

Swarming: A Quality Agricultural Extension Technique among Organic Farmers in Cameroon

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Abstract— Researchers in different regions of the world are constantly thinking about strategies for environmental protection. In relation to that, this study is aimed to analyzing the transmission mechanisms put in place to transmit and popularize organic agriculture. A survey using a questionnaire ($n = 10$) and an interview guide ($n = 07$) collected data from organic pineapple farmers ($N = 17$, i.e. 13 men and 04 women, aged 25 to 64). This study took place in the Littoral region, in the Mounjo-Cameroon administrative division, more precisely in three of its districts (Loum, Njombé-Penja and Mbanga). The SPSS Version 23 software made it possible to analyze the quantitative data and the interviews led to content analysis and the collection of testimonies. The results show that 60% of organic farmers say that the mechanisms of appropriation and transmission of OA is a matter of swarming. In addition, there is a difference between the means of transmission used and this difference is in favour of the swarming means of transmission ($F = 21.17$; $p < 0.05$). In conclusion, swarming ($r_{\text{swarming}} = 0.957$; $p < 0.01$) is the most widely used means of both appropriation and transmission in the Littoral for the extension of organic farming.

Keywords— Organic agriculture, Swarming, Organic farmers.

Résumé— La réflexion sur les stratégies de protection de l'environnement ne cesse de préoccuper les chercheurs dans les régions du monde. La présente étude vise à analyser les mécanismes de transmissions mis en place pour transmettre et vulgariser l'agriculture biologique. Une enquête par le biais d'un questionnaire ($n = 10$) et d'un guide d'entretien ($n = 07$) a permis de collecter les données auprès des agriculteurs d'ananas biologiques ($N = 17$, soit : 13 hommes et 04 femmes, âgés entre 25 et 64 ans). Cette étude s'est déroulée dans la région du Littoral, dans le département du Mounjo-Cameroun, plus précisément dans trois de ses arrondissements (Loum, Njombé-Penja et Mbanga). Le logiciel SPSS Version 23 a permis d'analyser les données quantitatives et les entretiens ont donné lieu à des analyses de contenu et le recueil des témoignages. Il ressort des résultats que 60% des agriculteurs biologiques affirment que les mécanismes d'appropriation et de transmission de l'AB relèvent plus de l'essaimage. En plus, il existe une différence entre les moyens de transmission utilisés et cette différence est en faveur du moyen de transmission par essaimage ($F = 21,17$; $p < 0,05$). En conclusion, l'essaimage ($r_{\text{essaimage}} = 0,957$; $p < 0,01$) est le moyen le plus utilisé tant pour l'appropriation que pour la transmission au Littoral en vue de la vulgarisation de l'agriculture biologique.

MotsClés— Agriculture biologique, Essaimage, Agriculteurs biologiques.

I. INTRODUCTION

At first sight, swarming corresponds to a phenomenon observed in bee hives, which consists of a part of the bee population leaving with one queen bee too many (the swarm), to form a new colony elsewhere in which the same activities are more or less reproduced. Swarming in humans refers to the desire of humans to work, seek or learn knowledge in order to satisfy their motivations: this phenomenon is called "oil stain" (Chatué and al., 2014). It is also the act of reproducing or adapting on another site (alone or accompanied) knowledge and know-how that have been heard, seen and practiced. We can speak of the swarming of ideas, of techniques such as the swarming of organic farming. In organic farming, an individual who works with more experienced farmers in a field is talking about leaving that initial site for another in order to continue the practice of organic farming as he or she has learned or by improving it. In short, it means splitting up and going to form new groups (Dictionnaire Hachette 2007).

This procedure is less costly and appropriate for small farmers. It is easily associated with the "word-of-mouth" phenomenon that positively influences the intentions of individuals (Ltifi & Faouzi, 2015). Several swarming possibilities exist (Chatué and al., 2014), and three that favour swarming among farmers are mainly listed by authors. The first possibility is the role played by agro-industries; the use of labour in agricultural plantations contributes to the acquisition and transmission of a certain amount of knowledge that will subsequently be reproduced when workers move to a new site. The second possibility is the role played by development projects; the implementation and sustainability of development projects has facilitated the appropriation and transmission of new knowledge. Indeed, each project, through its mechanism, popularizes its mission to its target population and this information is promoted by the latter. The third and last possibility is migration and demographic dynamics; the movement of populations contributes to the transfer of technologies, the return of immigrants or the arrival of expatriates contribute strongly to agricultural production in general and particularly to organic agriculture.

These possibilities are not sufficient and complete, as today ICTs facilitate access to information anywhere in the world. The world has become a global village, which promotes the circulation of knowledge from one region to another. Nowadays, with the help of a smartphone, tablet or computer, it is possible to access several applications via

the internet, to download videos and courses on themes of your choice, such as organic agriculture. These advantages in communication contribute to swarming, especially at a time when the environment is experiencing real ecological crises. This argument is based on the observation that conventional agriculture has largely been subject to extension systems in Africa. These systems exploded with the "green revolution" that influenced African agricultural production. To address the problems of food insufficiency, the agricultural world has seen agricultural extension emerge and evolve in Africa over time. Agricultural extension in Africa has moved from the standardized system with the training and visit approach, farmers field school, endogenous facilitator, integrated approach, farmer training to the co-constructed system from targeted extension to agricultural advisory. Despite the criticisms of extension, it is still useful to make something public to someone or a target audience (Benor, 1988). Extension thus is more beneficial to conventional agriculture.

Conventional agriculture is an agricultural production system characterized by the systematic use of chemical inputs, and which seeks to maximize production in relation to the factors of production (labour, soil, materials, etc.). This agriculture, although beneficial according to some researchers, (Tarla and al., 2013) significantly pollutes biodiversity, undermining biodiversity, food security and human health. The consequences of its use lead to soil, water and air degradation (Tetang & Foka, 2008). A study reveals that after repeated use of pesticides in market gardening, "100% of farmers report feeling uneasy after using chemicals". (Djoufack & Tohnain, 2020). While these chemical products (chemical fertilizers, herbicides, fungicides, insecticides, growth regulators and pesticides) make it possible to destroy pathogens harmful to crops, they on the other hand cause serious environmental pollution (soil, water, air pollution, etc.), which has consequences on human health (dermatological, neurological, cardiovascular and respiratory diseases, neurodegenerative diseases, cancers, etc.) (MINEPAT, 2018). Yet this form of agriculture remains the most popular in Cameroon, with a multiplicity of development projects facilitating its transmission (Lando & Tohnain, 2019). According to the SDOs, to counter the environmental threat worldwide, sustainable solutions must be adopted in all sectors.

Organic agriculture (OA) presents itself as one of the strategies for sustainable development. It is a holistic

system of agricultural management that refers to a farming technique that finds its originality in the use of cultivation and breeding practices that are concerned with natural balances (IFOAM, 2007; FiBL & IFOAM, 2018). It excludes the use of synthetic chemicals, genetically modified organisms (GMOs) and limits the use of inputs in the production process. The term "organic" in this form of agriculture is often assimilated to a "natural" or "ecological" production method. Organic agriculture is regulated and meets very precise standards issued by certification bodies. Products from OA must therefore be certified to be recognized as such. However, this study is of the opinion that, depending on the context, there are forms of organic agriculture that differ from one country and farmer to another and are not necessarily certified. In Cameroon there are certified organic agriculture, hybrid organic agriculture and natural organic agriculture. With the event of the COVID-19 pandemic, forms of organic agriculture will multiply because each individual, each country realizes that the contribution of resources rests only on itself and that in the event of a global crisis each country seeks its own interest first: international relations are fragile. Traditional modes of production respect natural balances, although they are not authenticated by a certification body (MINEPAT, 2018). Organic agriculture, which nevertheless contributes to the preservation of biodiversity, is not popularized in Cameroon, yet environmental pollution is gaining ground. This is contrast to some African countries, as for instance Nigeria, which is developing the necessary means to popularize organic fertilizers (Arokoyo, 1994). Yet extension work is important, as it increases farmers' performance through easy access to information (Fokou and al., 2020).

The objective of this paper is to analyze the appropriation and transmission mechanisms of organic farming among organic farmers in order to identify the most commonly used extension tool in this farming system.

II. METHOD

Informants for the data collection for this study are organic pineapple farmers. They consist of 13 men and 04 women, for a total of 17 farmers. Their ages range from 25 to 64 years old. They were interviewed in the Moungo administrative unit in Littoral region of Cameroon especially in the districts of Loum, Njombé-Penja and Mbanga.

III. PROCEDURE

The questionnaire used is composed of a preamble, a series of 81 closed, semi-structured, simple choice and open-ended questions. The content of the questionnaire is furnished with questions such as: Do you pass on this activity to someone? In what way? How did you learn OA? Which way do you think is the most suitable?

The interview guide was used to help carry out this study (N = 07). The guide is very detailed and allows a quick and efficient follow-up. The themes addressed concern appropriation and transmission mechanisms, organic farming and some sub-themes such as: technical and cognitive mastery and repetitive practice.

The respondents were very aware of the themes and the sub-themes. The qualitative data were analyzed by the use of content analysis. Statistical analysis of the data was done by calculating frequencies, correlation testing, and ANOVA at the significance level ($p < 0.05$). SPSS Version 23 software was used for quantitative data analysis.

IV. RESULTS

Table 1: Analysis of the link between organic farming appropriation mechanism, swarming, transmission and positively appropriate training

Variables		1	2	3
1- Appropriation mechanism for OA	Pearson Correlation	1		
	Sig. (Bilateral)			
	N	10		
2- Process of Transmission of OA by	Pearson Correlation	,957**	1	

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swarming	Sig. (Bilateral)	,000		
	N	10	10	
3- Appropriate training process for OA	Pearson Correlation	,218	,201	1
	Sig. (Bilateral)	,604	,633	
	N	8	8	8

Note: **. The Correlation is significant at the 0.01 (Bilateral) Level. re [-1 1]

Based on this analysis, it appears that the appropriation mechanisms of organic farming are positively and very strongly linked to the swarming transmission process ($r = 0.957^{**}$; $p < 0.01$). While a positive, weak and non-significant link is observed between OA appropriation mechanism and OA-appropriate training process. ($r = 0.218$; $p > 0.05$). This weak and non-significant link

reveals that interaction effects between these two variables cannot be predicted, as is the case for the relationship between appropriation mechanism and swarming process. The results show that the appropriation of OA depends more on swarming than on appropriate training.

Table 2: Descriptive statistics of the means (M) and standard deviations (SD) of the mechanisms

Appropriation of OA	Average	Standard deviation
Swarming/Mimicry	4,33	1,528
Observation	2,67	,577
Appropriate training	3,33	1,155
Contamination	3,00	.
Total	3,40	1,174

Among the mechanisms of appropriation of organic farming presented in the table above, it follows that organic farmers report having appropriated OA by different methods, namely: by contamination (A = 3.00; SD = 0); by appropriate training i.e. in a training institute (A = 3.33; SD = 1.155); by simple observation (A = 2.67; SD = 0.577) and finally by swarming or mimicry (A = 4.33; SD = 1.528). It should be noted that swarming has a higher average because it is the most common means used by farmers to obtain OA. It should be noted that the

Contamination and Observation mechanism are all elements of swarming, of which (A = 10) swarming is far above any other mechanism. This mechanism is practiced informally. It certainly results from the absence or rarity of OA training institute in Cameroon. It is certainly true that in agricultural training schools, units relating to organic farming do exist, but they are insufficient to trigger the appropriation of organic farming by a large number of farmers.

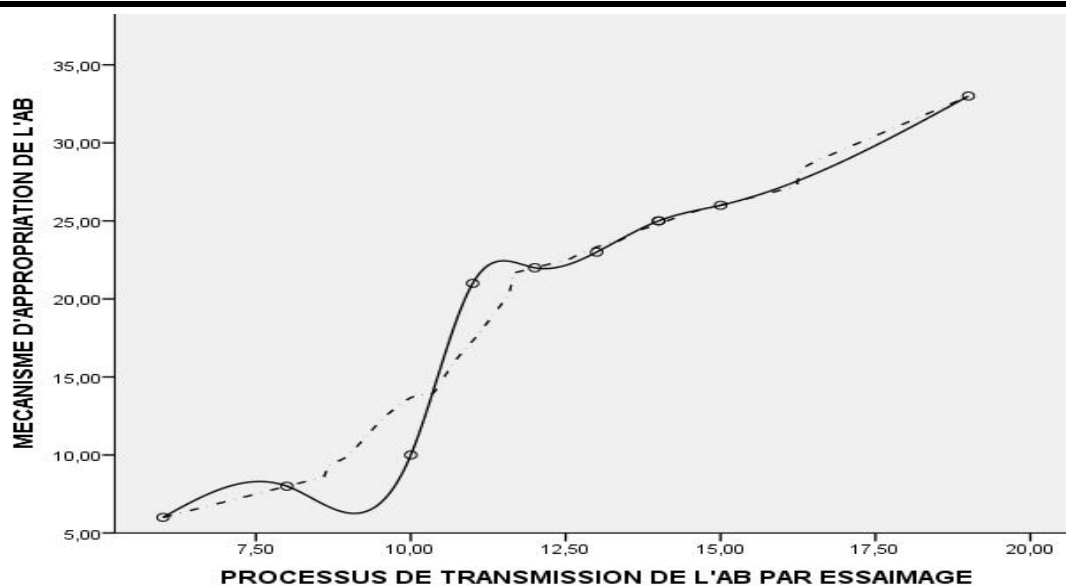


Fig.1: Mechanism of appropriation of OA according to swarming and appropriate training in OA

This graph clearly illustrates the results in the sense that the curve of the appropriation mechanism of organic farming increases with the curve of the swarm transmission process. This study demonstrates the link between the appropriation technique and the transmission technique. The method used to transmit something is related to the method by which it is received.

Table 3: The different mechanisms of transmission in organic farming

			Sum of squares	Ddl	Medium square	F	Sig.
Informal communications*	Intergroups	(Combined)	112,933	3	37,644	21,175	,001
			10,667	6	1,778		
	Total		123,600	9			
Formal Transmissions							

The ANOVA analyses relate formal and informal transmission mechanisms used among farmers. They reveal that the transmission mechanisms of organic farming are more informal than formal. $F(1, 10) = 21.175$; $p < 0.05$. That is, the difference in means or differences between informal and formal transmission mechanisms of OA is significant. This result is in favour of informal transmission mechanisms ($A_{infor} = 12.2000$; $A_{for} = 11.00$).

Table 4: Analysis of variance between the transmission process of organic farming swarming and the process of appropriate formation of organic farming

			Sum of squares	Ddl	Medium square	F	Sig.
1. Swarming process *	Inter-groups	(Combined)	112,933	3	37,644	21,175	,001
			10,667	6	1,778		
	Total		123,600	9			
2. Process by appropriate training	Intra-groups						
	Total						

In the present study, it is noted that swarm transmission mechanisms are highly significant, in contrast to transmission mechanisms by appropriate formation ($F(4, 10) = 21.17$; $p < 0.05$; $A_{Swa} = 4.33$; $E-T = 1.528$; $A_{for} = 3.33$; $E-T = 1.155$). This means that farmers use swarming more than other existing methods. In fact, swarming practices, which refer to a kind of "oil stain", allow the learner to use all his sensorimotor elements to memorize using long or short term memory. Then, when he becomes independent, he reproduces the activity identically or better and becomes autonomous. Swarming in agriculture is the sum of several facts such as: the influence of migration and population dynamics, the role of development projects, and that of agro-industries (Chatué, and al., 2014). All these elements have contributed to the oil stain in some farmers who have been able to reproduce the activity. Here are the testimonies recorded during interviews with farmers:

"We had a certain Mr. Appolinaire peace of mind; he taught us how to do OA; we practiced several chains".

"I met a mother of mine, mummy Eli, she was an organic farmer, she held my hand in it with a lot of advice and because of that, I got a taste for it".

"I'm pulling my little one into organic, as I understand it, he has the will to do organic. I teach him how to do it so he can also protect nature".

"I would be very happy if someone close to me practices organic farming".

V. DISCUSSION

The assumption made in this study is that swarming is the most common means of both appropriation and transmission of organic farming. In detail and in line with the models used to transmit knowledge in rural areas, agricultural extension techniques are multiple (Achancho & Lothoré, 2008). Firstly, Cameroon in the agricultural sector went through successive five-year development plans in an administered economy between 1960-1986. Second, it went through agricultural sector adjustment plans with New Agricultural Policies (NAP) between 1986-1998. Finally, Cameroon is undergoing a revision of the new agricultural policy after 1999, which ends with new challenges and recognition of family farmers and their organizations.

Secondly, given the number of existing agricultural extension schemes, one would expect that all these types of extension would similarly lead to the transmission of organic farming, or that only one of these

schemes would be used so that farmers receive knowledge and know-how about OA. Above all, given their large numbers, it is up to each extension worker or project coordinator to choose the one that suits him or her best. The extension schemes have evolved from technical advice to cooperatives and development societies to a "Training and Visit" approach promoted by the World Bank. The agricultural sector has also gone through a refocusing towards more targeted extension and facilitation-advice "Farmer Field School, FFS". This was followed by a "decision support" approach, for family farms and farmers' and peasants' organizations (FOs). Finally, a support and advice system implemented by the ACEFA programme will be created, which will support farmers' groups if they approach the structure and present a profitable project. All these mechanisms have served conventional agriculture. In terms of ecological issues, agricultural extension systems are practiced rather by organic farmers, who are not supported by the State. Despite the history of existing farm support, despite the ecological challenges, farmers are passing on organic farming. Despite the history of existing farm support, despite the ecological challenges, farmers are passing on organic farming through their own techniques (Najwa, 2018).

The results of the present study do not deviate from the stipulations of the study by Chatué and al (2014), which presents swarming as an "oil stain". This work refers to swarming as an oil stain that one person or legal entity can leave in the mind of another. Indeed, organic farmers mostly opt for informal means of transmission, and use various sources of information to pass on their knowledge and know-how. The swarming factor associated with contamination and observation is more significant (60%), with organic farmers admitting to having appropriated OA through swarming. Informal mechanisms prevailed in the study (70%). The study presents swarming as an appropriate extension technique. Chatué, and al, 2014 say that it is the sum of several facts such as: the influence of migration and population dynamics and demographics, the role of development projects, and the role of agro-industries. It is also the result of the impact of ICTs; it goes beyond social learning or observation. It makes it clear that no individual is simply an empty box that only needs to be filled by external pressures and conditioning. Individuals observe, imitate, develop, adapt and create themselves in a specific social and cultural environment and exhibit certain mental states that encourage or hinder learning (Bandura, 1977).

Despite the fact that theoretically speaking, there is a plethora of extension techniques, swarming takes precedence over all others in this study. This can be explained by the fact that, since extension has been used in the agricultural sector in the past, it has had limitations, including the consideration of the black man as a black box and therefore unable to think for himself. It can also be attributed to the absence of the state in the extension process of organic agriculture in Cameroon. However, agriculture has always been the main activity and source of income for African populations, particularly in rural areas (Olandele and al., 2004). Thus, in order to better increase agricultural productivity, set extension objectives have been achieved through a variety of rural intervention methods. The flagship objective is the productivity of export products corresponding to Western needs (Adams, 2000; Dufumier, 1996; Evenson, 2000; Mero, 2000; Oladele, 2004).

In terms of extension approaches, one would have expected the prevalence of a known or standardized approach as listed above (Feder & Slade, 1986; Groeneweg & Tafur, 2003) or andragogical practices that relate to the concern to continuously improve farmers' capabilities: 'empowerment' (Ajaga Nji, 2000). In addition to confirming the hypothesis, this study reveals that more than the majority of organic farmers have received organic farming apprenticeships through informal channels. This illustration poses a sufficient organizational question in the field, as organic farming is still in its infancy in Cameroon (MINEPAT, 2018) and therefore very little known and sought after by farmers. A study has already noted the shift that takes place between transmission and accompaniment (Bossard, 2012). According to it, formal transmission tends to fade away as the advent of reflexivity of the taught is born.

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