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Research Article

Contribution of Phytosanitary Products to the Revenue of Market Garden Farmers in Mezam Division, North West Region of Cameroon

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Abstract

This study on the contribution of phytosanitary products to the revenue of market garden farmers within the framework of the ACEFA (Amélioration de la compétitivité des Exploitation Familiales Agropastorales) observatory in Mezam Division in the North West Region of Cameroon describes farmers' perspectives of phytosanitary products, evaluates the extent to which farmers handle and use phytosanitary products, assesses the contribution of ACEFA towards reducing the excessive use of phytosanitary products and estimates the effect of phytosanitary products on the revenue of market garden farmers. Data was collected from 216 farmers using a structured questionnaire and analyzed using descriptive and inferential statistics with the aid of SPSS version 14 and Microsoft office excel 2010 software. The results show that a majority of the surveyed farmers were married women (54.6%) of more than 40 years (81.5%) of age with a low level of education and having spent at least 16 years in the activity. The findings show that the respondents were very much aware that phytosanitary products are very harmful to human health, but they kept mishandling the chemicals due to ignorance and negligence as many did not know the names of the chemicals they used. Respondents' level of education had an influence on their knowledge about the names of chemicals. ACEFA has impacted the lives of the farmers positively. In terms of phytosanitary products use, more is still expected of the ACEFA counsellors. All the variables regressed were statistically significant at 1% level of significance and accounted for 67.7% of the variations in total output per cropping cycle. Phytosanitary products contributed least to the variations in total output with a partial productivity of 0.246. Phytosanitary products affect market garden farmers' revenue in all ways. Stakeholders should seek improved ways of managing pests, which will in turn improve on the farmers' revenue. The government should redesign a new extension approach in the sector of phytosanitary products to create more awareness on the farmers.

Keywords: *ACEFA Observatory; Partial Productivity; Phytosanitary Products; Market Garden Farmers; Revenue; Gross Margin*

Introduction

Market gardening plays a great role in food security. One of the major challenges faced by farmers who are into this activity is scarcity of appropriate land [1]. The scarcity of land has caused the farmers to cultivate the same piece of land year in year out. The over cultivation of the same piece of land has resulted in an increase in the frequency of pests and disease attack. This is because the land has been exposed to the cultivation of crops of the same family (which are susceptible to particular common pests and diseases), year after year. To ensure high yields and counteract against losses especially in perishable crops, there is high use of chemicals before and during production, and farmers face difficulties using the chemicals.

The outcome of chemical use in agricultural production gives varied results. According to the Farmer's Voice [2], there are standard margins for some crops (if all norms are respected). A comparison between the results provided by the farmer's voice and those of ACEFA [3] shows some differences in the net benefits generated by farmers. For tomatoes and potatoes, The Farmer's Voice proposes 3,380,165 FCFA and 2,000,000 FCFA per hectare while ACEFA data gives 1,186,800 FCFA and 1,513,845 FCFA respectively per hectare as net benefit. These disparities continue in other market garden crops and for other information sources. Apart from other factors that can have a great influence on the margins of market garden farmers, the use of phytochemicals is of interest because of the high use of the chemicals and difficulties faced by garden farmers in using them. This study is therefore aimed at investigating the contribution of phytosanitary products to the revenue of market garden farmers in Mezam Division of the North West Region of Cameroon.

Methodology

Presentation of the study area

The North West region is one of the regions that make up the ten regions of Cameroon. It has seven divisions namely; Boyo, Bui, Donga-mantung, Menchum, Mezam, Momo, and Ngoketunjia. According to 'Bureau Central des Recensements et des Etudes de population' (BUCREP) [4], the Mezam division which is the study area has a population of 524,127 inhabitants with a population density of 300.4/km^2. It is made up of seven sub divisions namely; Bamenda I, Bamenda II, Bamenda III, Bafut, Bali, Santa, and Tubah.

Mezam Division is located in the regional head quarter of the North West region of Cameroon. It is bounded by the Menchum Division to the north, Boyo Division to the east, Ngoketunjia to the south and the Momo Division to the west. Bamenda, the regional capital situated in Mezam Division is located between latitudes 5°56" N and 5°58" North of the equator and longitude 10°09" and 10°11"East of the Greenwich Meridian. The map of Cameroon, North West region and the Mezam Division are presented in figure 1.

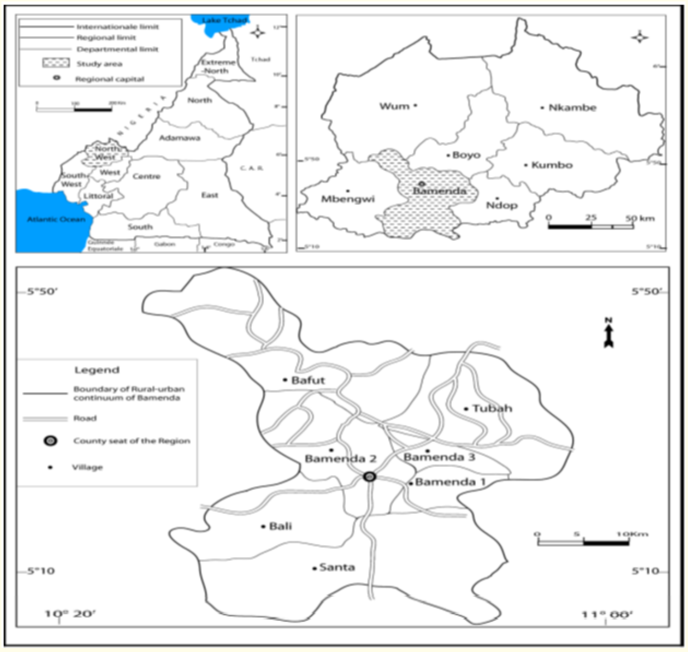

Figure 1: *Location of Mezam Division in the North West Region of Cameroon.*
Source: Kamga., et al [5].

Mezam Division has an undulating nature with lands forming gentle slopes, escarpments, plains and valleys as well as mountains that measure up to about 2000m above sea level. The nature of most parts of Mezam Division favours soil erosion, leaving most of the lands infertile and encouraging the high use of fertilizers. Majority of the forest vegetation is manmade with most of the natural vegetation that has been replaced by patch work of crops cultivated due to the increasing need of farm lands. Eight major vegetables were identified in the Bamenda continuum, they include: leek (*Allium porrum L.*), tomato (*Lycopersicon esculentum Mill.*), lettuce (*Lactuca sativa L.*), amaranth (*Amaranthus cruentus L.*), black nightshade (*Solanum scabrum.*), carrot (*Daucus carota L.*), pepper (*Capsicum chinensis L.*), cabbage (*Brassica oleracea L.*) and African traditional vegetables. This makes the rural-urban continuum of Bamenda a large vegetable production area [5]. The dispersion of market gardening activities in the Mezam division shows that, Santa is leading in production, while Bamenda 1, 2 and 3 come last on the list. This is presented in figure 2.

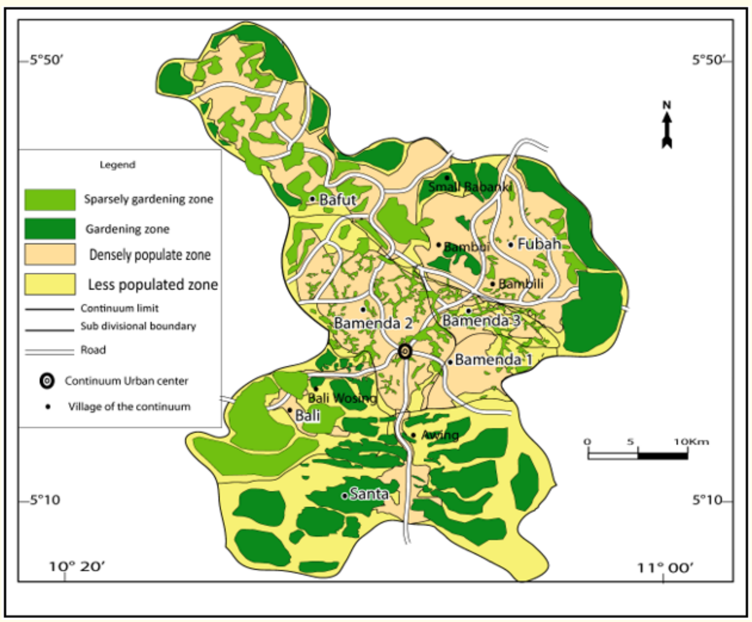

Figure 2: *Bamenda rural urban continuum superimposed in Google satellite map.*
Source: Kamga., et al [5].

The soil type varies from one location to another, with a predominance of reddish brown soils which are infertile; but also with patches of dark soils due to the high use of organic manure. The study area is characterized by a cool temperate-like climate, influenced mainly by mountainous terrain and rugged topography. Temperature averages 23°C, ranging between 15° - 32°C.

Study population, unit of analysis and sampling technique

The population this study were farmers practicing market gardening (irrespective of the speculation) in the ACEFA observatory within the Mezam division of the North West Region of Cameroon. Two Sub Divisions (Santa and Tubah) were purposefully chosen from which 32 groups that are purely into market gardening were purposefully selected (29 from Santa subdivisions and three from Tubah). Each of these groups had an average of seven (7) family agro pastoral farms (FAFs) giving a total of 224 FAFs. These FAFs came from different work areas; six in Santa (Menka, Buchi, Mbei, Awing, Kwindegli and Akum) and two inTubah (Sabga and Kedjom-ketinguh). The distribution of the work areas, number of groups and hence the FAFs in the study area is presented in table 1. The unit of analysis is the individual market garden farmer.

Sub-Divisions	Work areas	N° of groups	Average N° of FAFs	Total N° of FAFs
Santa	Menka	5	7	35
	Buchi	6	7	42
	Mbei	6	7	42
	Awing	4	7	28
	Kwindegli	4	7	28
	Akum	4	7	28
Tubah	Sabga	2	7	14
	Kedjom-Ketinguh	1	7	7
Total		32		224

Table 1: *Distribution of groups and FAFs in the study area.*

A structured pre-tested questionnaire was administered to 224 farmers but only 216 questionnaires administered returned were valid for analysis, thus giving a percentage return rate of 96.43%.

Data collection and analysis

Data collected for the study were both quantitative and qualitative data, obtained from primary sources. The data were collected through the administration of structured questionnaires to farmers who are members of groups that are practicing market gardening and accompanied by ACEFA, through the observatory. Combinations of both open and close-ended questions were used. The technique of data collection was reactive.

Data collected were analysed with the help of the Statistical package for the social sciences (SPSS) version 14 and MicroSoft Office Excel 2010. The tools used to realise the objectives included simple descriptive statistics and econometric calculations. Descriptive statistics which involved the use of measures of central tendency such as mean, frequency and percentages, were used to present the socio-economic characteristics of the respondents, the perspectives of the respondents and their use of phytosanitary products. The budgeting technique was used to analyse the cost and returns in the market gardening activities. More specifically, the "Cobb-Douglas Type" production function [6] was adopted, the gross margin analysis and the productivity concept were used.

Results and Discussions

Socio-economic characteristics of the respondents

This section describes the characteristics of respondents in terms of sex, age, marital status, level of education, and their farming experience. Table 2 presents the distribution of market garden farmers according to sex, age, marital status, level of education and farming experience.

Characteristic	Frequency	Percentage
Sex		
Female	118	54.60
Male	98	45.40
Total	216	100.00
Age		
≤ 20 years	1	0.50
21 - 30 years	13	6.00
31 - 40 years	26	12.00
41 - 50 years	77	35.70
≥ 51 years	99	45.80
Total	216	100.00
Marital status		
Married	185	85.60
Single	13	6.00
Divorced	1	0.50
Widow/widower	17	7.90
Total	216	100.00
Level of education		
No formal education	24	11.10
Primary	125	57.90
Secondary	45	20.80
Tertiary	21	9.70
Others like vocational training	1	0.50
Total	216	100.00
Farming experience (years)	**Frequency**	**Percentage**
0 - 5	8	3.70
6 - 10	17	7.90
11 - 15	17	7.90
≥ 16	174	80.50
Total	216	100.00

Table 2: *Distribution of respondents according to some socioeconomic characteristics.*

Results in the table 2 show that a slight majority (54.6%) of the respondents were women. This can be explained by the fact that the women in the study area have limited access to arable land and market gardening goes well even with a small piece of land. These results are in line with Fon [7], who noted that women are those mostly involved in agriculture and have very limited access to land. As such, they are bound to use more chemicals because of disease prevalence.

The age of an individual gives a measure of how active he/she can be. Results in table 2 also show that a majority (45.8%) of the surveyed farmers were above 50 years; while those with age of 30 or less were very few (6.5%). This implies that the study population was an aged one. This aging nature of farmers has been reported in similar studies [8,9]. This type of population Tarke [10] posited might be the cause of certain constraints in the agricultural sector Family labour is very important in market gardening and as such, marital status is an important factor as it is related to labour force size. A large majority of the respondents were married (85.6%).

Education is a key element in the adoption of new technology. It is an advantage, particularly with regards to farmers' acquisition of technical knowledge, the capacity to integrate them into the system, farm management skill and accessing valuable information. Results in table 2 show that 69% of the study population had at most primary school level of education. The low level of education implies that the farmers work mainly by experience and not training. This low level of education has been shown to be the major characteristic of the actors in the market gardening sector [5,9,11].

Farming experience enables the farmer to master the crops and to use appropriate technology on his/her farm. Results in the table (2) show that 80.06% of the farmers have been doing farming for at least 16 years. This indicates that a majority of the farmers are experienced in their activities with implication of being exposed to the toxic chemicals for quite a long period of time, in which their health might be of top most priority at this level. The fact that most of the farmers have low level of education is a clear indication that the farmers have been working by experience.

Description of farmers' perspectives of phytosanitary products

The perspectives of the farmers on phytosanitary products was aimed to determine the farmers' opinion on the health hazards of phytosanitary products, the illnesses that the farmers think are caused by the phytosanitary products and the extent to which the farmers know the names of the chemicals they use. Figure 3 presents a distribution of the respondents according to their opinions on the health hazard caused by phytosanitary products.

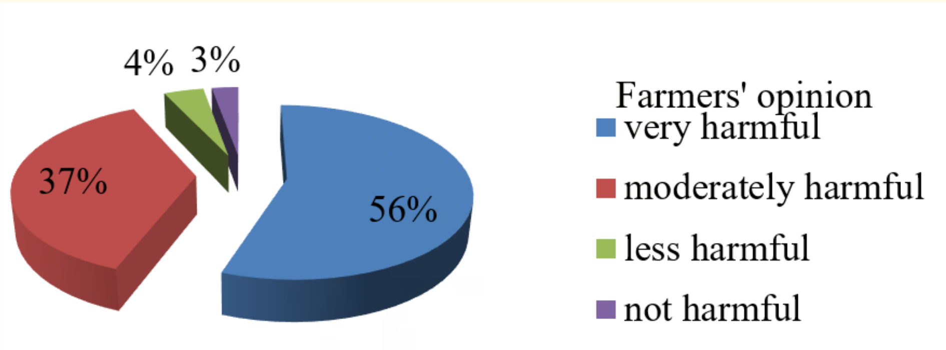

Figure 3: *Distribution of respondents according to their opinion on health hazards of phytosanitary products.*

The results in figure 3 show that 56% of the farmers were of the opinion that pesticides are very harmful to health. 37% said phytosanitary products are moderately harmful, 4% indicated that pesticides are less harmful and 3% were of the opinion that pesticides are not harmful at all. These results are similar to the findings on pesticides health hazards on human s studies such as those of Kamga., *et al.* [5] and Tadesse and Asferachew [8] who stated that farmers are aware of the harmful effects of pesticides.

Table 3 shows the different illnesses that the farmers suffer from and think/feel they are as a result of the chemicals that they use. This is because real hazards are those diagnosed in the hospitals like cancer and respiratory tract infections in which the farmers are ignorant of. From table 3, 39.4% of the farmers reported that they have never been sick of anything whose cause they think is linked to the chemicals they use. This is against 60.6% who enumerated some persistent illness that they suffer from whenever they use chemicals in their farms. The case of those answering no illness might even be worst because they might have very high amount of chemicals accumulated in them (since their farming experience shows that they have been exposed to those chemicals for a very long time). The illnesses reported by the farmers were: stomach disorder, eyes irritation, headache, catarrh, dizziness, ankle ache and skin rashes. Among these illnesses, eyes irritation was mentioned by most (18.5%) of the farmers especially when using chemicals. These results are similar to other researches which outline similar or the same illnesses which users of phytosanitary products suffer from as a result of chemical exposure [5,11,12]. The might have been because most of the farmers in the study area do not protect themselves when using phytosanitary products.

Type of illness	Frequency	Percentage
Stomach disorder	2	0.90
Catarrh	37	17.10
Dizziness	9	4.20
Eye irritation	40	18.50
Headache	13	6.00
Ankle ache and skin rashes	30	13.90
No illness	85	39.40
Total	216	100.00

Table 3*: Distribution of respondents according to types of illnesses they suffer from.*

In verifying whether the farmers actually know the names of the chemicals they are using on daily basis, the following results were obtained. A majority (61.1%) of the farmers did not know the names of the chemicals that they used. They could only identify them by the colour of the chemical or the colour of the packages. Only 38.9% knew the names of the chemical and most of them who knew did not know all the names of the chemicals they themselves use. Some gave names such as; 'mancozeb', 'penncozeb', 'gramaxon', 'mancozan', 'parastar', 'dimeforce', 'roundup' and 'beau-champs'. The reason for most of these farmers not knowing the names of the chemicals they use can be linked to the fact that most of them are illiterate (primary school dropouts) who cannot read and write, as indicated by the results on the level of education of the surveyed farmers on table 2.

Extent to which respondents handle and use phytosanitary products

The evaluation of the knowledge of the farmers is aimed at assessing where the farmers buy and store pesticides, the use of pesticides by the farmers, the frequently used pesticides and the frequency of use. The results show that a large majority (80%) of the farmers buy their pesticides from local agrochemical input dealers. This is not surprising as the majority of the respondents are unable to identify the pesticides by names. The local chemical dealers in the quarters rarely take time off to educate the farmers whenever they come to buy chemicals. They are only concerned with the benefit they make by selling their products [12]. In addition, to confirm the non-education of chemical users by the sellers, it was noticed that 67.6% of the farmers store chemicals in their homes (bedrooms, kitchens or food stores). All these cases of wrong storage of chemicals can still be blamed on the farmer's little knowledge on the management of pesticides. The farmer considered storage of chemicals in the kitchen, food stores or in the bedroom as being safe from theft [11,13]. Tarla., *et al.* [14] stated that 3 cases of suicide and 2 cases of accidental poisonings of children were recorded in a village in Foumbot, one of which a grandmother used herbicides in the place of spices, leading to her dead and that of her three grandchildren. These results are consistent with the findings of Afari-Sefa., *et al.* [12], Kamga., *et al.* [5] and Tandi., *et al* [15].

Pesticides use here by farmers includes the equipment that farmers used in spraying and the gender that is in charge of spraying in the different fields. This was aimed at evaluating the level of the farmers as far as their farm tools were concerned and also the involvement of the farmers by gender in farm activities. A great proportion (94.9%) of the farmers used the knapsack sprayer in spraying chemicals, against 4.2% who used the hand sprayers and 0.9% who used buckets. This result shows that the farmers are relatively advanced in their type of spraying equipment; and this might be as a result of the fact that all these farmers are in the ACEFA program of which majority have benefited farm equipment from the program. In most studies, the most common material used is the knapsack sprayer not only by small vegetable famers but also for food crops, coffee and cocoa [15,16].

Results show that both men and women participate in the application of farm chemicals. The treatment period varies from one gardener to another. The most frequently used pesticide indicates to an extent, the most common disease in the study area. Table 4 presents the distribution of respondents according to the frequency of spraying, time of application and the most frequently used pesticide. The results show that 81.0% of the respondents sprayed on a weekly basis against 1.4% who sprayed on a monthly basis. Less than three per cent of the surveyed market gardeners administered phytosanitary products as a curative measure for pest and or disease attack situations, while 97.7% of applied phytosanitary products as a preventive measure. The most frequently used group of pesticides was fungicides with a percentage use of 95.4%.

Indicator	Frequency	Percentages
Frequency of application		
Weekly	175	81.00
After two weeks	12	5.60
Monthly	3	1.40
Every two days	26	12.00
Total	**216**	**100.00**
Time of application		
After attack	5	2.30
Before attack	211	97.70
Total	**216**	**100.00**
Pesticides most frequently used		
Fungicide	206	95.40
Herbicide	5	2.30
Insecticide	4	1.90
Others (like avicides)	1	0.50
Total	**216**	**100.00**

Table 4: *Distribution of respondents according to frequency of spraying, spray timing and most frequently used pesticides.*

Contribution of ACEFA towards reducing the excessive use of phytosanitary products

The contribution of ACEFA towards reducing the excessive use of pesticides, through the counsellors was measured based on the duration of counselling given to the farmers, the number of trainings on phytosanitary products that the farmers received from the counsellors, the opinion of the farmers about the works of ACEFA and making comparison with the helps/supports that the farmers received from other sources apart from ACEFA. The duration of farmers in the program indicates whether or not the farmers has or is liable to benefit from a funded project. While the number of trainings received by the farmer shows the level at which ACEFA has impacted the farmers with knowledge in the domain of phytosanitary products through trainings.

It should be noted that all the farmers responding to the questionnaires were FAFs, belonging to Common Initiative groups (CIGs) and registered in the ACEFA program. The duration of the farmers in the ACEFA program was limited to the number of years the program has existed in the Mezam division which was four years as of the time of the research. From the results, it could be noted that 56.5% of the farmers interviewed were among the very first groups which entered the program in Mezam division; i.e. they have been in the program for close to four years. Just very few (1.9%) farmers were new (one year or less) in the program.

Figure 4 presents how the farmers are distributed according to the number of trainings received from the ACEFA counsellors. From figure 4, only 2.3% of the surveyed farmers had not received any training from the counsellor on phytosanitary products. Approximately 74% had received at least tree trainings. The farmers had varying opinions as to the effort put in by ACEFA to make them aware of and control phytosanitary effects. From the results, 40.7%of famers were of the opinion that ACEFA's effort was moderate in creating awareness while less than one per cent said ACEFA's effort was absolutely low. Those answering moderate, low, very low and absolutely low, justified their choices by saying that they still require much from ACEFA in terms of trainings on phytosanitary measures. While those for high and very high said they have had a lot from ACEFA in terms of equipment and trainings, compared to other government programs and projects which exploited farmers and helped in no way. 91.2% of the farmers confessed that their incomes have increased tremendously as a result of ACEFA intervention in their lives while 8.8% said their incomes are almost still the same; these definitely could be those who recently entered the program.

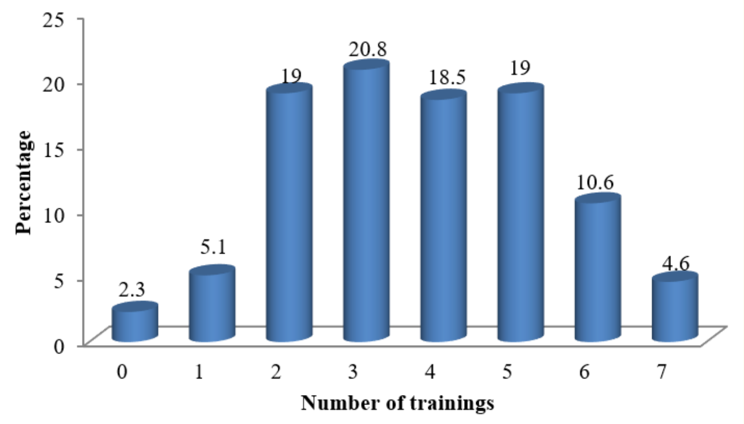

Figure 4: *Distribution of respondents according to the number of trainings received from CEFA.*

The help/support that the farmers receive from other organisations, projects of programs was used to compare the relative contribution of the ACEFA program to the lives of the farmers. Results show that most (42.6%) of the farmers had their help in the form of inputs. This help, as explained by the farmers came from MINADER who usually share maize seeds and fertilizers to farmers. The results also show that some farmers had received help from other places different from ACEFA (56.48%) while others (43.52%) had ACEFA as the only program which ever supported them. Those who received the help had it in form of trainings, inputs and finance.

Estimation of the effects of phytosanitary products on the revenue of market garden farmers

The economic effects of phytosanitary products were measured using different methods; productivity, gross margin and partial productivity of phytosanitary products.

Effects in terms of the productivity of phytosanitary products

Productivity= output/unit input

Therefore, productivity of phytosanitary products = output/cost of phytosanitary products

But total output per market gardener = 4,233.12Kg

Average cost of phytosanitary product per market gardener = 40,614.35 FCFA

Then,

Productivity = 4,233.12 Kg/40,614.35 FCFA = 0.104 kg/franc of phytosanitary products.

This means that on each franc that the farmer spends on phytosanitary products, he/she gets 0.104 kg of crops in return.

Effects in terms of gross margin analysis

Gross margin (GM) = Total revenue (TR) - Total variable cost (TVC)

But the TR per market gardener (total output * unit price of output) = 846,624.07FCFA

TVC (cost of labour, seeds, phytosanitary products, fertilizer and transportation) per market gardener = (40,614.35 + 111,861.11 + 177,916.67 + 49,095.370 + 34,778.86)

= 414,266.36FCFA

Hence, GM =846,624.07FRS-414,266.36FRS =432,357.71FCFA

Average land size per market gardener = 0.43ha

Therefore, gross margin per ha:

If GM for 0.43 ha = 432,357.71FCFA,

Then GM for 1ha = 1*432,357.71/0.43

= 996,152.17FRS/ha

This result shows that the gross margin on per hectare basis of land is 996,152.17FCFA.

Effects in terms on partial productivity of phytosanitary products

Reported output per production cycle of market gardener in kg was regressed on some selected production factors such as land, labour, amount of seeds used and the amount spent on phytosanitary products. The results show that all the above mentioned factors are statistically significant, with a 0.05 probability level. The predicted estimated production of market gardening for the 216 farmers in the study area is shown on table 5.

Sum of Squares	Df	Mean Square	F	Sig.
204.992	4	51.248	110.486	0.000

Table 5: *ANOVA Statistics of market garden production in selected localities in Mezam Division, North West Region.*

The above factors (land, labour, seeds and phytosanitary products) accounted for 67.7% of the variation in estimated production per cropping cycle (Table 6).

R	R^2	Adjusted R^2	Std. Error of the Estimate
0.823	0.677	0.671	0.68106

Table 6: *Regression model summary of market garden production in selected localities in the Mezam Division, North West Region.*

The regression model for predicting estimated production in kg per cropping cycle was given as:

Output (Y) = $\ln\beta_0 + \beta_1\ln L + \beta_2\ln S + \beta_3\ln M + \beta_4\ln P$

= $0.943 + 0.587\ln L + 0.280\ln S + 0.489\ln M + 0.246\ln P$ ($R^2 = 0.677$)

(1.401) (5.627) (6.135) (8.244) (4.279) (t-value)

(0.163) (0.000) (0.000) (0.000) (0.000) (sig. or p-value)

Note: $\ln\beta_0 = 0.943$ $\beta_0 = e^{0.943} = 2.568$

The non-linear expression of the Cobb-Douglas function is then:

$Y = 2.568L^{0.587}S^{0.280}M^{0.489}P^{0.246}$

Interpretation

The function; $Y = 2.568L^{0.587}S^{0.280}M^{0.489}P^{0.246}$ implies that a one percent increase in the amount spent on phytosanitary products will be associated to a 0.246% increase in the kilograms of garden crops harvested.

The results show that the most productive input is land with a partial productivity of 0.587, against 0.246 for phytosanitary products which is the lowest. After this analysis, the farmer can then decide to make a choice (apply the rational choice theory) on the different inputs to adopt or intensify.

Conclusion and Recommendation

Based on the findings in this study, it can be concluded that the farmers are very much aware that phytosanitary products are very harmful to the human health. What they do not actually know is how the pesticides affect humans and the ways in which they are contaminated by these chemicals. The wrong use and handling of chemicals by the farmers can be greatly blamed on their wrong sources of chemicals and storage places. The farmers did preventive treatment on their crops, spraying weekly due to the vulnerable nature of their crop. Support from ACEFA has a positive effect on the lives of the farmers. The farmers have each received at least training on phytosanitary products, even though the trainings are not efficient and sufficient.

Phytosanitary products affect the revenue of farmers in all aspects. Market gardening is a profitable venture with a positive gross margin. Although phytosanitary products appeared to be the least important among the selected inputs for the analysis, it significantly influenced farmers' revenue by 0.246%.

The farmers should adopt some other forms of pest management techniques such as the integrated pest management technique, organic and biological pest control ways using non-chemical products, which are safe for both human health and the environment. Farmers should abstain from buying chemicals from local chemical dealers in order to widen their scopes on chemical usage because when they buy from certified dealers, there are added advantages like follow up of the farmers in case of any problem and training the farmer on the usage. The counsellors should foster training on the safe handling of pesticides and audiovisual training materials should be made with pesticides safety manuals to enhance perfect assimilation of the message by the farmers since they are mostly illiterates.

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