher education, acquisition of television, banking financial support to farmers and non poor households (see, column 1 of table 3, reduced form equation result). In the same way, agricultural training is negatively correlating with rainfall variability, number of agricultural workers, cost of seeds, farm size, farm experience, urban residence, farming experience, primary and secondary education. Principally, farmers in possession of modern farming equipments, will necessitate training to manage and use the equipment, this explains why the acquisition of modern equipment is strongly correlating with food crop production. Technology varies; hence each agricultural tool has its specific training for a better application in the agricultural farms, however, the ability to use the equipment will depends on the farmer initial training such as professional, workshop and on the farm training.

Men have a higher tendency of being trained as compared to the women especially in the urban community. The men in general are more involved in cash crop production while the female are more in food crop production to meet the subsistent and nutritional need of the family. However, following the widely distributed presence of nongovernmental organizations involved in all manner of capacity building for the women, they are therefore, motivated to constitute themselves in to Common Initiative Groups, Associations or Cooperatives. With such groups, women or farmers in general can easily be trained. The cost of fertilizer is another factor strongly correlation with food crop production. Fertilizer acquisition constitutes an extra cost to agricultural production. It therefore becomes necessary for farmers to be trained in using the various types of fertilizer and most importantly their practical farm applications. As to what follows, this enables them to maximize their full benefit in terms of farm yield and hence compensating for the production cost. With regards to household size, we observed that the higher the number of persons in a given household, the more the quest for food. This can only be achieved through mass production, by the acquisition of technical and professional knowledge.

As already revealed in the literature, people in higher education will always solicit more training as a result of the initial awareness of the importance of training in productivity. As intimated earlier, this result is strongly consistent with the case of training on Malaysian livestock farmers' capabilities and performance level in farm practice by Noor and Dola (2011). One of the principal ways through which farmers can be taught is by watching television. Television watching creates an awareness of the various platforms through which farmers can solicit for agricultural training. In addition, watching the television one can receive practical lessons on either the use of farm equipments, different methods of farm cultivation as well as fertilizer mixture and application.

Banking institutions such as agricultural credit unions by their mode of functioning, cannot provide finances to individual farmers or groups of farmers without prior collateral security and guaranty that the credit will effectively been use for the purpose that it's given. The farmers on their part will not want to take money that will not yield benefits because the pay back can be very traumatizing. Consequently, they will preferably solicit farm training that will permit them to acquire the best performance. Finally, non poor households are

households that will sacrificially spend on training because of their conscious of acquiring knowledge in other to produce substantially.

Table 3: Determinant of Agricultural Training in Cameroon and Food Crop Technology

Variables	Reduced Form	2SLS	CF Without Interaction	CF With Interaction
HH Agricultural Training	n/a	0.027*** (2.89)	0.027*** (5.55)	0.029*** (5.83)
Farmer Use Modern Farm Technology	22.194*** (1.05)	-0.089 (1.48)	-0.089*** (2.84)	-0.100*** (3.33)
Rainfall Variability	-0.112*** (3.89)	-0.000*** (3.71)	-0.000*** (7.12)	-0.001*** (9.65)
Number of Agricultural workers in HH	-13.945 (1.37)	0.036 (1.25)	0.036** (2.39)	0.042*** (2.94)
HH head male Sex	36.056* (1.94)	-0.139** (2.36)	-0.139*** (4.52)	-0.143*** (4.88)
Log of cost of seeds	-11.144* (1.81)	0.037** (2.00)	0.037*** (3.83)	0.059*** (6.24)
Log of farm size	-124.994*** (9.19)	0.770*** (6.00)	0.770*** (11.50)	0.850*** (13.19)
Log of cost of fertilizer	29.104*** (4.56)	-0.061** (1.99)	-0.061*** (3.81)	-0.092*** (5.87)
HH Size	3.430* (1.69)	-0.010 (1.60)	-0.010** (3.07)	-0.009*** (2.92)
Primary Education	-58.504*** (3.40)	0.168** (2.36)	0.168*** (4.52)	0.194*** (5.43)
Secondary Education	-97.040*** (4.57)	0.169* (1.65)	0.169*** (3.17)	0.225*** (4.39)
Higher Education	282.520*** (5.52)	0.586** (2.05)	0.586*** (3.93)	0.668*** (4.67)
Farming Experience	-2.101*** (3.94)	0.004 (1.58)	0.004*** (3.03)	0.004*** (3.66)
Non poor HH	18.658 (1.21)	-0.076* (1.72)	-0.076*** (3.30)	-0.058*** (2.64)
Banking Financial Support	49.049** (2.41)	0.172** (2.43)	0.172*** (4.66)	0.172*** (4.85)
Urban Residence	-1.759 (0.08)	0.146*** (2.80)	0.146*** (5.36)	0.135*** (5.19)
HH ownership of Radio_MPU	-16.473* (1.72)	n/a	n/a	n/a
HH ownership of Television_MPU	51.705** (2.45)	n/a	n/a	n/a
Predicted Residual	n/a	n/a	-0.002*** (4.40)	-0.001*** (2 .91)
Predicted interaction term	n/a	n/a	n/a	-0.000*** (11.34)
Constant	2,347.694*** (17.16)	1.035 (0.45)	1.035 (0.86)	0.363*** (3.32)
R^2 /Pseudo- R^2 / Pseudo R2	0.1129	0.9677	0.6717	0.7158
F-Stat [df; p-val]	10.59[17, 11,221; 0.0000]	16.90[16, 11,101; 0.0000]	74.33[17, 11,101; 0.0000]	83.68[18, 11,101; 0.0000]
F test of excluded instruments/ Joint F / χ^2 (p-value) test for Ho	n/a	3.57[2, 11,221; 0.0085]	n/a	n/a
Angrist-Pischke multivariate F test	n/a	7.190[0.0075]	n/a	n/a

Cragg-Donald F-Stat [10% maximal IV relative bias]	n/a	3.568[19.93]	n/a	n/a
Sargan statistic: (Chi-sq(2) P-val)	n/a	0.518[0.4716]	n/a	n/a
Durbin-Wu-Hausman χ^2 test	n/a	19.328[0.000 3]	n/a	n/a
Observations	**11,391**	**11,391**	**11,391**	**11,391**

Source: Author from 2007 Cameroon Consumption Survey; CF= Control function, 2SLS= Two Stage Least Square.

6.3 Food Crop Production Function

Assuming IV estimates is based on the assumptions that the unobservable variables are uncorrelated with excluded instruments or that the correlation is linear and that the estimation sample is randomly selected among FCP farmers, while the assumptions used for control function holds that the sample on which farmers are estimated is non-random. To test the assumption that the extra instruments are uncorrelated with the structural error term we use the diagnostic test. The diagnostic tests indicate that the inputs into agricultural production function are endogenous, since the Durbin-Wu-Hausman Chi-square Statistic is 19.328 for a P-value of 0.0003 and also indicates that the OLS estimates are not reliable for inference. The Chi square statistics is sufficiently high, revealing that the instruments are strongly identify, while the F-statistics on excluded instruments for the input equations are low, suggesting that though the instruments are weak but the are relevant.

The set of instruments used in the work is said to be valid both for the input equations and for the control function equation. The first-stage F statistic on excluded instruments varies from about 9.29 to 13.49 (P-value = 0.0000), while the Sargan statistic (0.518, P-value = 0.4716) proves that the instruments are valid and so relevant, however, looking at the Cragg-Donald F-statistic we realized that though the instruments are relevant, they are marginally weak (3.568[19.93]). Since there is an endogenous regressors and two instruments, it is necessary to check whether over-identification restrictions holds.

The 2SLS, CF without interaction and with interaction results revealed that household agricultural training strongly correlates with food crop production by 2.7 percent and 2.9 percent respectively. Focusing on the magnitude of the results especially the control variables such as the residual and the interaction term, we observed that the control function results with interaction has a stronger magnitude as compared to the 2SLS and CF without interaction results. Considering the result of the control function with interaction, we observed for 2.9 percentage points agricultural training is affecting FCP in Cameroon. Training creates awareness, expertise, introduces new techniques of production, effective use of inputs, better management of cropping system and marketing strategy. In fact as noted in the literature section, Noor and Dola (2011) summarized the impact of training on farmers into six major benefits according to priority: (a) increased in work quality, (b) increased in farm products, (c) cost savings, (d) time savings, (e) increased in income and finally (f) increase in networking. This result is consistent with that of Tambi and Nganje (2017), using primary data from Fako division they observed that farmers' agricultural training is strongly correlating with agricultural production.

Other variables contributing to increase agricultural production are: number of agricultural workers in households, log of cost of seeds, log of farm size, primary, secondary, higher education, banking financial institution, farming experience and urban residence. Ceteris paribus, the greater the number of people in agricultural production given the appropriate production conditions, the greater agricultural performance. The more the people, the more

the competition to produce the highest, land is not wasted, the strife to do more is high, training is also requested. All these factors help to increase food crop production. It should be noted that, the rate of competition among women in food crop production is greater than that of their male counterpart. In the same way, the lower the cost of input the more seeds will be planted and hence the greater the production capacity of the farm considering that the seeds are planted in the right conditions.

Farm size is another major contributor to agricultural production. Large farm size simply means more space for cultivation, employment of more persons, sowing of more seeds, quest to satisfy many more mouths, this is a logical way of improving agricultural production. Education being primary, secondary and higher has a higher probability of increasing production. In this perspective, Appleton and Balihuta (2010) confirmed that household primary schooling has impacted crop production comparable to the developing country average while Mirotchie (1994) investigates technical efficiency in cereal crop production in Ethiopia using aggregate data for the period 1980/1986 and reported that primary schooling tends to increase productivity, while secondary schooling has no effect. Lastly, Weir (1999) examining the effects of schooling upon farmer productivity and efficiency revealed substantial internal private benefits of schooling for farmer productivity in terms of efficiency gains and identified a threshold effect in which at least four years of primary schooling are required to have a significant effect upon farm productivity.

Banking financial institutions supply credits to farmers to encourage them to: cultivate more land, buy more agricultural input such as seeds, fertilizers, modern ploughing machines, reduced manual work by hiring workers hence increasing agricultural production. In addition, farming experience simply means acquisition of greater skills in farming, mastery of seasonal behaviour of crops hence increase in agricultural production. Finally, urban residence can help promote more training, especially new techniques of production; this can easily increase Food crop production in Cameroon.

6.4 Food Crop Production by Type of Agricultural Training Effect

Verifying the situation of food crop production with respect to the type of agricultural training effect; we observed that the three types of agricultural training being professional, workshop or on the farm training, strongly affects agricultural production, significance at one percent level. Professional training is simply the art of receiving specialized training or skills in agriculture, this can possibly be obtained from professional and vocational schools, faculty or research centers and specialized institutions in agriculture (e.g. Faculty of Agronomy and Agricultural Science, IRAD, IITA CRESA...). This result shows that any farmer that have acquire professional training such as agronomist, plant and animal specialist given appropriate agricultural conditions has a higher probability of producing more in fact to about 2.6 percentage higher as compare to their counter parts who do not have professional training.

Table 4: Determinant of Average Annual Rainfall Variation and Production Effects

Variables	Professional Training	Workshop Training	On the Farm Training
HH Agricultural Training	0.026*** (5.88)	0.003*** (6.83)	0.028*** (5.93)
Farmer Use Modern Farm Technology	-0.100*** (3.33)	-0.310*** (3.00)	-0.104*** (4.33)
Rainfall Variability	-0.008*** (3.15)	-0.001*** (8.65)	-0.001*** (9.65)
Number of Agricultural workers in HH	0.042* (1.94)	0.024*** (2.94)	0.104** (1.97)

HH Male Sex	-0.143*** (4.88)	-0.154*** (3.18)	-0.013*** (4.72)
Log of cost of seeds	0.901*** (3.21)	0.059*** (6.24)	0.059*** (2.84)
Log of farm size	0.351*** (13.19)	0.850*** (11.11)	0.850*** (12.10)
Log of cost of fertilizer	-0.021*** (5.11)	-0.092*** (5.87)	-0.022*** (5.07)
HH Size	-0.005 (1.52)	-0.904* (1.92)	-0.201*** (2.92)
Primary Education	0.100 (1.43)	0.140* (1.74)	0.194*** (5.43)
Secondary Education	0.225*** (4.39)	0.202*** (4.00)	0.501*** (4.09)
Higher Education	0.608*** (4.17)	0.768*** (7.07)	0.668*** (4.67)
Farming Experience	0.104*** (2.16)	0.004*** (2.60)	0.204*** (3.66)
Non poor HH	-0.008*** (2.64)	-0.058*** (2.04)	-0.007*** (3.64)
Banking Financial Support	0.172*** (4.85)	0.172*** (4.05)	0.172*** (4.15)
Urban Residence	0.135*** (5.19)	0.385*** (6.59)	0.153*** (5.10)
Predicted Residual	-0.006** (2.94)	-0.002*** (2.01)	-0.001** (2.91)
Predicted interaction term	-0.000*** (31.94)	-0.000*** (11.34)	-0.023*** (11.44)
Constant	0.363** (2.01)	0.333 (0.32)	0.362 (1.22)
R^2 /Pseudo-R^2 / Pseudo R2	0.7158	0.5958	0.5158
F-Stat [df; p-val]	78.68[18, 11,301; 0.0000]	83.68[18, 11,301; 0.0000]	83.68[18, 11,301; 0.0000]
Observations	**11,391**	**11,391**	**11,391**

Source: Author from 2007 Cameroon Consumption Survey

Agricultural workshop training is simply a brief intensive course on agricultural education for a small group; emphasizes interaction and practical problem solving. It can equally be considered as an academic conference; usually organized by NGOs, Civil Society Organizations, State Agencies such as, Ministry of Agriculture and Rural Development. Our result clearly shows that farmers that have receive agricultural workshop training has a probability points of about 0.3 percent of increasing agricultural production as compare to farmers who have not had any workshop training.

Agricultural on the farm training is simply the art of training/teaching farmers on their farms different methods and techniques of agricultural production. By our result, farmers that received on the farm training in agriculture have a probability of about 2.8 percent producing higher than those that do not. Comparing the result of the three types of training, we observed that the magnitude of on the farm agricultural training is higher than others meaning that on the farm training is better increasing agricultural production as compared to professional training and workshop agricultural training.

7.0 Conclusion

This study attempt to analyze the effects of farmers Agricultural Training on Food Crop Production in Cameroon; the contribution of professional, workshop and on the field training

is important in explaining agricultural production. The objectives of this study are: examine the impact of agricultural training on food crop production; determine the factors influencing agricultural training, decompose the effect of farmer's agricultural training on food crop production by type of agricultural training (professional training, workshop and on the farm training) in Cameroon and to recommend relevant economic policies on the basis of our analysis. Using data from the 2007 MINADER and data from 2007 Household Consumption Survey, we used the control function model to estimate our result from STATA 13.0.

Our variable of interest is food crop production captured by rice, yams, maize and cocoyam production in tons. The principal endogenous variable is agricultural training; the instruments for endogenous variable are cluster mean of household ownership of radio and television. The exogenous demographics are: household head education such as primary, secondary and higher education, farm experience, number of workers' in agricultural sector, male household head, household size, banking financial support, non poor households, farm size and farm input such as seeds and fertilizers geographical location of household.

In terms of policy, there are considerable opportunities to take advantage of agricultural training in terms of increase food crop production. The decision makers, civil society organizations and stake holders operating in agriculture should multiply agricultural training in both formal and informal training through the creation of agricultural schools, workshop and on the field training.

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