

# UNLOCKING THE PROFIT POTENTIALS OF INNOVATIONS. A CASE STUDY OF THE IITA PLANTAIN AND BANANA HYBRIDS.

B.O. FATUROTU., G. N. EMAH., B. I. ISIFE., A. TENKOUANO., T. A. ADENIJI., and J. LEMCHI

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## ABSTRACT

Plantain and banana hybrid varieties that are resistant to black Sigatoka disease (a leaf disease reported to have caused between 30-50% yield loss in plantain across the world) were disseminated by IITA plantain improvement programme in three southern states of Nigeria. This study was designed to determine the profit potentials of these disseminated technologies. Ninety farmers from fifteen villages spread across the three states were sampled and percentages applied for data analysis. It was revealed that the main disseminated technology (plantain hybrid) was fairly adopted in the three states: Bayelsa 46%, Akwa-Ibom 38% and Rivers 36%. The hybrids were disseminated in a package that was established to have influenced high adoption rates in the components that had high profit values. Such components include sucker production in which 45% of the respondents recorded more economic returns (money) than even fruit sales, post harvest utilization was also revealed as a main source of income in the disseminated technology as potential waste from wind damage and over ripening were turned into products such as flour (which 93% of the respondents have adopted) and fruit juice respectively. The respondents as a result of the technology recorded a high profit margin of N37, 063 extra income per hectare. The regression analysis revealed that only two variables, plantain and banana constraints identification and number of innovation adopted had predictive values for the IITA hybrids adoption ( $R=0.87$ ). It was concluded that agricultural technology dissemination should be approached in a total way with motivational factors to cater for glut that may result from massive production, adoption and yield increases as well as ways to ensure steady and continuous innovation spread through organized seed/planting material production.

**KEYWORDS:** Black Sigatoka, profit potentials, motivation factors and adoption.

## INTRODUCTION

Plantain and banana are among the most important staple food crops in humid forest zone of West and Central Africa. Improved socio-economic conditions in the recent past have suddenly increased the use of the crop as a staple food in urban and rural communities, in spite of the soaring prices occasioned by short supply, poor and inefficient production systems. In West and Central Africa, banana and plantain are an important part of the fight against poverty. This is due to the crops contribution to food security, employment, diversification of income sources in rural and urban areas, and contribution to the gross national product (GNP) (Nkendah and Akyeampong, 2003).

Bananas are mostly eaten raw as a dessert fruit, because in the ripe state they are sweet and easily digested. Plantains are generally much starchier and can be eaten ripe or unripe. They are usually boiled, fried or roasted (Robinson, 1996).

Plantain production is relatively efficient, given the limited resources available in traditional production systems. Plantain grows well in areas of heavy rainfall, 1250 - 3000mm per annum (KariKari, 1972), or 100mm per month (Swennen, 1990) where winds do not prevail, and rains are evenly distributed. Plantain can tolerate different types of soils but because of its shallow root system, it does best in well-drained soil rich in organic matter.

Important threat to plantain & banana production in Africa includes black Sigatoka disease, weevils and nematode attack as well as low propagation rate (planting materials) and its perishability. These constraints propelled researches aimed at counteracting the limitations. IITA plantain and banana hybrids offered farmers the opportunity of bumper harvest as they are not only resistant to these diseases and pests but they also combine high yielding and flexibility of processing into many home and industrial products. Eleven varieties were deployed to the farming system in the southern states of Nigeria plantain growing belt. The varieties were: PITA 14,

PITA17, PITA 26, BITA3, FHIA17, FHIA18, FHIA20, FHIA23, FHIA25, CRBP39 and Agbagba (Landrace check). Agronomic practices and maintenance were the same for all the varieties and they had similar but slightly different physiological characteristics. These hybrids produce suckers profusely which allows for rapid multiplication and the fruits though many are shorter than the landrace. Infact, this was the initial concern of disseminators. The technology dissemination was not limited to hybrids plantlets dissemination. Other packages such as sucker multiplication (macro propagation techniques), post harvest utilization techniques ensures a turning of waste to wealth as all the plant parts as well as all stages of maturity and ripening even over ripening can be converted to one cash spinning and nutritious products or the other (Adeniji et al, 2004).

Cochrane (1979) stated that a key issue in the economics of innovation and adoption is to understand the impact of technology change on prices and, in particular, the well being of the population overtime. When a supply increasing innovation is adopted to a significant degree, it will lead to reduction in output prices, especially in agricultural commodity with low elasticity of demand. Thus, Cochrane (1979) argues that the real gainers from technology change and innovation in agriculture are likely to be consumers, who pay less for their food bill.

This paper therefore sets out to unlock the profit potentials and impact of the IITA plantain and banana hybrids in three states of the southern Nigeria.

## MATERIALS AND METHODS

The study covered Akwa-Ibom, Bayelsa and Rivers, which are located in the Niger Delta area of Nigeria, where plantain and banana is regarded as a major traditional food crop. Five villages were purposefully selected from each of the states with particular bias to the Agricultural Development programme (ADP) operating zones in these states. These five villages in the pilot project had five farmers one per village,

**B. O. Faturoti**, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

**G. N. Emah**, Rivers State University of Science and Technology, P.M.B. 5080, Nkpoolu, Port Harcourt, Nigeria.

**B. I. Isife**, Rivers State University of Science and Technology, P.M.B. 5080, Nkpolu, Port Harcourt, Nigeria.

**A. Tenkouano**, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

**T. A. Adeniji**, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

**J. Lemchi**, International Institute of Tropical Agriculture, P.M.B. 5320, Oyo Road, Ibadan, Nigeria.

thereafter random selection was done to select five farmers per each village plus the original one pilot farmer to whom the innovations were initially disseminated in the state. Thus six farmers were interviewed in each of the selected villages making up a total 30 respondents per state and 90 in all.

Data were collected in two phases. The first one being the data from researchers and extension agency to provide background for the innovations developed and disseminated to farmers, while their prospects for adoption were being studied. The second phase was basically the individual farmer's field survey and interview.

These data revealed that fourteen Plantain and banana-based technologies were developed and disseminated through the extension outfits for farmers' adoption in the study area. These included disease resistant hybrids; PITA 14, PITA17, PITA 26, BITA3, FHIA17, FHIA18, FHIA20, FHIA23, FHIA25, CRBP39 and Agbagba (Landrace check), selection of planting materials, selection of land (soil), cropping system (intercropping method), weed control methods and rapid sucker multiplication techniques as well as fertilizer usage and post-harvest processing techniques. Farmer's data was gathered through interview schedule and structured questionnaire. Adoption was defined as the acceptance and sustained use of the technology over a time period. Since this technology was disseminated in 2001, its adoption index was

then calculated by dividing the number of innovations practiced by number of innovations disseminated, multiplied by 100. The data was analyzed using SPSS for windows version 10 (1999), for frequency counts and percentages as well as correlation and regression analysis, which revealed the predictive variables for adoption.

## RESULTS AND DISCUSSION

The respondents' revealed four sources of planting materials. Gift source accounted for 11.8%, old-field 43.5%, purchase sources 42.4% while research and extension sources accounted for only 2.4%. This suggests that plantain-farming experience played a major role in its spread and innovation testing as farmers still relied heavily on their old-fields for planting materials. Another implication of this finding is that, apart from fruits sales in plantain production, sucker sales possessed the potentials to generate income especially in Bayelsa where 80% of the planting materials were purchased (Fig1). Of the 90 farmers interviewed 45% made more money from sucker sales than from fruits, a result of attraction to the hybrids by other members of the communities who have seen the obvious advantage of the hybrids, and felt motivated to pay the pilot farmers for the hybrid suckers from plantain and banana stock supplied free by IITA to the pilot

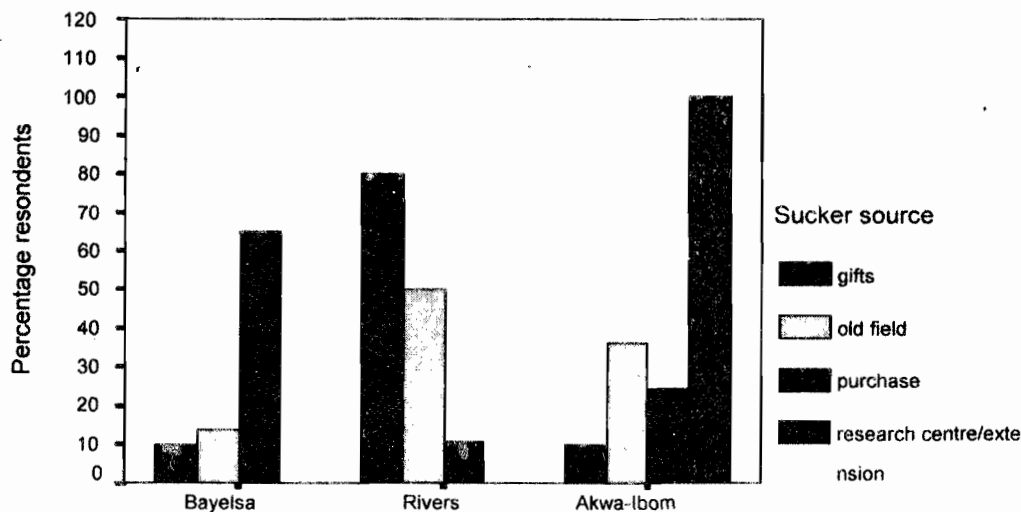


Fig. 1: Sources of planting materials by state.

The frequency of respondents as related to type of plantain and banana variety grown showed that 34.1% of the respondents grew only local variety, 2.4% cultivated only the hybrids varieties while 63.5% of the respondents cultivated both improved and local. Fewer respondents grew hybrids/landrace in combination, in Bayelsa (46.67%) while Rivers (80%) and Akwa-Ibom (64%) had overwhelming number of respondents growing hybrids and landrace in combination. This mixture of hybrids and landrace materials inter planting is an adoption of the concept of varietal mixture trial by IITA (inter planting hybrids with landrace in orderly arrangement) to the pilot project farmers, wherein the hybrids served as a bio-pesticide to slow down *black sigatoka* symptoms and improved the yield of the hybrids. This showed that the respondents preferred to plant the new hybrids in association with their own varieties while looking out for comparative advantage in the innovation. This is in agreement with Rogers and Shoemaker (1971).

Post harvest processing innovation adoption results (table1), revealed that 69.4% of the respondents had post-harvest processing awareness, while only 12.9% of the respondents adopted the innovation. Though adoption of this variable is evolving, 93% of the respondents processed their products into flour. Price sample of this product showed a price of N450 (\$3) for 0.5kg package (table2). Other products are yet to be adopted at considerable level but the obvious value added to the plantain and banana hybrids had brought about adoption and extra income to the respondents as attested to by 15% of them (6% in Akwa-Ibom, 7% in Bayelsa and 2% in Rivers) (fig 2). The rather low adoption rate of post-harvest processing of plantain may be traced to the complexity of the innovation and the capital outlay needed to adopt it. This is in agreement with the report of Lehvall and Wahblin (1973) explained that communicability of an innovation and its degree of complexity affects adoption.

**Table 1: Post-harvest processing awareness / adoption level**

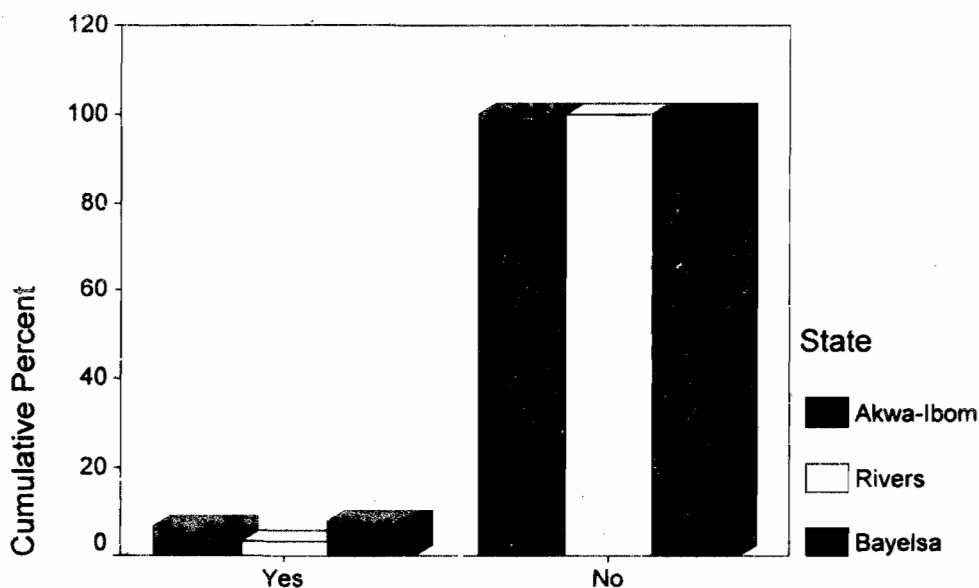
Post harvest awareness level	Frequency	Percentage	Post harvest adoption level	Frequency	Percentage
Aware	59	69.4	Adopted	11	12.9
Not Aware	26	30.6	Not adopted	74	87.1
Total	85	100	Total	85	100

Source: Field survey 2004.

**Table 2: Post-harvest product and pricing regime.**

Products	Respondents frequency	Respondents %	Average product price
Flour	79	93.03	N450 / 0.5kg pack
Juice	5	5.8	N100 / 50cl
Cake	1	1.17	N100 / 100g pack
TOTAL	85	100	

Source: Field survey 2004.



**Outstanding income from processing**

**Fig.2: Respondents with outstanding income from plantain processing**

Source: Field survey 2004.

Various sources of awareness were identified, the highest source of the innovations' awareness in Bayelsa was extension agents (33%) while the lowest was field day (7%), the number of field days to popularize the innovations in Bayelsa and Rivers State were extremely low. Rivers had the highest source of awareness from fellow farmers (63%) and the lowest source from field day (3%). Akwa-Ibom had the combination of ADP, farmers and field day as the highest source of awareness (32%) and fellow farmers (8%). On the whole, the major source of awareness from the respondents in the three states was farmer – farmer source

which accounted for 30.3% source of awareness, followed by extension agent's source (20%), then field day (7.1%) and research staff (7.1 %) awareness. The least source of awareness was from Radio (1.2%), (Fig 3). On this basis it is recommended that dissemination efforts should target established and liberal farmers from whom diffusion could then be achieved. This is in agreement with the ideal of Training and visit (T&V) as proposed by Benor and Baxter (1984), which recommended the use of contact farmers to demonstrate and spread innovations.

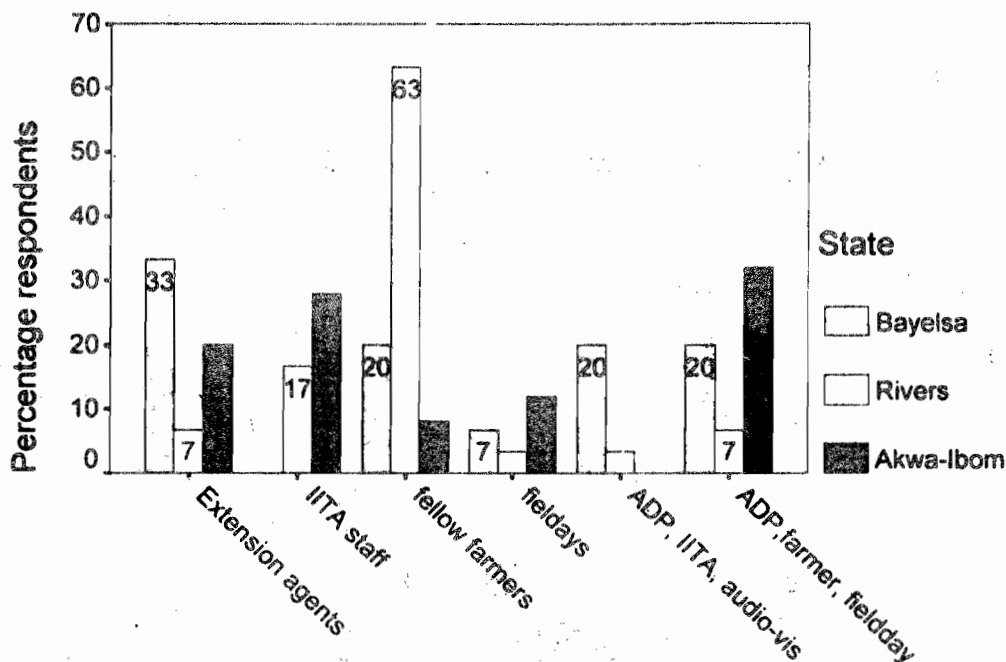


Fig. 3: Sources of Awareness by State

Technology dissemination of the type in this study demands constant and guided visits to induce and sustain adoption. From table 3, data revealed that 48.2% of the respondents confirmed a no visit/ occasional visits by extension agents, while only 17.6% of the respondents had fortnight visitation from extension agents. The worst farmer-extension contact was recorded in Rivers with 66.7% respondents having no contact with extension agents (table3), from the result, it could be said that there is a weak relationship between extension agents and the respondents (farmers), and this could have negative consequences on

adoption. Adesina et al (1995) elaborated on the consequence in Africa. Extension is expected to assist in answering farmers' questions and remove constraints encountered by farmers in climbing the adoption ladder. Where these extension roles are absent or low, a low adoption rate should also be expected especially with complex innovations. This might have partly accounted for low adoption of post harvest processing innovation, herbicide innovation, debudding innovation and hot water treatment innovation in this package.

Table 3. Frequency of Extension Visits

Class	Time of Visit	Combined Frequency	Combined Percent	Bayelsa Percent	Rivers Percent	Akwa-Ibom Percent
1	Fortnightly	15	17.6	0.00	6.67	52.0
2	Monthly	18	21.2	50.0	6.66	8.0
3	Quarterly	11	13	0.00	16.67	20.0
4	No visit	33	38.8	30.0	66.67	16.0
5	Occasionally	8	9.4	20.0	3.33	4.0
	Total	85	100	100.0	100.0	100

Source: Field survey 2004

Figure 4, revealed that the highest income class range was ₦10,000 - ₦50,000 by 33.3% of the respondents, 26.2% of the respondents made between ₦1 - ₦10,000, while ₦11,000 - ₦20,000 and ₦21,000 - ₦30,000 income classes were 11.9% each of the respondents respectively. The respondents in the income bracket of ₦51,000 - ₦80,000 and ₦81,000 - ₦400,000 accounted for 7.1% of the respondents each. An often overlooked potential of seed market in agriculture accounted for a major breakthrough in the study, as sucker sales generated significant income for the respondents. Infact 45% of the respondents had formed a cottage industry from sucker production

These extra income as a result of the IITA Plantain hybrids technology adoption, when viewed with the area of respondents' farmland used for plantain, showed 92.9% respondents having 0.1-3.5 hectares planted to plantain, which generated enormous monetary reward (Fig 4). The total amount of extra income realized by the respondents as a result of the innovation was ₦1,823,500 while the total area planted to plantain by the respondents was 49.2 hectares, this translates to ₦37,063 extra income from the technology per hectare.

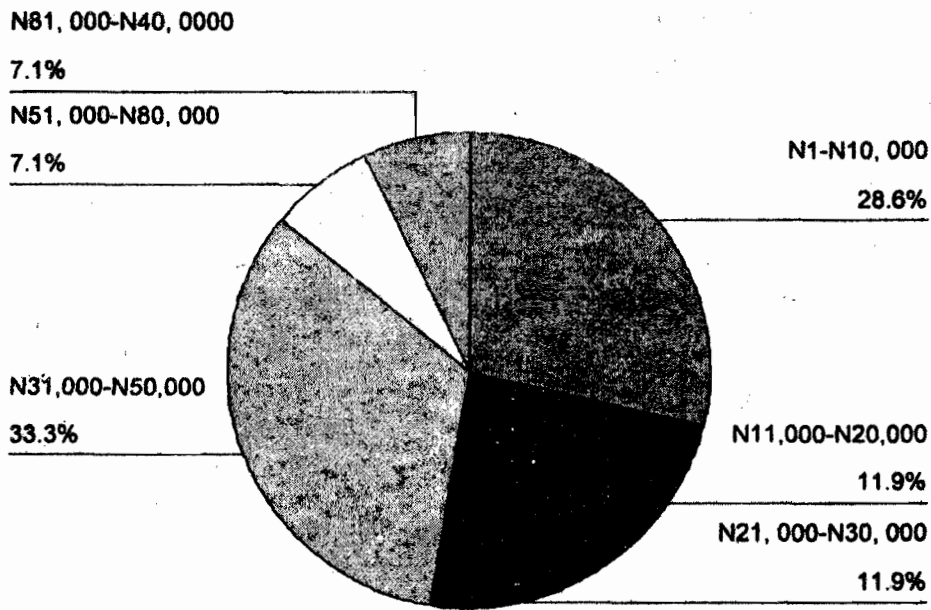


Fig.4: Profit as a result of technology.

Source: Field survey 2004.

The rate of adoption of the new hybrids disseminated in the states was slightly different from state to state. Bayelsa state had the highest rate of 46% followed by Akwa-Ibom State (38%) and Rivers State (36%) fig 5. The organized major

plantain and banana market situated in Bayelsa state and the high enthusiasm generated by the project farmers in the state may have accounted for better adoption rate in the state.

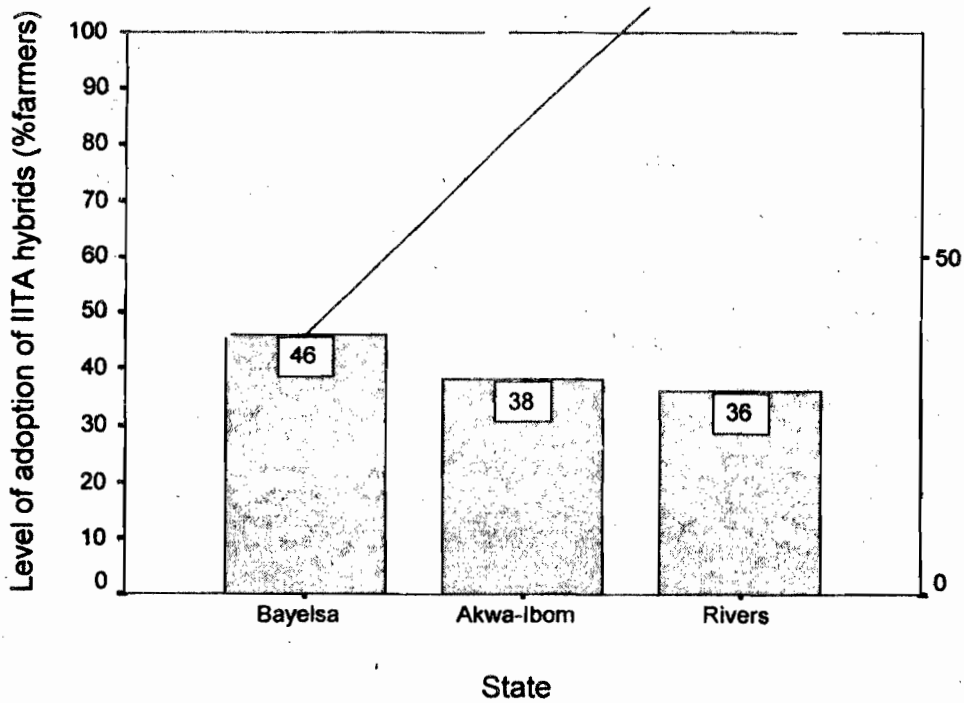


Fig. 5: Adoption level of IITA plantain and banana hybrids.

Correlation analysis revealed some variables with positive significant relationship with the new hybrids adoption. The variables were, age of farmer ( $X_1$ ), marital status ( $X_2$ ), size of household ( $X_3$ ), plantain and banana production constraints identification ( $X_4$ ), interviewer ( $X_5$ ), frequency of extension visits ( $X_6$ ), experience since innovation awareness ( $X_7$ ), yield/income increase ( $X_8$ ), market distance ( $X_9$ ) and number of innovation adopted ( $X_{10}$ ). These variables were subjected to regression analysis to ascertain their predictive effects on adoption.

The regression analysis revealed that, the variables pooled together explained 75% of the new hybrids adoption ( $r = 0.87$ ). The linear regression model used was  $Y = a + bx$ , where;

$Y$  = new varieties adoption (Dependent variable)

$a$  = constants

$b$  = regression coefficient and

$x$  = independent variables ( $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}$ )

Substituting the models therefore.

New hybrid adoption =  $1.034 - 0.0184 X_1 + 0.0017 X_2 - 0.0050 X_3 + 0.0009 X_4 - 0.0035 X_5 + 0.0071 X_6 - 0.013 X_7 - 0.0041 X_8 + 0.032 X_9 + 0.500 X_{10}$ .

( $P < 0.01$ ;  $SE = 0.088$ ;  $r = 0.87$ ,  $r^2 = 0.754$ )

This regression analysis explained that 75% of the new hybrids adoption was attributed to these ten variables, but only three of the variables had statistical significant association with the adoption of new hybrids. The significant variables were age of farmers, constraints identification and number of innovation adopted. The contribution of farmers' age on adoption of new hybrids, which is significant but negative, revealed that younger farmers had a higher propensity to adopt new innovations as they are more daring and can easily seek for help. In the same vein the influence of plantain and banana constraints identification on adoption could be explained in that interventions were tailored to constraints identified during the exploratory/baseline survey conducted before the dissemination. The respondents also seemed to have been endeared to the disseminators, as the innovations were perceived to target their jointly identified problems during the exploratory survey. The innovations must have been seen as evolving from their needs for interventions to declining yield and disease prevalence. In the same vein the influence of the number of innovations adopted may be as a result of the facts that the innovations were disseminated in a package that had fourteen sub-innovations with implications for yield increase. The chances of adoption of the main innovation (new hybrids varieties) increased with the adoption of more innovations in the package most of which are culturally and visibly profitable to the farmers as they addressed both increased productivity and post harvest storage loss.

## CONCLUSION

This study concluded that originators/disseminators of innovations should package innovations with obvious motivational factors that present flexibility for users. Since innovations are primarily meant to improve the lots of the end users, the potentials for economic gains when made obvious will no doubt encourage adoption. Exploratory survey of the end users to gather their perceived problems and resources made at the beginning of the study as well as regular contacts

of originators with the end users (farmers) are necessary precursors of adoption as revealed by this study. Since originators of innovation (research) are not the traditional disseminators, national agricultural systems saddled with these roles need to be strengthened and should also live up to expectation.

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