Socio-economic impact of a cocoa integrated crop and pest management diffusion knowledge through a farmer field school approach in southern Cameroon

By

Njankoua Wandji Dieu ne dort[a]*; Lapbim Nkeh Julius[a]; James Jim Gockowski[a] and Tchouamo Isaac[b]

[a] Sustainable Tree Crop Program, International Institute of Tropical Agriculture (STCP/IITA-HFC), Yaoundé, Cameroon B P 2008 Yaoundé – Cameroun Tel (00237 2237522/ 223 74 34) Fax: (00237 223 74 37)

[b] University of Dschang, P.O.BOX 110 Dschang, Cameroon

*** Corresponding author: Dr. Njankoua Wandji Dieu ne dort; Email: n.wandji@cgiar.org; Phone: +237 7610538; Fax: +237 2237437**

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ABSTRACT

We focused on the Socio-Economic Evaluation of Farmer Field School Training on Integrated Pest Management in the humid forest region of Cameroon. The main objective was to assess the impact of training on integrated pest management (IPM) on cocoa farmer field school graduates.

The results indicate that *shade management*, *phytosanitary harvest, pruning, improved spraying practices and grafting of improved materials* were adopted at the rate of 94, 93, 90, 66 and 35 % respectively, with the overall rate of adoption being 76 %. There was a 47 % reduction in the frequency of spraying fungicides and a 17 % reduction in the number of sprayers applied per treatment following the implementation of the training. Labour inputs increased significantly for *pruning, phytosanitary harvest, and shade management* but decreased for *spraying*. A partial budget analysis reveals that the IPM practices lowered overall costs of production by 11 % relative to previous practices.

The poster presenting the synthesis of this work comprises a general introduction, a methodology and study area map, results and discussion which comprise two photographs of farmer field school activities, a graph and a table of different technical results, a short conclusion and recommendation.

Key words: integrated pest management, farmer field school, adoption rate.

INTRODUCTION

Cocoa is one of the most important cash crops and it is grown largely (>80%) by the small-scale farmers (Assoumou, 1977). In 1900, Africa's share of the total world cocoa production was mere 17%. In 1996, total production from the four largest producing countries accounted for 65% of the global output (ICCO, 1997). Compared to other agricultural activities, cocoa has been a leading sub-sector in the economic growth and development of these countries.

However, since the late 1980s, the cocoa sector has been subjected to several major economic shocks that have led to new institutional and organizational frameworks. This was particularly the case with countries such as Cameroon and Côte d'Ivoire.

Cameroon cocoa farmers have typically received subsidies and state support to control pest and disease. Until the early 1990s, the government provided fungicides at no cost to the farmers and treated their plantations with insecticides. The cost for the service was recovered through a state controlled cocoa marketing system. Following the fall in price and subsequent liberalization of the marketing sector, the government discontinued the service. In the depressed cocoa markets, farmers were unwilling to pay for inputs or if they were willing, they had difficulty finding private suppliers. Consequently, cocoa production suffered of neglect and in some cases was abandoned (Losch et al., 1990). When devaluation of the FCFA occurred in 1994, the weak institutional development of privatized input market liberalized in 1992 inhibited a strong supply response; in contrast to Côte d'Ivoire where current production of 1.3 million tons is double the level in 1993.

The increase in price of cocoa from 1998 led to greater interest on the part of small farmers. This has encouraged farmers to intensify their production and by use of input such as pesticides and fertiliser on their farms. According to FAO (1992), it has become apparent that a dependence on pesticides may not be an effective and sustainable way to manage pests. Some of the problems, which have become apparent with the widespread use of pesticides include: the elimination of natural enemies, resistance to pesticides (over 500 pests have now developed resistance to one or more type of pesticides), pesticides can be dangerous, and pesticides are expensive.

Developing cost effective and environmentally sustainable integrated pest and disease management is thus a possible strategy towards promoting cocoa agro forests. Equally important is the need to minimize risk to farmers' at times of drastic institutional changes and fall in commodity price (Duguma et al., 2002).

A new approach to pest management has developed which attempts to make the most use of economical and environmentally safe pest control methods and to minimise pesticide use. This approach is called the Integrated Pest Management (IPM)-the integration of available techniques to reduce pest populations and maintain them below the level causing economic injury in a way, which avoids harmful side effects (FAO, 1992). However, there is insufficient implementation of general known crop management practice by farmers. This implies that there is need for additional activities. Asiaka (2003) pointed out that for research to be effective there must be an efficient mechanism whereby the end users can use its results and that the process of making available the fruit of research is the function of extension. The experience of extension systems over the past few decades have been mixed. Some studies estimate high rates of return to the investment in extension (Birkhaeuser et.al, 1991), or to farmer education (Jamison et al 1982; Lockheed et al., 1980). Yet many observers document poor performance in the operation of extension and informal education systems, due to bureaucratic inefficiency, deficient program design, and some generic weaknesses inherent in public-operated, staff-intensive, information delivery systems (Feder et al., 2003) .One deficiency highlighted by researchers and practitioners is the tendency of many public officers dealing with the transmission of knowledge to conduct their assignment in a "top-down" manner. Often the information conveyed is presented, as a technological package comprised of recommended practices. This is perceived as a less effective method for improving knowledge compared with more participatory approaches (Braun et al. 2000) .Vos (2002), also noted that current extension services are often demotivated due to reduced capacity and poor pay. As a result, research extension linkages are generally weak.

In recent years, a number of development agencies, including the World Bank, have promoted Farmer Field Schools (FFS) as a more effective approach to extend science-based knowledge and practices (J.N. Binam et al., 2004).. The Sustainable Tree Crops Program (STCP) is testing the Farmer Field School (FFS) approach which is a participatory approach of diffusing new science base knowledge and information to farmers (The World Bank, 2002) in integrated pest management through pilot projects in Cameroon. The FFS training program utilizes participatory methods "to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions" (Kenmore, 1997). Such an approach, in which the trainer is more of a facilitator than instructor, reflects a paradigm shift in extension work (Roling and van de Fliert, 1994).

AREA DESCRIPTION AND SURVEY METHODOLOGY

In Cameroon, cocoa is grown in Southwest, Littoral, East, Centre, and South Provinces (MINAGRI, 1993). Cocoa is frequent in the forest agro eco-system because of its tolerance to shading. The traditional cocoa based multi-strata agro-forestry plantations are characterized by a combination of cocoa trees, fruit trees, non-fruit trees, and other vegetable and leguminous species like cocoyams, cassava, and sweet potatoes. Food crops are usually associated in the agro forestry systems during the creation of the plantation and often disappear after some years leaving a monospecific cocoa field (Tonye *et al*., 1987).

This study concerns only the Centre Province, which is one of the two provinces (South and Centre) that cover the STCP pilot project sites of Cameroon. The pilot project sites are where the Farmer Field Schools were implemented. The Centre Province was purposefully selected for convenience of accessibility; and also because it is second only to the South-West province in terms of cocoa production.

The vegetation in this zone is secondary forest. The climate is equatorial, with four seasons (two rainy season and two dry seasons). Rainfall is 1654mm in Yaoundé 1624mm in Ebolowa (Sonwa, 2002). Soils are ferralitic, nutrient poor, acid and fragile. Yaoundé is considered as a high population density zone with about 50-100 persons/Km^2 (Coulibaly, 2002). Land shortage is increasing and fallow lengths are being shortened from 20 to almost less than four years (Weber, 1977; Russel, 1993). In the Mbalmayo area the population density ranges from 13 to 25 inhabitants/Km^2 .The secondary forest is gradually disappearing with fallow periods varying from 5 to 10 years for mixed food crop fields. Land pressure has intensified as a result of population pressure but is lesser here than in Yaoundé zone.

Sampling Technique and Sampling Size

A systematic sampling got the sample of this study from a list of 284 farmer field school graduates who fulfilled the criteria for selection (were included in the 2002 baseline survey and also applied fungicides in their cocoa farms).

Primary data were collected from September to October 2004 in the Mefou and Afamba ,Nyong and So'o, and Lekie divisions of the Center Province of Cameroon. These data were supplemented with baseline data that were collected prior to the implementation of FFS training.

III. RESULTS AND DISCUSSIONS

III.1 Application of IPM practice by respondent

The purpose of this section is to present the degree of application (adoption) of IPM technologies exposed to the respondents by the FFS .To achieved this, average adoption rate for each technology and overall adoption rate for all the IPM technologies have been calculated

Table 1: *Application of IPM practice by respondent*

The major management requirements of cocoa agroforest are shade control, weeding, pest and disease control, harvesting of pods and processing of beans (Wessel, 1987). According to Wessel, (1987), the role of shade in the management of cocoa agroforests is rather complex as it affects or is related to several other growth factors. It reduces light intensity, temperature and air movement, and influences relative humidity, which indirectly affect photosynthesis and pest and disease management. Several reports suggest that, all other factors being equal, a level of shade that allows 20 to 30% of full light to reach the cocoa is needed for optimum growth and productivity (Lemée, 1955; Okali and Owusu, 1975). It should be noted however, that depending on the age of the tree and the intensity of light, there could be a significant variation in the level of shade requirement. This may vary from place to place and even from provenance to provenance. Farmers in Cameroon are quite familiar with the importance of shade in cocoa cultivation but they receive little assistance, if any, on how to better manage shade at various stages of the plant development.

The most severe problem faced by cocoa farmers in the region is pest and disease control. At a global level, yield loss due to disease is estimated at about 30% (Padwick, 1956). In West Africa, it ranges from 10 to 80% (10 to 30% in Côte d'Ivoire, 30 to 50% in Ghana and Togo, and 50 to 80% in Cameroon (Lass, 1987; Nyasse, 1997; Bakala and Kone, 1998). Among the several diseases that are responsible for such loss, black pod (*Phytophthora* species) is the most important (Bakala, 1981; Lass, 1987). Similarly, several insects are reported to attack different parts of the plant at different stages of development.

Depending on the prevailing climatic conditions in a given area, chemicals, cultural practices or biological control methods can be used to control cocoa pests and diseases. Enhancing air circulation through regular weeding and pruning, ensuring there is adequate drainage, and removing pod husks immediately after harvesting and extracting the beans are some of the cultural practices recommended (Muller, 1974; Maddison and Griffin, 1981). Copper-based fungicides are also reported to be very effective to control *Phytophtora* pod rot (Bakala and Kone, 1998).

Table 1 below reveals that shade management has the highest average rate of adoption (94.38 %). Phytosanitary harvest ranked second with an average rate of 93.33 %. Pruning also had a high adoption rate of 89.89%. Improved spraying practices and grafting occupied the second to the last and the last rank with adoption rates of 65.56 and 34.78 % respectively. The high rates of adoption of shade management, improve spraying practices and pruning could be associated to the fact that farmers consider them to have high impact on potential yield (table 9). Low application of grafting techniques could be due to the fact that farmers considered it to have non-immediate low impact on potential yield. Insufficient grafting material could also have been the reason that hindered it application.

The overall adoption rate was 75.59 %. This is slightly lower than the findings of Bahadur and Siegfried (2004) where the rate of adoption was 78.3 % but lower than those of Belle (2003) where only 36.78 % was recorded. It is important to note that the general high adoption rate may be associated to the fact that the season long training helped farmers to explore some of the benefits and cost of various IPM technologies. This implies they are sure of their net benefit.

III.2 Change in farm management practices

This section presents the change in spraying practices, sprayings per seasons and number of sprayers per farm.

III.2.1 Spraying practices

Before the FFS a small percentage of the farmers (26.4%) applied the recommended spraying practices, i.e. spray until fungicide had moistened cocoa pods, but would not spray until runoff (table 2). However, some farmers (32.2%) still apply the wrong spraying practices after receiving the FFS training. This could be attributed to their usual habit spraying practices ie spray until fungicides would runoff cocoa pods.

Table 2 : *Pre and post program spraying practices*

There was a significant change in spraying methods (table 3). This implies graduates in the majority no longer spray until saturation of cocoa pods.

Sprayings per season and number of sprayers per farm

It is important to note that there was a significant reduction in the number of sprayings per season between the pre and post program periods. The mean number of sprayings reduced from 7.37 during the pre program period to 3.86 after the farmer field school training. Therefore there was a 47.22% reduction in the frequency of application of fungicides. The significant change could be as result of the fact that most farmers (67.78 %), as seen in table 26, did not depend on the calendar bases to spray but take decision to spray based on the powers of observation in the field. Significant changes did not only occur with the number of sprayings per season but also with the number of sprayers per farm(s). The average number of sprayers per farm(s) by participants was found to be 18.86 before the program intervention; the average number of sprayers per farm(s) by participants was found to be 15.65 after program intervention. Thus, there was a 17.02 % reduction in the number of sprayers applied by participants. This is not surprising as table 16 indicates that about 70 % of respondents spray until fungicide had moistened cocoa pods, but would not spray until runoff. By spraying in this manner, farmers avoided wastage of fungicides.

Table 3: *Pre and post sprayings per season and number of sprayers per farm*

Change in Labour Input and Amount of Fungicides use

Also reported in Table 7 are the fungicide costs incurred. In effect we see that labour is substituted for fungicide. Both variables show significant differences in the pre- and post-FFS situations. In terms of the sum total costs the post-FFS costs are slightly higher than the pre-FFS cost although not significantly so. But it is important to note that the farmer has reduced his cash outlays for fungicides by nearly 40%. Given the cash constraints facing poor households this seemingly modest outcome can offer an important incentive for adoption.

Table 4: *An evaluation of the effect of farmer field school training on the cost structure of cocoa farming.*

Conclusion and implications for policy

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The main objective of the study was to evaluate the impact of FFS training on Integrated Pest Management on cocoa Farmer Field School Graduates in the Centre Province of Cameroon. Working within the framework of the adapted logic model of program evaluation and based on the findings arrived at, certain conclusions can be drawn.

There was a significant difference in spraying method before an after the program intervention. In the majority, farmers no longer spray until saturation of the pods. There was a 47 % reduction in the frequency of application of fungicide. Also worth mentioning is the significant change in the number of sprayers per farm (17 % reduction in the number of sprayers per farm.). The cost of labour and fungicide cost incurred showed significant difference in the pre- and post –FFS situations. In terms of sum total costs, the post-FFS costs are slightly higher than the pre-FFS cost although not significantly so. But it is important to note that the farmer has reduced his outlays for fungicides by nearly 40 %.

Pruning and shade management were those technologies farmers felt that require much labour. On the whole, more than 60 % of respondents indicated that the new practices require a lot more labour than previous practices. These two technologies were also considered by farmers to have high potential impact on yield. Farmers also felt that there was a significant lower use of fungicide in the post program periods than the pre-program periods. Experimentation skills, self confidence, decision making based on powers of observations and better relation with other farmers were some of the non-technical benefits farmers thought they derived from the training.

The policy implications are clear. Strengthening extension services by promoting FFS training approach. This farmer-to-farmer extension approach is expected to bring about cost-effective knowledge dissemination and financial sustainability, issues that have hampered many public extension systems in developed and developing countries (Quizon et al., 2001; Hanson and Just, 2001).

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TABLES

Table 1: *Application of IPM practice by respondent*

IPM technology	Number of respondent exposed to	Number of adopter	Average adoption rate
Pruning	89	80	89.89
Shade management	89	84	94.38
Grafting	69	24	34.78
Phytosantitary harvest	90	84	93.33
Improved spraying practices	90	59	65.56
Overall adoption			**75.59**

Table 2 : *Pre and post program spraying practices*

Spraying Practices	Year	Number	Percentage
Spray until fungicide would run off cocoa pods	2002(N=87)	64	73.6
	2004(N=87)	28	32.2
Spray until fungicide had moistened cocoa pods, but would not spray until runoff	2002(N=87)	23	26.4

Table 3: *Pre and post sprayings per season and number of sprayers per farm*

		Mean	Std	Min	Max	2-tail sig
Number of sprayings per season	2002	7.3671	3.830	0.00	16.00	0.00
	2004	3.8608	2.341	0.00	19.00	
Number of sprayers per farm(s)	2002	18.86	19.693	0.00	98.00	0.00
	2004	15.6456	18.646	0.00	90.00	

Table 4: An evaluation of the effect of farmer field school training on the cost structure of cocoa farming.

Management practices	Pre FFS2002labour quantity (man/day)	costs	Post FFS 2004 labour quantity (man/day)	costs	Change in cost (FCFA)	T-test	Prob
Pruning of cocoa trees	7.573	7,573	15.152	15,152	7,579	4.36	0.000
Phytosanitary harvest	3.854	3,854	7.044	7,044	3,190	3.04	0.0036
Shade adjustment	1.292	1,292	7.266	7,266	5,974	6.75	0.000
Spraying labour	28.815	28,815	17.900	17,900	(10,916)	-3.62	0.0005
Sub total labour	41.5	41,534	47.362	47,362	5,827	7.72	0.0000
Fungicide use (sachets)		37,215		22,876	(14,339)	-2.84	0.0063
Total		78,749		70,238	(8,511)	-1.26	0.2122