Low Productivity of Onion in Côte d'Ivoire: Causes and Recommendations

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Abstract

Onion is a low-yielding vegetable in Côte d'Ivoire despite the favorable natural conditions to its cultivation. This study investigated the causes of low agricultural productivity of onion in northern Côte d'Ivoire. The survey was carried out in the regions of Poro and Tchologo, the biggest areas of onion production. Eight hundred (800) farmers in each region to make a total of 1600 farmers were investigated. The results showed that there are multiple causes of the low productivity. Among them, the most important affecting onion production are the land non-acquisition by women who are the main producers, the bad organization of onion sector, the high level of illiteracy of producers, the misuse of chemical inputs, the non-mastery of plots preparation, the non-treatment of organic manure before its application, the bad cultural association, the lack of extension and the bad road system for the flow of production to the big markets. Moreover, the instability of onion price contrary to a lot of crops is not a factor of encouragement. It is therefore recommended that the government improves the organization of onion sector, the stability of onion price, the extension services and adult literacy classes in the regions. Producers also need to be trained on animal wastes treatment before their use and on crops rotation system. Factors that affect productivity such as transportation, access to fertilizers and credit facility to farmers should also be improved.

Keywords - *onion, low productivity, Côte d'Ivoire, Poro, Tchologo*.

I. INTRODUCTION

Onion (*Allium cepa* L.) is one of the fifteen most commonly grown vegetables in the world and is used in many recipes and preparation spannings (Best, 2008; Jahromi and Amirizadeh, 2015). Onion is called "the queen of the kitchen" (Selvaraj, 1976). The bulbs are used in soups, sauces, condiments, spice, seasoning of many foods and for the preparation of value added edible products like powder, flakes and salts and in medicine (Selvaraj, 1976; Griffiths et al., 2002). A distinct characteristic of onion is its alliaceous odor which accounts for their use as food. The pungency in onion is due to a volatile compound known as Allyl-propyl disulphide. Onion has many uses as folk medicine and recent reports suggest that onion contains 11 amino acids and plays an important role in preventing heart and cancer diseases and has anti-inflammatory, anticholesterol, aphrodisiac and antioxidant properties (Augusti, 1990; Goldman, 2011; Nicastro et al., 2016). Its worldwide annual production is about 64 million tons of bulbs for 3.45 million ha (FAO, 2007). In Côte d'Ivoire, the annual demand for onions in 2015 was about 115,000 tons, while the domestic production was only about 4,500 tons (RONGEAD and CHIGATA, 2015). Because of this wide variation in supply and demand, Côte d'Ivoire was the largest onion importer in West Africa during this same period with more than 50,000 tons of imported bulbs per year (RONGEAD and CHIGATA, 2015). In this context, Côte d'Ivoire spends about 75 million dollars every year to import onions from Holland, Niger, Mali and Burkina Faso. To address this problem, the Ivorian State encouraged farmers to start producing onions in order to limit imports. To this end, the northern region has been identified for onion cultivation, which should be the essential complement to improving the living conditions of peasants and therefore a lot of inorganic fertilizers and pesticides have been distributed to producers. Because of this policy, in three years the area planted increased from 23 to 160 ha. Despite these efforts, the country has not reached half of its target because the national production was still largely insufficient and covered only 20% of national needs and this has lead to deficits in onion consumed per capita. However, Côte d'Ivoire is endowed with considerable proper agricultural land and inland fresh water resources that can be utilized for irrigation in the north for onion growth. But much of the land utilized often exhibits very low productivity. In fact, onion productivity in Côte d'Ivoire is 10 tons per hectare compared to that of Mali, Niger and Burkina Faso that ranges from 20 to 30 tons per hectare (RONGEAD and CHIGATA, 2015). The most part of the onion consumed in Côte d'Ivoire is still imported from Niger (20,000 tons), Holland (16,489 tons) and Burkina Faso (5,000 tons).

It is therefore important to investigate the factors which affect onion productivity in Côte d'Ivoire. This will help to understand the causes of this low productivity before conducting any other research activity. The present work inserts into this context and aims at expounding on the obstacles that hinder the

good productivity of onion. Moreover, the knowledge of the different causes will help researchers to better orient their research to improve the productivity of onion in Côte d'Ivoire. In this study, it was hypothesized that the low productivity is due to non-mastery of good farming practices by onion growers.

II. METHODOLOGY

A. Survey area

This study was carried out in the districts of Tchologo and Poro (northern Côte d'Ivoire) which are the most producing areas of onion (**Figure 1**). The district of Tchologo lies between latitudes 9°35 and 9°00 North and longitudes 5°11 and 5°00 West. It covers a total area of 17,728 km^2. The district of Poro is situated between latitudes 9°27 and 9°41 North and longitudes 5°38 and 5°19 West and covers a surface of 13,400 km^2.

B. Data collection

The study was conducted in two phases to collect sufficient information and cater for bias. The first step consisted of a questionnaire survey with the producers and the second step involved visits on producer's fields from the soil preparation to the harvest.

1. Producers survey

To fit our concerns, a questionnaire was drawn up. The questionnaire was relevant to the objectives of the study and the respondents involved in the study. Before beginning the work, all the producers were reassured that their responses will be handled with confidentiality and will only be used for academic purposes. They were also requested to answer the questionnaire as honestly as possible.

The questionnaire consisted of section A and section B. Section A was related to the demography of the respondents while section B contained questions covering farming skills of the respondents. The questions in the questionnaire were designed in french but during the interviews they were translated in the major local languages that are Senoufo and Malinké by the research team members. In fact, most of producers have low education levels and express their views better when they speak in their own language. All the questions were based on the growing technique and the difficulties the producers meet in their work that can affect negatively their production. In each region, 800 producers were interviewed making a total of 1600 producers in this study. These numbers of producers were sampled to get a representative population that can give the general views of the target population (Kothari, 2004).

2. Field visit

Prospecting was the first phase of the work and this was to see the different works from the preparation of the soil to transplanting. After transplanting, some regular visits were made by our team to observe the progress of the plants and the field works. All major observations were noted during the field visits.

C. Data analysis

The study employed descriptive statistical methods in order to analyze the data collected. There was cross checking of the questionnaires to ensure that the questions were answered properly. The data were first divided into themes and sub themes before being analyzed with the IBM SPSS Software. Frequencies and percentages were used in the analysis and presented in a tabular form to enhance proper interpretation of the data. The frequencies and percentages were used to determine the factors influencing onion production.

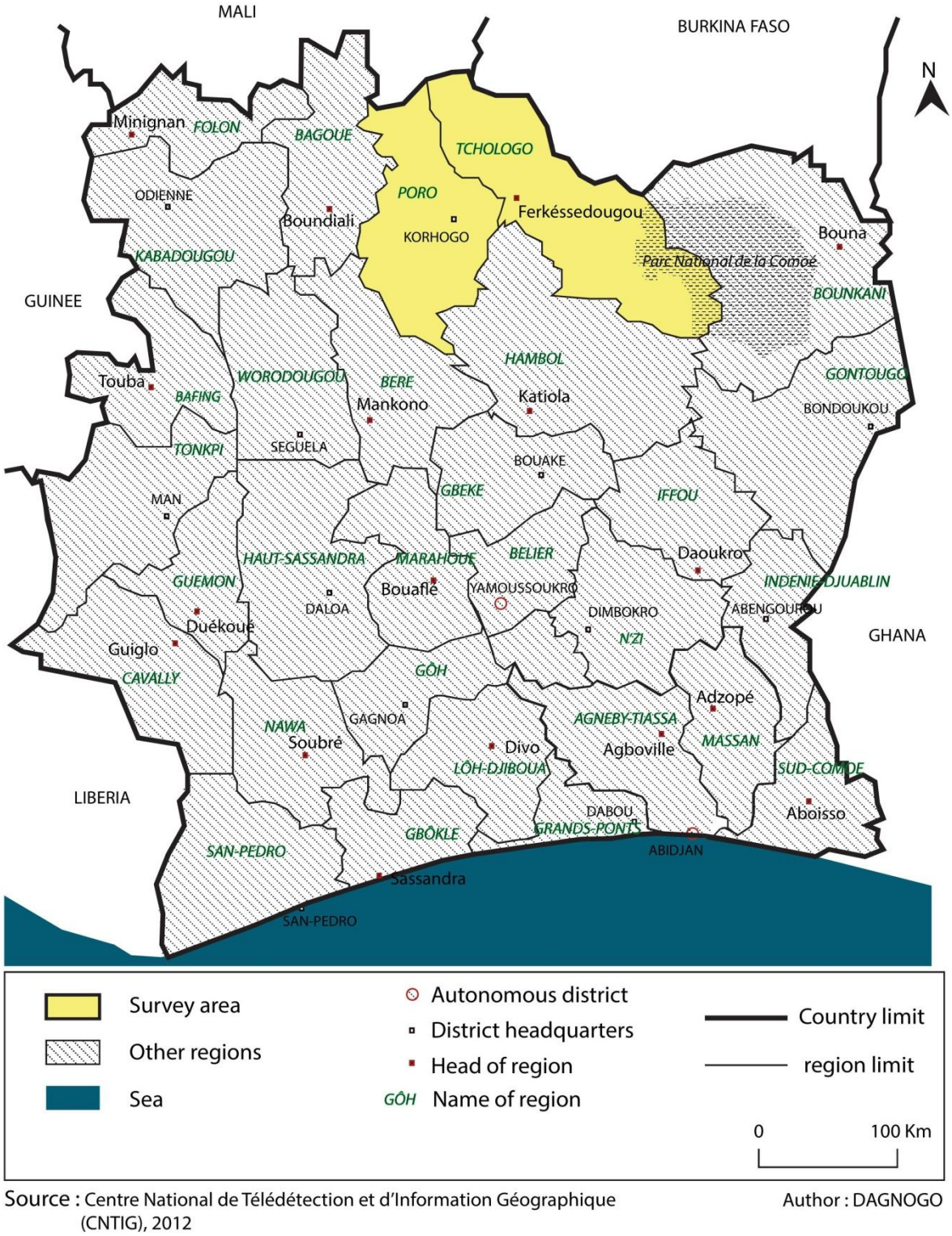

Figure 1. Map showing the regions of the study.

III. RESULTS AND DISCUSSION

The results from this questionnaire have allowed us to obtain a number of essential informations for the improvement of onion productivity in Côte d'Ivoire. According to Mugenda and Mugenda (20003), a questionnaire is a list of standard questions prepared to fit a certain inquiry. A questionnaire survey permit to measure what a person knows and the type of information he/she has, the values and beliefs of the person and the attitudes towards what the questionnaire is about (Truckman, 2000; Van Niekerk, 2002). The success of this study in getting a lot of information could be linked to the use of personal interviews that

enable the interviewer to observe behavior that the questionnaire is not designed to detect. According to Van Niekerk (2002) when conducting a questionnaire survey it is better to use an administered questionnaire for better results.

A. Influence of farmers characteristics on onion production

The study sample was 1600 subjects, all of which were onions producers in the regions of Tchologo and Poro districts of Côte d'Ivoire. The response rate was 100% and this was possible since we worked closely with agricultural extension officers who also helped in collection of the questionnaires. According to Frankel and Wallen (2004), a response rate of above 95% of the respondent can adequately represent the study sample and offer adequate information for the study analysis and thus conclusion and recommendations.

The characteristics of the onion producers in the regions of Poro and Tchologo are registered in **Table 1**. It is observed that in the region of Poro, 89.63% of onion producers were female while 10.37% were male. In the district of Tchologo, the majority of the producers were female (89.25%) and the percentage of male was about 10.75%. The higher percentages of women in both regions of Poro and Tchologo could be explained by the fact that gardening crops are considered as unprofitable crops by men. In the north of Côte d'Ivoire, cash crops such as cotton, cashew, sugar cane, etc. and some food crops like corn, rice, etc. are considered as the most profitable crops and are grown by men. In contrast, vegetables crops such as onions are considered generally as secondary crops, tedious crops that do not earn much money and therefore are reserved to women. In addition, mining in the Poro and Tchologo areas, as well as the immigration of young people to Europe or to the big cities have considerably reduced the number of men in agriculture. The results also showed that almost all the producers are illiterate and married. However, the illiteracy rate of women was higher than that of men. These factors could influence negatively the onion production. In fact, education is fundamental to development. According to Amin and Awung (2005), education is a growth factor as it increases labour productivity, and reduces income inequality and poverty. Günaydın (2006) found a positive correlation between farmer's education and agricultural production increase in Turkey based on the principle of "learning by doing". Our result is higher than the 75% recorded by INS (2015) as the illiteracy percentage in rural areas of the north of Côte d'Ivoire. Also important to note is that all the producers of onion in this study were married. This leads women to consider first the work of the main farm that belongs to the husband. In fact, in the north of Côte d'Ivoire, the biggest fields are those of cash and food crops and maintaining works of these fields are prior than those of the vegetable crops that are supposed to belong to the wives. Thus, women don't get enough time to work in their fields and that can affect negatively the productivity. Moreover, women grow more onion during the dry season after the harvest of the main farm. During this period, vegetables producers are confronted to the lack of water to irrigate plants.

Table 1. Characteristics of onion producers

Region	Gender	Frequency	Percentage	Illiteracy rate	Marriage status (%)
Tchologo	Male	83	10.37	0.96	100
	Female	717	89.63	0.99	100
Poro	Male	86	10.75	0.88	100
	Female	714	89.25	0.98	100
Total	-	1600	-	-	-

B. Adopted farming practice and onion productivity

The different parameters related to the type of organic fertilizer used, the type of cultures grown by producers, the mastery of the cultural technique, the practice of alternating cultures and the yield are shown in **Table 2**. In the region of Poro, 100% of onion producers are using both mineral fertilizers and organic fertilizers. On the other hand, 65.22%, 4.35% and 30.43% of onion's producers are using respectively inorganic fertilizer, organic fertilizer and the mixture of both of them. It also appears that in the region of Poro, 69.23% of the producers got a low productivity and 30.76% of them obtained a medium productivity. In the region of Tchologo, 95.65% of onion producers harvested a low yield and 4.35% a medium yield. The mixture use of chemical fertilizer and animal manure in the region of Poro could be linked to animal dung availability in that region. According to Le Guen (2002), the region of Poro is the cotton-corn and animal breeding area in the north and that makes animal wastes available. Moreover, cotton and corn are crops whose productivity relies on a lot fertilizer and onion producers generally use their inorganic fertilizers for these crops. The fertilization of onion plots is done with the rest of the main crops and completed with animal dung which is assumed to increase onion productivity. During our visits, several diseases related to fungi, nematodes, insects were noted on plants in the region of Poro. That could be linked to the use of animal wastes as fertilizer. Although animal waste has undeniable agronomic value, its utilization without preliminary treatment in

agriculture has drawbacks and limitations. In fact, when brought, the decomposition of dung is accelerated by decomposing organisms that also attack everything below ground including roots of the plants and therefore causes a lot of diseases followed by the death of the plants and hence reducing the productivity. Contrary to the region of Poro, onion producers used more mineral fertilizers in the Tchologo. Despite the use of fertilizers the productivity of onion was still low. That could be due to the misuse of inorganic fertilizers that might provoke the acidification of the soil and therefore prevent plants from absorbing nutrients. According to Ogbodo (2013), the application of inorganic fertilizer can lead to very strongly acidic soils and therefore leading to soil poverty.

Also, the results showed that in the regions of Poro and Tchologo respectively, 94.87% and 84.78% of producers mastered the cultural technique of onion. But during, the preparation of the plots in the dry season, producers burned the crops residues on the field which were supposed to serve as organic fertilizers after decomposition. Unfortunately, after the burning, the ash was blown away by the wind before the planting. Nevertheless, the ash contained the nutrients that could fertilize the soil and consequently reduce the soil acidity. The mastery of cultural techniques of the producers could be linked to their experience in onion culture. More than 50% of the producers were intercropping onions with other vegetables. The intercropping could create a competition between crops for nutrients and that could reduce nutrients per plant. That competition might negatively affect onion productivity. According to Weiner (1993), it is rare to find a plant which has not been affected negatively by neighboring plants. Almost all plants are negatively affected by neighboring plants and that effect is due to the depletion of some limiting resources. It has also been shown that some plants release chemicals into the environment which reduce the growth and survival of other plants and therefore reducing crop yield (Harper, 1977; Holliday, 1960).

Table 2. Onion **f**arming systems in the regions of Poro and Tchologo

M : Mineral ; **O :** Organic

Category		**Proportion of producers (%)**	
		Poro	**Tchologo**
Type of fertilizer	M	00	65.22
	O	00	4.35
	M+O	100	30.43
Type of culture	Onion	41.02	43.48
	Onion+other vegetables	58.97	56.52
Mastery of the cultural technique	Yes	94.87	84.78
	No	5.13	15.21
Practice of alternating cultures	Yes	100	100
	No	00	00
Yield	Low	69.23	95.65
	Medium	30.76	4.35
	High	00	00

Data on crop type and family load are summarized in **Table 3**. In the region of Poro, the proportion of producers growing onion only or onion associated with other vegetables varied in function of the family load (number of the children). The results revealed that with 0-1 child, the number of producers growing onion only (68.75%) was higher than that of the producers cultivating onion and other crops (31.25%). Beyond 1 child, the proportion of producers associating other vegetables to onion was higher than that of those who grew onion only. This proportion was increasing when the number of children rose. Similar observations were made in the region of Tchologo. In fact, 70.10% of the producers who had 0 to 1child cultivated onion only when 29.9% associated onion to some vegetables. Except the producers who had 0-1 child, 60.94% of the growers who got 2-5 children and 65.38% of those who had more than 5 children combined onion with other vegetables. This kind of onion growing practice seems to be linked to the family load in the two main regions. The low productivity of onion might encourage producers to combine it with others vegetables to increase their income. Moreover, in these regions of Côte d'Ivoire, producers who associated onion with some other vegetables might do it for the family feeding. Thus, the more the family is big, the more the intercropping of other vegetables with onion is. The diversification of crops produced could potentially permit them to sell their crops at different times of the year and this helps them to undergo the variation of the vegetables prices. Moreover onion prices in rural areas are not stable and

producers diversify their crops for seasonal stabilization of farm income to meet other basic household needs such as children's education, household subsistence, food and nutrition needs, and a reduction of risk of overall farm returns by selecting a mixture of activities whose net returns have a low or negative correlation whilst lessening price fluctuations. Similarly, Djokoto et al (2017) observed other vegetables in a field of *Amaranthus spp*, an African vegetable in Ghana. They explained their result by a way for farmers to suffer less from the variation of vegetables prices.

Table 3. Practice of the type of culture and the family load

Regions	Number of children per producer	Proportion of producers (%) growing	
		Onion only	Onion + other crops
Poro	0-1	68.75	31.25
	2-5	26.61	73.39
	+ 5	18.75	81.25
Tchologo	0-1	70.10	29.9
	2-5	39.06	60,94
	+ 5	34.62	65,38

C. Type of farming system in function of producers experience

In the region of Tchologo, 36.36% of producers experienced of 0-5 years and 63.64% experienced more than 5 years grew onion only. Among the producers who associated onion with other crops, 18.18% of them were 0-5 years experience and 81.82% were more than 5 years experience in onion farming (**Figure 2**). Contrary to the region of Tchologo, 50% of producers experienced of 0-5 years grew onion only and also associated onion with other vegetables in the region of Poro. The results also showed that 65.38% of those experienced more than 5 years grew onions only and 34.62% grew onions and other vegetables (**Figure 3**). These results could be explained by the fact that in the region of Tchologo, onion is grown by people of a certain age and therefore have an experience. The youth might be more interested in some crops like cashew, sugar cane, corn, rice, etc. which are considered more profitable crops than onion. Also the highest number of producers diversifying their cultures was more than 5 years experience in onion farming. That could be explained by their despondency due to the low price of onion. Thus to increase their income, onion growers diversify their culture. According to onion producers, onion is not an earning crop compared to cashew, sugar cane. Onion sector is not well organized as the other sectors and its prices in rural areas are not fixed since they depend on the buyers. In fact, after the harvest, the buyers go in rural areas to buy onion basing on their financial means and not basing on the price fixed by the government. Moreover, the poor state of the road network in Côte d'Ivoire affects the buyers who travel to rural areas to purchase onions. There is also the issue of non-tracking of the onion sector by the state of Côte d'Ivoire despite the distribution of agricultural inputs to producers. The lack of subsidies for onion growers in contrast to cash crop growers also influences negatively the devotion of producers. The majority of young experienced producers from 0 to 5 years in the region of Poro who grow onions only can be linked to better onion prices in this region compared to those of Tchologo. Indeed, the Poro is the most developed region of the northern Côte d'Ivoire because it includes the capital of the savannahs. In addition, the road system is more developed and this facilitates the purchase of onion in rural area contrary to the area of Tchologo. Also, producers can often easily transport their production to the capital for sale.

IV. RECOMMENDATIONS

The study sought to investigate factors influencing onion production among producers in the regions of Poro and Tchologo with an aim of suggesting corrective measures so as to improve onion yield, to attain food security and to improve income levels among households.

A. Improvement of the land law and fairness of the price of agricultural products

In northern Côte d'Ivoire, land never belongs to women but rather to men. This means women are not independent in the choice of culture and the period of culture. If the law allows women to have the right to land in the same way as men, it will allow them to grow onion on a larger scale at the right time and maintain the fields clean. Also, the unstable of onion prices, lack of organization of the sector discourage onion producers. The State of Côte d'Ivoire must organize the sector and fix onion prices as other cash and food crops. Moreover, the Ministry of Agriculture needs to help onion growers by allocating them credits. Producers need to be organized into cooperatives so that the production can be pooled and sold easily. When organized, a lot of men will be interested in onion culture and it will not be considered as a second culture.

B. Strengthening of extension services

During the investigation, it was noticed that there were some inefficiencies in plots preparation and fertilizers application. It would be necessary to strengthen the training of the producers through field extensions. Since extension services contribute more to agricultural productivity, government investment in

agriculture should be channeled towards the provision of better extension services. The Ministry of Agriculture and rural Development should transfer more extension officers to the different regions and provide them with motorbikes to facilitate easy movement among communities most especially to the hinterlands. Some farmers also refuse to patronize the extension services provided but have problems with pests and disease management on their farms. Extension officers should be trained to practice evidence-based teaching whereby things taught will be practiced on a sample farm with community members monitoring progress so that when other farmers see the results, they will change their perceptions and apply the lessons taught. Also, individuals in communities who are respected and acknowledged by community members can be trained and used as advisors to farmers so that they can be a link between other farmers and extension officers.

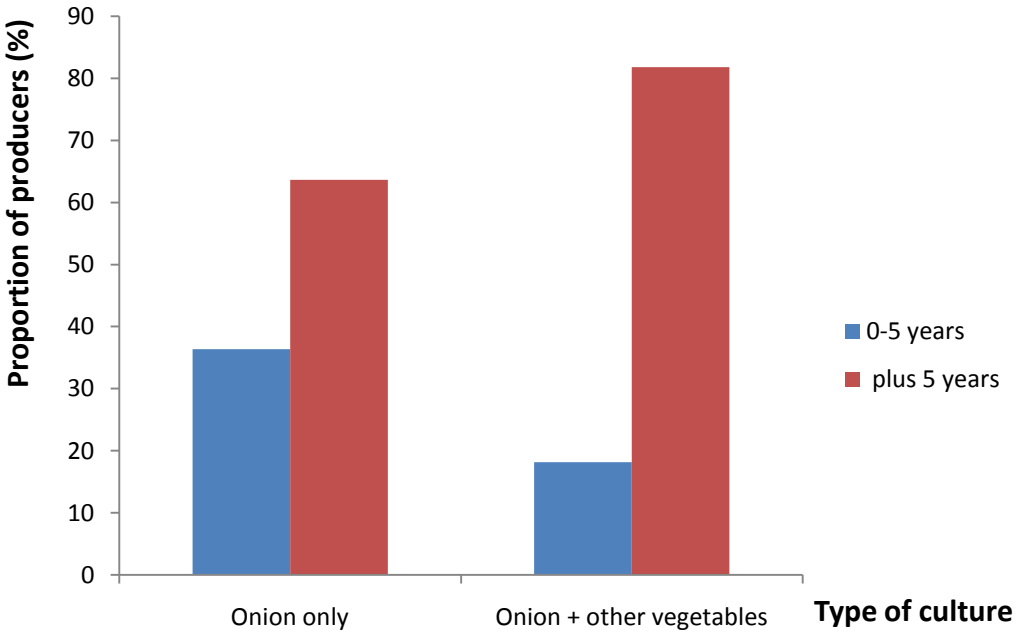

Figure 2. Type of culture in function of producer's experience in the region of Tchologo

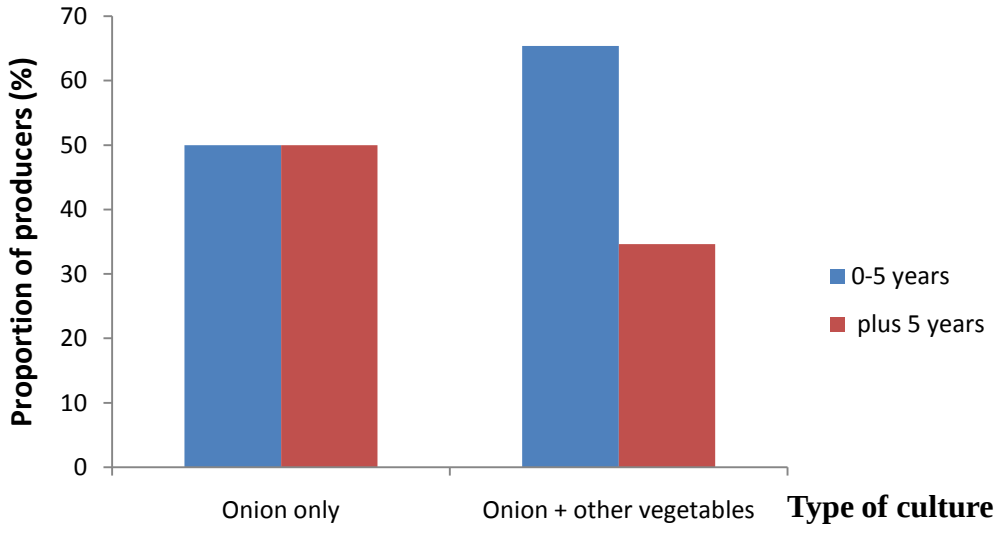

Figure 3. Type of culture in function of producer's experience in the region of Poro.

C. Government investment in roads sector and agricultural equipment

In Côte d'Ivoire, there is a real need to improve the state of the roads in rural areas. Also, there is a lack of agricultural equipment. Thus, for productivity to increase in agriculture there should be a right mix of all the factors that affect productivity and the government in investing in agriculture must consider this. The Ministry of Agriculture should consider subsidization of input and equipment used for agricultural purposes. The Municipal Assembly should make sure that roads leading to farming areas are frequently graded and bridges built over streams to enable easy movement of produce from the farms to the markets.

D. Education of farmers

Poro and Tchologo are among the regions with an illiteracy rate above 85% in rural areas. Thus, there is an urgency to raise the level of literacy of farmers in rural areas to reap the benefits that education has on agricultural productivity. The channel through which this can be done is through adult literacy classes. It was found out during the study that a few farmers in the study area have access to adult literacy classes but still insufficient. Adult literacy classes are a great channel that can be exploited because enhanced literacy gives farmers confidence in decision making and enables them to read instructions, gives a better understanding of issues confronting agriculture. The Non-formal section of the Educational Directorate can train basic school teachers and other literates in the communities to hold the classes and teach the illiterates so that more farmers will learn basic literacy and numeracy to enhance their agricultural activities.

V. CONCLUSIONS

At the end of this study, it was noted that beyond the lack of the non-mastery of certain aspects of the cultural technique, other factors hinder the productivity of onion in Côte d'Ivoire. The main ones highlighted by this study are the problems of land acquisition by women, the bad organization of the onion sector, the misuse of chemical inputs, the non-treatment of animal wastes before their application, the bad cultural association and the bad road system for the flow of production to the big markets. In addition, it is necessary to add the bad agricultural policies which do not encourage the producers of onion because of the very low purchase prices compared to other crops and the very high levels of illiteracy. The State of Côte d'Ivoire must therefore have better monitoring of the onion sector to address these problems.

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