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AGRICULTURAL EXTENSION SERVICES USING A PARTICIPATORY APPROACH IN VEGETABLE GROWING AREAS IN SURINAME

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ABSTRACT: *Extension Officers from the Agricultural Extension Service in Suriname, charged with communication, face difficulties in transferring information to farmers. Therefore, a mixed method study was carried out to explore possibilities to improve communication strategies and to facilitate the introduction of novelties and good practices. From August 1, 2016-February 15, 2017 388 small-scale vegetable farmers participated in a survey gauging their knowledge and practices. In addition, a participatory farmers' experiment was conducted with 15 farmers to convey information about the application of Biochar, an innovative soil-improving compound. Results revealed that extension officers lack relevant specific agricultural knowledge. Important information on sustainable agriculture did not reach most farmers, although the participatory approach provided the means for information exchange and allowed conveying the needed information. The experiment showed that practical sessions on a regular basis with bi-directional information interchange with farmers as conducted in this research can be an effective method to introduce novelties and good practices.*

KEYWORDS: Small-scale Farmers, Extension, Communication, Agricultural Innovation, Sustainability, Biochar

INTRODUCTION

Many countries are struggling with global challenges such as population growth, effect of climate change and the need to reduce greenhouse gas emissions. These challenges have a great impact on agriculture. This, emphasizes the importance and need of agricultural innovation on sustainable techniques. The approach to support and introduce agricultural innovation changed over time. In the eighties, the National Agricultural Research System (NARS) concept was developed in Sub-Saharan Africa to guide investments in agricultural development. In the nineties the concept of the European Commission on the Agricultural Knowledge and Information System (AKIS) focused also on the links between research, education, and extension to identify the farmers' demand for new technologies. These days, the development of sustainable innovation systems is the main focus to strengthen the broad spectrum of science and technology activities of organizations and individuals. It demands and supplies knowledge and technologies as well as the rules by which these different agents interact (World Bank, 2006).

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In what follows an innovation is an idea, practice, or project that is perceived as new by an individual or other unit of adoption. An innovation system is a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance (Rogers, 2003; World Bank, 2012). To promote technical innovations, an investment in knowledge is crucial at national level. Transferring knowledge to farmers is the difficult part. Farmers gain their knowledge through many years of experiences, which has been passed on from generation to generation. Their traditional knowledge is adapted to local conditions, customs and culture, in contrast with more cultural detached scientific knowledge. Because of the sustainable aspect, there is a need to share traditional knowledge with researchers to translate scientific knowledge into understandable aspects to farmers (Rengalakshmi, 2002). Indeed, communication is the transfer of a message from a sender to an audience or receiver via a channel (Wiese et al., 2010; Akinbile and Otitolaye, 2008). Effective communication has long been recognized as vital to food and agricultural enterprises (Zumalt, 2007).

Still, many farmers, especially in third world countries such as Suriname, do not receive information due to miscommunication and a weak extension system. Research conducted in Suriname shows that many farmers use a high dose of pesticides while cultivating vegetables (Malgie et al., 2013). In Suriname, communication and the transfer of technology between farmers and the relevant institutions like Ministry of Agriculture, Animal Husbandry and Fisheries (MoA) does not result in the aspired adoption of innovations. In Suriname, the extension officer is charged with the distribution of knowledge. One of the key factors is the lack of skills in the methods and techniques of teaching adults as well as lack of proper communication (Malgie et al., 2013; MoA, 2013). As a result, the farmers do not have sufficient confidence in the extension workers of the MoA. In Suriname the extension officer is charged with the distribution of knowledge.

Agricultural extension can be seen as one of the policy instruments which governments can use to stimulate agricultural development. Its activities are a form of social innovation in agricultural change, which was developed over nearly four thousand years by being created, recreated, adapted and developed (Jones 1986 in Oladele 2011; Ahmed, 1982, as quoted by Bne Saad, 1990). Haugh (2007) reported that agricultural extension services are supposed to fulfill many aims, from reducing rural poverty and improved livelihoods for rural households to increasing the overall production and contribution to foreign exchange earnings from export. Wongsodikromo (2012) mentioned in her research that in less developed countries, extension work is a challenge due to the weak link between research and extension. This researcher also reported that research focuses on technical aspects to generate useful technologies, while extension focuses on the acceptance and adoption of those technologies by users.

According to the Food and Agriculture Organization (FAO, 2017), there are different types of extension methods to provide information. They are classified by the way of contact:

(a) Individual Extension Method (IEM): one-to-one discussions, farm visits, office visits, telephone calls and written correspondence;

(b) Group Extension Method (GEM): speeches, meetings, talks and seminars, demonstrations and group discussions;

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(c) Mass Extension Method (MEM): newspaper, magazines, publications, exhibitions, internet, radio and television.

During the 1960s, in Suriname, the focus was on GEM, where meetings were arranged through interest groups. This method was time-saving for the extension officer and as the farmer became more aware of his own business, the results with this group information are also more favorable than when information would be provided individually (del Prado, 1965).

The MoA uses "Transfer of Technology" as a method which is based on results from research institutes (which are not necessary gathered from public research departments) and provided to the extension officers, who are expected to be able to transfer these results to farmers. According to an evaluation report of MoA, the proposed participatory approach whereby researchers provide practical research activities in cooperation with extension officers, is never implemented due to inadequate resources, poorly trained field staff, mobility problems or the use of extension workers for non-extension problems (Wongsodikromo, 2012). Anderson (2004) identified some new improved approaches, developed during the past three decades: Training and Visit Extension (T&V), Decentralization, Fee for Service and Privatized Extensions and Farmer Field Schools (FFS). The current method used in Suriname is the Training and Visit Approach (T&V) of extension. It was propounded by Daniel Benor and was first developed in the early 1970s. It was encouraged during 1975-95 in more than 70 countries by the World Bank (Umali and Schwartz, 1994). It was characterized by directly outreaching to individual farmers to transfer specific agricultural knowledge to target groups to increase their skills and to transfer the same to other farmers. Several studies resulted in the fact that this method had its limitations. For example, in Bangladesh poor linkages were identified between research and extension and the recommended technologies were not demonstrated. In Nigeria, an increase in cost and lack of transportation as well as implementation difficulties were found (Musa, 2013). Earlier field work also indicated that in Suriname farmers were not 'satisfied' with the current used way of communication with the extension officers of MoA.

Theoretical framework

This study was guided by the Three Theoretical Model designed by Ingram (Charalambous-Snow, 2011) (Fig. 1):

(a) The Adoption-Diffusion Theory (Rogers, 1995) explains why farmers choose to adopt new ideas and how an innovation is communicated through certain channels over time among the members of a social system;

(b) The Communication Progress Theory (Leeuwis, 2004) defines communication as a process were messages and signals between social actors are exchanged. The *Source* (knowledge, skills and attitudes of extension officers), *Message* (the information that needs to be transmitted to the farmer), *Channel* (communication method to transmit the message to the receiver), *Receiver* (decodes the message according to his/hers skills, knowledge, socioeconomic status and attitudes to make a decision to use the information or not), and *Effect* (the decision is the effect) (SMCRE) are very useful in extension for the analysis of communication factors. The SMCRE model was adapted by Rogers and Schoemaker from the model of Berlo of sender-message-receiver (Charalambous-Snow, 2011).

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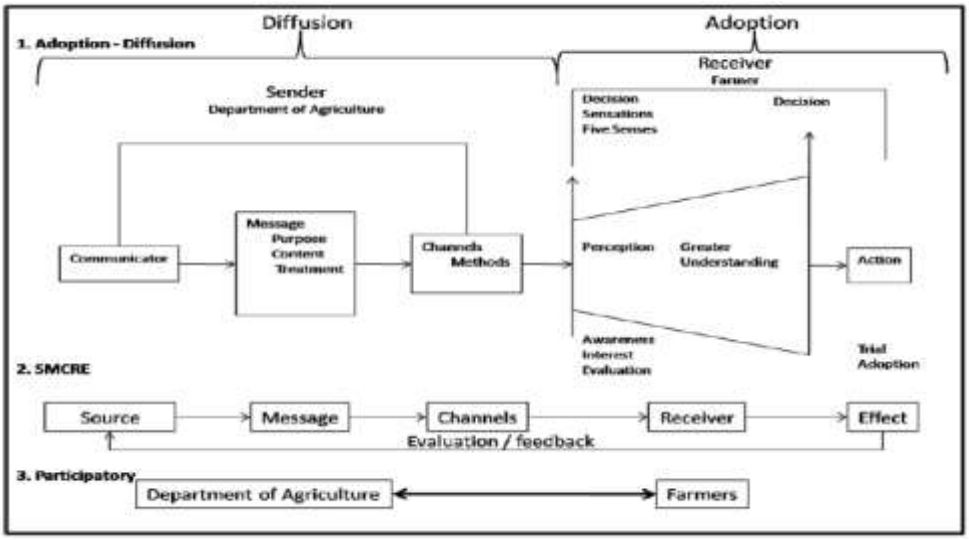

Figure 1. The Three Theoretical Models, adoption-diffusion, evaluation-feedback, and the model of participation, in combination the framework of the Study (Charalambous-Snow, 2011)

The elements of diffusion in the SMCRE communication model (FAO, 2011) are:

- the source (S) is the originator of the innovation (an inventor, scientist, change agent, or opinion leader);
- the message (M) is the new idea or innovation;
- channel (C) is the means through which the innovation is distributed;
- receivers (R) are the members of a social system; and
- effects (E) are changes in knowledge, attitude and overt behavior (adoption or rejection) with regard to innovation (Rogers & Shoemaker, 1971).

(c) The Participatory Rural Approach (Chambers, 1994) is based on "methods and approaches in order to enable local people to analyze, enhance and share their knowledge of life and conditions to plan and to act".

This research focuses on the SMCRE model (Fig. 2) which is used for the delivery of information to farmers in Suriname.

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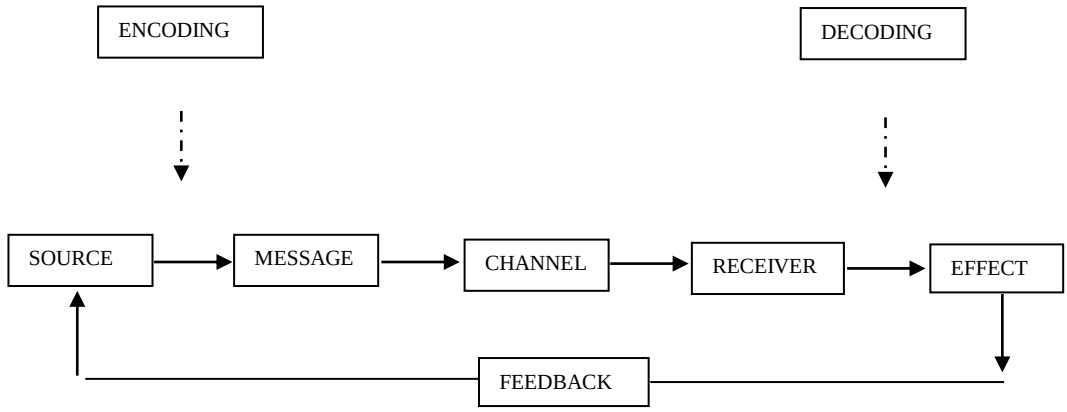

Figure 2. The SMCRE-Model of Communication (FAO, 2011)

Purpose and objectives of the study

In general, agricultural extension in Suriname does not have a desirable status. It has not been possible to promote it in a manner of selecting the approaches and extension methods, of developing objectives and duties and, of organizing structural organizations. With respect to current problems and limitations, the Surinamese agricultural extension system requires being reassessed and it needs basic transformation. Therefore, the main purpose of this paper is to analyze the problems in the extension work to improve its communication. Specific objectives were as follows:

- to analyze the current relationship that exists between farmers and extension officers;
- to identify the problems in communication between farmers and extension workers.

METHODOLOGY

Description of study area

This study was conducted in three districts of Suriname where most vegetables are cultivated: Paramaribo, Saramacca and Commewijne.

Data Collection Method and Analysis

To gather data a questionnaire was conducted with 388 small-scale farmers and an experiment was conducted with 15 small-scale farmers. First, a semi-structured questionnaire was designed to gather data about the relation and the satisfaction of farmers towards the MoA. The list of farmers which was provided by extension service of the MoA was outdated and contained no specification about farmers who were small-scale farmers, vegetable farmers and fruit farmers. After a random selection a total of 388 small-scale vegetable farmers responded to the questionnaire. Second, to implement the communication method of Fig. 2, an experiment, using the participatory approach, was conducted with 15 farmers (5

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farmers from each district) on how to use biochar as an innovative production method in agricultural activities. These farmers were weekly provided with information and they practiced on the farm while the Individual Extension Method was used. The experiment lasted five months from December 5, 2016 until April 2, 2017 to gather data on the information flow to farmers. One (preparation phase) to four hours (observation and measurement of the growth phase and harvest crops in the last stage) were necessary each week per visit and per farmer, leading up to a total of approximately 45 hours of field work and participation interaction per farmer. The production of biochar took 9 days (from 07.00h - 23.00u). The activities were completed on January 5, 2017. Data about the needs of farmers consisted of primary data, which were obtained through an experiment and direct observation of the phenomena of the object being studied. Data for the Participatory Rural Approach (PRA) were collected from the research observation through an elicitation diary data collection method. The data were analyzed using IBM SPSS v.20.0 (SPSS Inc., Armonk, NY).

RESULTS

Demographics

The 388 small-scale farmers participated in the survey, with 80.1% of the participants being male, growing different vegetables such as pepper (52.8%), eggplant (37.5%) and yard long beans (35.5%). Most participants (72.4%) were above 40 years of age, of which 21.7% had more than 35 years of experience. Although 80% of the respondents was educated, only 17.4% had a high school degree. Almost 44.1% of the surveyed farmers were full-time farmers; 51.5% were growing vegetables on a farm smaller than one hectare. The 15 respondents who participated in the experiment consisted of two female and thirteen male farmers.

Current relationship between farmers and extension officers

The first research objective sought to analyze the current relationship that exists between farmers and extension officers. Only a small percentage of farmers (2.9%) received information, while 17.9% received training (on Integrated Pest Management and Global Good Agricultural Practices) from the extension officers from MoA. Almost 5.1% of those who received the training rated the effect of this information as ‘high’, but only 2.0% indicated that they were informed enough about the subject. The majority of the respondents (73.2%) indicated that farmers do need to be trained by MoA.

However, fewer farmers (4.8%) were satisfied with the contribution of MoA, while 49.7% indicated not being satisfied, because the information derived from the extension officers had no added value for them. From the results derived from the surveyed farmers it can be stated that less than 20% of the extension officers of MoA were keeping in touch with the farmers and that they (35.5%) gather information from other farmers. Only 18.1% contacted the extension officer to get information, while others make use of media (8.1%), newspaper (1.5%) and internet (1.3%). Another essential result is that more than 50% of the farmers (51.5%) indicated that they do not know any extension officers belonging to their area. It is obvious that the communication between the extension officers and the farmer is not optimal and not on a regularly basis as it should have been.

Print ISSN: 2058-9093, Online ISSN: 2058-9107

Communication problems between farmer and extension

The second research objective sought to identify the problems in communication between farmers and extension officers. Most of the surveyed farmers (51.5%) could not remember who the extension officer in their area is to make contact with. Depending on the communication modality the percentage that indicated that there was never contact or could not remember that there was a contact, ranged from 92.5-98.2%. Only 21.4% indicated that they had contact with an extension officer in the past year.

Another problem in the communication pattern is the transfer of technology. For example, the extension officer is responsible for providing information and training about sustainable techniques such as Global Good Agricultural Practices (GLOBALGAP) and Integrated Pest Management (IPM) to create awareness among the farmers about the harmful impact on health and environment. Most respondents indicated that they were not familiar with IPM (95%) and GLOBALGAP (90%). This response indicates a huge concern in the information flow between farmers and extension, resulting in a negative impact on the farmers and their community.

As shown in the Table 1, the type of contact made most by farmers (9.7%) with the extension officer was the 'face-to-face' contact. Data also show that the most used source to retrieve information from is MoA (33.2%), while 20.2% rely on information from other farmers. The most common purpose for farmers (14.3%) to contact the extension officers was for agricultural problems such as pest and diseases.

Table 1. Type of contact made by farmers with extension

Type of contact	very often (%)	fairly often (%)	Sometimes (%)	seldom (%)	Never (%)
Face-to-face	9.7	1.0	4.6	1.5	23.0
Village meeting	0.8	0.3	0.8	1.5	25.0
Office meeting	2.3	0.5	3.1	1.5	23.2
Plant area	3.1	0.5	2.8	1.0	23.7
Group leader	0.8	-	0.3	0.8	24.7
Field days	1.8	0.8	1.3	0.3	21.2

Table 2 shows that only 4.2% of the respondents used mass source of information (radio/television) and that less than 6% of the respondents used group meetings or discussions as a source of information.

Table 2. Type of extension method used by farmers for information

Extension Method	Perceived information through	N	%
Individual Extension Method	One-to-one discussion	66	16.8
	Farm visit	16	4.2
	Office visit	29	7.4
Group Extension Method	Village meetings	13	3.4
	Group discussion	7	1.9
Mass Extension Method	Radio/ Television	16	4.2

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Farmer-Extension relationship through a better communication approach

The information from table 1 and 2 clearly points out that the information about sustainable agricultural techniques need a better communication approach. Therefore, 15 small-scale farmers, who participated in the experiment, need easily accessible training and information about sustainable agricultural techniques in order to cultivate according to international standards. In addition, communication between farmers and extension needs to be strengthened. To identify how the communication flow between farmers and extension should be, the three theoretical models of Ingram were adopted for this study (Charalambous-Snow, 2011) to provide information on biochar, a rather new innovative agricultural technique. The results are described according to the three models.

The Adoption-Diffusion Theory

Diffusion and adoption are two interrelated processes contributing to develop new ideas from their source of initial development to the acceptance by farmers (Bohlen et al., 1955). De adoption process is divided into 5 stages:

1. Awareness: The farmer knows about innovation but he lacks information about it.

The farmers were individually and face-to-face informed of the new innovation by verbal communication. Those farmers indicated that they had never heard about biochar.

2. Interest-information: The interest of the farmer in the new innovation increases and he seeks for more information.

The farmers were convinced by the information that the beneficial effects of the innovation of biochar were discovered more than 2000 years ago by ancient, indigenous cultures in the Amazon and that it is scientifically tested that application of biochar lead to an increase in agricultural production, thus resulting in more profit. The farmers showed interest in this innovation but they were surprised by the fact that this innovation (biochar) is more than 2000 years old and that it has many benefits as a soil enhancer which also aid to combat climate change.

3. Evaluation-application-decision. The farmer makes an evaluation of the innovation based on his/her present and anticipated future situation and decides whether to try it or not.

All respondents confirmed that they were voluntary and willing to try to use ‘biochar’ (innovation) to find out if this innovation will surely benefit their vegetable production.

4. Trial. The farmer uses the new practice (innovation) on a small scale to validate its workability on his own farm.

All respondents were enthusiast to try with biochar and they voluntary provided a piece of their land for the biochar experiment to observe and confirm that this new innovation would work.

5. Adoption. The farmer uses the innovation on a full scale and incorporates it into his way of farming.

Most farmers indicated that they would be happy to use the ‘biochar’ innovation in the future. An example of one farmer was that he tried to make biochar by himself by following tutorials

Print ISSN: 2058-9093, Online ISSN: 2058-9107

on YouTube on how to produce the 'biochar'. Another farmer stated that he needed more information for confirmation that the new idea would bring many benefits on the long term. He suggested to conduct the biochar experiment in different seasons and for a longer period of time.

The Communication Progress Theory

1. Source

To provide the information of the new innovation to the farmers. The information is coded into the language with which the farmers feels comfortable and translated into simple words (based on the education level of the farmers).

2. Message

Based on the model of Leeuwis (2004) the information provided to the farmer are soft data, given face-to-face to have more impact upon the farmer, because 'how' something is said has more effect on the farmer than 'what' is said.

3. Channels

Barbe (1981) indicated that people learn with sight (70%+), sounds (10-20%) and touch, taste, smell (10%) and that the voice and expressions of the source has also an impact on the farmer. Therefore, a one-on-one discussion using field demonstration methods was used to transfer the message to the farmer instead of using factsheets, radio or internet.

4. Receiver

The farmer decodes the message by relating it to his past experiences. The reaction of all participants was that they decided to use the information by participating in the experiment on their own field.

5. Effect

The farmer decides to adopt or reject the innovation. Most of the farmers indicated that they wanted to use the 'biochar' innovation in the future. Only one farmer was not totally convinced about the possible benefits.

The Participatory Rural Approach

The Participatory Rural Approach (PRA) was used to learn the farmers' perception on the method which was used to provided information (biochar). Based on how the information was provided to the farmers, the following results were revealed:

- Information was taken seriously. Farmers were asking questions which indicates that they were interested in the biochar and that they were serious about taking part in the experiment. For example:

  Male, 50 years from Commewijne:

  "Is biochar the same as charcoal?"

  "Can I use charcoal instead of biochar?"

Print ISSN: 2058-9093, Online ISSN: 2058-9107

"Can I use biochar also on other vegetables?"

"Is biochar a fertilizer?"

- Information leads to a trust relationship

  Some farmers shared private information which indicated that they trusted the researcher. For example:

  "*Three farmers shared that they did not use biological pesticides (Karateka/Bravo) as was recommended in the experiment (Neemal/Biopel) to spray against unwanted insects and diseases so that he has no loss in the harvest, although they are aware of the effect the used pesticides can have on the consumers."*

- Shared experience and problems on the field

  Because of the trust relationship which was built during the experiment, most farmers shared their agricultural problems they have to deal with (such as diseases and pests) and ask for advice and solutions for their problems. For example:

  Male, 45 years from Paramaribo: "Do you know what I can do for my tomatoes because they are shrinking and becoming brown"

  Male, 48 years from Saramacca: "Do you know why the fruits of the antroewa plant (Solanum sp.) have cracks"

  Male, 52 years form Commewijne: "Do you know why my pepper has brown spots"

  "When is the best time to fertilize and water the crops"

- Community involvement

  Some farmers were 'open' and not reluctant to share the information derived from the experiment. They involved other friend farmers from their own community to participate in the test and share the information with each other. Each farmer in the group shared a special bond of discipline, for example:

  Male farmers, between 30 and 55 years from Commewijne:

  "The crops were watered regularly by one of the farmers, agreed mutually"

  "On field days each farmer was on their own plot before the agreed time on which information is being provided".

After communicating with farmers through the communication model of Leeuwis (2004) and using the participatory approach of Chambers (1994) to provide information, a special bound of becoming part of their primary networks was developed (or like they would say it becoming a family member). It was observed that in the eye of the farmer, the researcher was seen as hope for his/her farm development because the farmer maintained contact with the researcher even after the experiment was finished. The method of communicating face-to-face with farmers and having practical information sessions in their fields to provide information was appreciated by each farmer, resulting in the fact that other farmers from their

Print ISSN: 2058-9093, Online ISSN: 2058-9107

community were also interested and were eagerly waiting to participate in further experiments.

DISCUSSION

Only one out of fifteen farmers had contact with an extension worker in the last year. This implies that the extension officers are not visiting farmers regularly. From the interviews it was noted that farmers who communicated with extension officers indicated that most of them do not have enough agricultural knowledge to assist farmers with their problems. During the interviews, extension officers in Paramaribo argued that their absence in the field was due to unavailability of fuel incentives (transportation problems) which prohibit them to visit farmers. Data also showed that most farmers are aging, although having many years of experience. A very important drawback is that if the communication between farmer and extension is weak, the farmers are dependent on their traditional knowledge which is mostly unsustainable. For example, the amount of pesticide they use is not based on the dosage recommended on the label of the bottle, but on their experiences to double the amount or to make 'cocktails' to get 'immediate' results.

Only a small percentage of farmers receives information from extension officers. This leads in combination with the perceived lack of agricultural knowledge, to dissatisfaction of farmers with extension officers, creating distrust in their relationship. These findings are also consistent with those of Petrović et al. (2009) who studied the problems with extension work and farmers' in Serbia. The findings also resulted in similar problems such as lack of trust in the relationship between extension officers and farmers.

More specifically, with respect to communication modalities, the transfer of information from extension workers to farmers is weak, irregularly done and most of the time destined for group extension instead of individual extension. These findings are supported by Baig and Aldosari (2013) who also found in Asian countries that extension professionals have weak technical knowledge, little interest in their work, a low status and less benefit to farmers.

Information is lacking because of the poor technology transfer by the extension officers. In addition, farmers need more and easily accessible information (communication channel) to adopt sustainable agricultural techniques. The linkage between farmers and extension officers needs to be strengthened to secure a trust relationship which is the basis to provide the needed information and to provide training in sustainable techniques to farmers. This finding is in line with the findings of Rasaga et al. (2015) in Congo. They reported that providing means of transportation and reducing the time and transaction costs for extension officers is one of the ways to interact and encourage greater interactions and linkages between extension officers and farmers. They also reported that the weak policy and low investment in complimentary inputs and services in Congo also limit the effectiveness of extension.

Based on the qualitative evaluation of the participatory communication experiment, it is clear that the participatory model used to provide information to farmers created a type of a trust relationship between the person who provided the information and the farmer who received the information. However, other aspects are also important and need to be taken into account, as similar case studies in other countries have shown that trained and motivated extension officers in addition to strong policies have to be in place in order to create a capable

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extension officer for this type of communication (Farooq et al., 2010; Okeowo, 2015; Sam et al., 2016).

CONCLUSION

In Suriname, it is evident that there are problems in the extension systems between MoA and farmers. The current relationship between farmers and extension officers is not optimal. There is no trust in the extension officers due to lack of agricultural knowledge. As a result, important information on sustainable agriculture does not reach most of the farmers, who produce unsafe food.

The extension officer of MoA is responsible for providing information and training to farmers, but due to the ineffective way in which information is being provided, farmers are facing many agricultural problems in the field.

The participatory experiment using introduction of 'biochar' as an innovation showed that it is possible for extension officers to have a trust relation and to effectively communicate new techniques to farmers. The experiment also showed that practical sessions on a regular basis with bi-directional information interchange with farmers as conducted in this research can be an effective method to introduce novelties and good practices.

RECOMMENDATIONS

For the transfer of technology and communicating information to farmers, the extension officers are the responsible information personnel of MoA who contribute to agricultural development by providing information on needed sustainable techniques in the agricultural sector and by assisting farmers solving their problems in the field. Therefore, the extension officers of MoA need support to enable them to work properly and to visit and train farmers regularly.

They need training in communication and agricultural subject matters as well as practical skills. For new challenges on developing appropriate extension materials and to deal with new problems identified in the field, it is recommended to have a flexible extension system.

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