International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET22913

Assessing the effects of training on rice farmers' yield. The case of JICA training on sustainable rain-fed lowland rice production technology in the Northern, Savanna and North-east Regions in Ghana

Adams Issahaku*[1], Francis K. Obeng[2], Richard W. N. Yeboah[3]

*[1]Faculty of Business, Department of Secretaryship and Management Studies, Tamale Technical University, Ghana

[2]Faculty of Agribusiness and Applied Economics, University for Development Studies, Ghana

[3]Faculty of Agribusiness and Applied Economics, University for Development Studies, Ghana

Article Info
Volume 9, Issue 1
Page Number : 41-54

Publication Issue :
January-February-2022

Article History
Accepted : 09 Jan 2022
Published: 19 Jan 2022

ABSTRACT

The consumption of rice has increased at an increasing rate globally with greater number of consumers deriving high calories through rice, hence the need for training of rice farmers to help increase its production to meet such high demand. This notion informed Japan International Cooperation Agency (JICA) to collaborate with Ministry of Food and Agriculture (MoFA) and Government of Ghana (GoG) to train rice farmers in Ghana specifically in the Northern, Savana and North-east Regions. The 'rain-fed lowland rice production technology training', which was intended to increase rice production and profitability of rice farmers in the selected regions was carried out successfully within the project time frame. This study sought to evaluate the success of the training along two key objectives - ascertaining the extent to which the training has contributed to increase in rice yield (per hectare) of farmers in the selected areas and assessing the correlation between the components (land development and rice cultivation) of the training project on rice yield in the selected areas. The findings revealed the there was increase in rice farmers yield per hectare after the training and there was also a positive correlation between land development as a component of the training and rice cultivation in the selected area. The research recommend that MoFA should endeavour to replicate the JICA training on rain-fed lowland rice production technology across all rice production areas in Ghana.

Keywords : Training, Yield, Evaluate, Rice-cultivation, Effects, Sustainable, JICA

I. INTRODUCTION

Rice has become and remain a major food cereal all over the World with an increase consumption rate. It is observed that over 3.5 billion people consume rice as their major food item deriving more than 20% of their calories need daily (CARI 2017; Demont & Stein, 2013) and rice serves as a main food consumed by about 2.7 billion people in Asia, and it provides between 20% and 35% of the calories they consume (CARI 2017,

Kadiri, et al., 2014). Rice has always been a staple food for some countries in Africa and is now the most rapidly growing food source across the continent (Tsujimoto et al, 2019; USDA, 2018). This rapid growth of rice as food source is fuelled by the rate of urbanisation in Africa, which is greater than any other region in the world and this means a shift towards convenience food, hence, rice (Tsujimoto et al, 2019; van Oort et al., 2015; Tiamiyu, et al., 2015; African Rice Centre, 2011). However, the production of rice in Africa falls short of quantity needed for domestic consumption and this has necessitated the need for increased importation of rice which is a drain on foreign exchange potential for African countries in general and Ghana in particular.

Rice has recently become a major food crop mostly cultivated and consumed by majority of farmers and households in the Northern Region and Ghana at large. As the second important staple food in Ghana after maize (Azumah & Zakariah 2019), its consumption is increasing at an increasing rate due to rapid population growth, urbanisation, improvement in income levels of most Ghanaians (urban and rural) and a change in consumer habits (Tsujimoto et al., 2019; van Oort et al., 2015; MoFA/JICA, 2008; Balasubramanian et al, 2007). Rice as being cultivated in Ghana, is seen and treated as a staple food and a cash crop. As a cash crop, rice is explicitly different from traditional cash crops such as cocoa and coffee. This difference stems from the fact that rice can be consumed at home with little value addition.

MAFAP (2013) in its report submitted that from 2005 to 2010, Ghana imported rice from several countries; about 36% was from Thailand, 30% from Vietnam and 22% from USA, with the rest coming from Pakistan, India, Togo, UAE, La Cote d'Ivoire and Uruguay. Global Food Security Response (GFSR) (2009) in a corroborative report indicated that rice is the highest cereal imported into Ghana and this constitutes about 58% of total cereals imports. Table 1.1 shows the total imports of rice into Ghana from 2010 to 2017.

(https://www.indexmundi.com/agriculture/?country=gh&commodity=milled-ice&graph =imports). There has been a consistent rise in the quantity of rice being imported into Ghana and this situation does not help the local rice farmers as well as the government in managing the economic indicators.

Table 1.1 : The volume of rice importation into Ghana between 2010 and 2017

YEAR	IMPORT VOLUME (1,000MT)	GROWTH RATE
2010	580	-
2011	605	4.31%
2012	665	9.92%
2013	530	-20.30%
2014	585	10.38%
2015	610	4.27%
2016	590	-3.28%
2017	600	1.69%

Source: USDA (2017), https://www.indexmundi.com/agriculture/?country=gh&commodity=milled-rice&graph=imports Access, 10-Mar-18

The figures as shown in Table 1.1, suffice to say that all stakeholders (government, MoFA, NGOs in the agriculture sector, AEAs, farmers, universities and agriculture related institutions) should come together to design a novel rice production plan. A good domestic plan would ensure high quantity and quality rice production to sustain both food security and

exportation to earn foreign exchange that can help grow the Ghanaian economy. Rice is very important in Ghana such that there have been policy interventions as captured in MTADP (1991-2000); AAGDS (1996); GPRS I (2003 – 2005) and II; FASDEP I (2002); FASDEP II (2007); GNRDS (2009) and Ministry of Food and Agriculture policy documents, all geared towards reducing the importation of rice and to increase local production levels to ensure food security and import substitution.

It is also clear that private sector organisations, local and international NGOs have joined the crusade to ensure that Ghana is able to produce sufficient rice to feed the over 30 million Ghanaians (www.statsghana.gov.gh) and if possible becomes a net exporter of rice. Therefore, effort to increase rice production in Ghana has been a major goal driving agricultural policy objectives of current and successive governments in the country. Suffice it to say that the achievement of this goal is dependent on knowledge of best agricultural practices which is disseminated through training via agricultural extension workers, hence the need for the improvement of farmers knowledge on best agronomic practices with particular reference to rice production in Ghana.

Farmers who engage in rice production in Ghana need to have the requisite knowledge about improved farming techniques to help increase their yields thereby leading to an improvement in livelihoods. JICA through MoFA in corroborative and collaboration made moves to improve rice production in Ghana to guarantee food security through rice for consumption and export.

To achieve this goal, JICA initiated a training project with the aim of increasing rice productivity and profitability of rice farmers in three districts then, now three Regions in the Northern Sector of Ghana and four districts in Ashanti Region. The project was for a five-year period from 2009 to 2014. The project was engaged in the development of technical package, improvement of farming support systems and establishment of extension procedure for sustainable rain-fed lowland rice development. This project provided training to AEAs and framers in four key areas using workshop in the form of Training of Trainers (ToT) and demonstration methods. The training covered areas of land development, rice cultivation, farming support system and extension service. The project aimed at increasing rice production, hence the rice cultivation component of the training constitutes the core of the training, covering about 70 percent of the project training (Baba, 2014). For the purpose of this study, the researchers focus was on evaluating the training project to help determine the effectiveness of the training in achieving intended objective of increase rice yields.

For this reason, attention was on the first two key thematic areas – land development and rice cultivation, hence this research did not investigate the effect of the farming support system and extension services on the farmers

The sustainable development of rain-fed lowland rice production training was jointly funded by the Japanese Government through JICA and the Government of Ghana through MoFA. It was a five-year project with an ultimate aim of facilitating improvement in productivity and profitability of rice farmers in rain-fed lowlands rice in selected districts in three selected districts in Northern Ghana and four selected districts in Ashanti regions.

The project for the training covered over 2,100 beneficiaries including farmers, rice processors and marketers. The purpose was to disseminate the model for sustainable rain-fed lowland rice production techniques to all farmers within the selected areas, to all farmers in the four regions and if possible, to all farmers in Ghana. For the purpose of effectiveness of the training, the project grouped the farmers into ten farmers per group. In the three regions in Northern Ghana, 880 rice farmers were selected for the training.

The research selected 257 farmers for this study using purposive sampling technique.

This researcher intends to evaluate the training project in all three selected areas in the Northern, Savana and North-east Regions in Northern Ghana where the training was carried out.

II. EFFECTS OF TRAINING ON RICE FARMERS

Training in general facilitate knowledge improvement in any skill and vocational area. Farming as a profession and a vocation need people with the requisite knowledge. This knowledge will provide the farmers with the motivational and positive attitude to engage in farming with a positive perception. If farmers are well trained, they perceive the farming vocation or profession as a business that need to be protected and sustain beyond generations. Andam, Makhida and Splelman (2019), Rahman et al., (2018); Bonan and Pagani, (2017); Oyebanji, (2010) and Benin and Pender, (2001) discovered that training of farmers can lead to the acceptance of improved or new technologies resulting in productivity increase and higher income for farmers. To Rahman et al (2018); Tsado, Ojo, and Ajayi (2014) and Alfred (2000), majority of participating farmers who benefited from various training activities enhanced their output and income greatly and significantly, and eventually improved their standard of living. It is important to note that the ultimate aim of all training interventions for farmers is to increase yield and income. Tsado, et al (2014) discovered that 99.4% of the rice farmers trained in Nigeria indicated that the training they received led to an increment in rice yield, income and new properties acquired (bicycles, motor cycle, cars). Nakano, Tanaka and Otsuka (2014) found that training leads to effective adoption of improved rice cultivation practices, increase paddy yield, and increase profit of rice cultivation by rice farmers.

Through interactions with the JICA training project farmers in the three regions in Northern Ghana, it becomes clear that the training made the farmers more complex, courteous and self-aware of their personal hygiene. All farmer groups met revealed a situation where the farmers who were called for a meeting for the administering of the research questionnaire appeared well dressed. The training taught them one thing which they all attest to, neatness in appearance even when going to farm with the intention of engaging in farming activities. This is an indication that training of farmers goes beyond what pertains in the farm. It goes to enhance their personal hygiene and appearance. Training of farmers also makes them conscious of matters relating to their health and wealth.

These soft benefits of training for farmers are known as cognitive benefits which are not easily quantifiable. When farmers are given training, they become more enlighten on general issues concerning farming. They will mostly learn how to read basic instruction even if their level of education is very low, become more conscious about timing, use right implements, seeds and seedling, herbicides and how to take personal care of themselves and the farm equipment. Farmers who go through training by their outlook are cognitively distinct from non-trained participants.

However, training of farmers comes with certain negative effects which cannot be overlooked. Basically, training makes farmers more complex to handle than before. As they become enlightened, they turn to question every decision and become suspicious of new technologies that they do not have proven records of. For rice farmers, since training leads to increased yield, there is mostly a corresponding reduction in prices on the market (Dibba et al., 2015; Asante et al., 2014). It is, therefore, common that after training, the increase in yield leads to glut on the market. This is more serious if the training does not come with contract for marketing the produce.

III. RESULTS AND DISCUSSIONS

Extent to which the Training Contributed to Increase in Rice Yield of Farmers in Selected Areas

The researchers sought to ascertain the extent to which the training contributed to increase in rice yield of farmers in the selected areas. The researchers made effort to establish the quantity produced before the training and the quantity produced after practising the technology in order to ascertain the increase in rice yield among rice farmers in the selected areas.

In 2009, there was a base line survey before the project began. Results from the survey revealed that rice yield per hectare in the Northern Region was 2.3 t/ha. By the end of the 2010 crop season, the results from demonstration plots supervised by MoFA/AEAs and JICA officials gave the yield per hectare as 3.3 t/ha in the Northern Region while rice yield from the trial plots in 2011 stood at 3.6 t/ha.

It is, however, important to note that the yield from trial plots were slightly higher than the yield from the farmers' farms due to the uneven application of fertilizer and other farm inputs. The result on the quantity of rice produced before and after the training is presented in Table 4.9.

Table 1: Changes in Rice Yield over the Period (n = 257)

	Yield Before Training		Yield After Training	
Quantity(t/ha)	Freq.	Percent (%)	Freq.	Percent (%)
0.1– 1	202	78.6	6	2.3
1.1 – 2	45	17.5	29	11.3
2.1 – 3	10	3.9	123	47.9
3.1+	0	0.0	99	38.5
Total	**257**	**100.0**	**257**	**100.0**

Source: Field survey data **N = 257**

Figures in Table 1 shows that as many as 202 respondents, representing 78.6% indicated that their yield/ha before the training was between 0.1kg and 1t/ha, 17.5% produced 1.1t/ha to 2.0t/ha and 3.9% said they used to produce between 2.1t/ha to 3.0t/ha. The results further show that the yield of rice increased after farmers received and practised the knowledge and skills gained from the JICA Rain-fed Lowland Rice training project.

The results show that only 2.3% of farmers had 0.1kg to 1.0t/ha of rice after the training. Majority of the farmers (47.9%) increased their yield to between 2.1t/ha – 3.0t/ha whiles 38.5% increased yield to 3.1t/ha and above after the training. It is clear from the study results that 86.4% of respondents now produce more than 2.0t/ha of rice after they received the training from JICA compared to 96.1% who produced up to 2.0 t/ha before the training. On the average, farmers yield increased about two times after the

training, a confirmation that the training has led to increase in rice yield in the selected communities as shown in Table 1.

The results of this study conform to those of Takahashi and Barrett (2014) and Styger et al (2011) whose studies found that farmers adoption of system of rice intensification (SRI) training in rural Bangladesh helped increase yield by about 64%, and even farmers who partially adopted the training realised an increase in their rice yield by 32% (Sinha & Jayesh, 2007). Similar finding by Islam et al (2012) in Bangladesh revealed that there were increases in rice productivity by 86% from SRI adoption by farmers. Another pilot project by BRAC in Bangladesh studied by Barrett et al. (2016) showed higher yields of around 50% among those who adopted SRI. Noltze et al (2013), however, argued that there were significant increases in yields among SRI farmers, but the farmers faced negative income effects upon adopting the SRI technology. It can, therefore, be concluded that the JICA rain-fed lowland rice training project has led to increase in rice yield in the three regions in the Northern sector of Ghana.

The before and after data in Table 1 was used to run a paired sample t-test to determine the statistical significance of the increase in rice yield. As shown in Table 2, the mean difference was calculated to determine the actual difference between rice average yield before and after the training. Before the training, the mean yield was 1.253 with a standard deviation of 0.518. The mean yield computed after the training was as high as 3.226 with a standard deviation of 0.737. The test results as presented in Table 2 clearly indicated that there is a significant difference between rice yield before and rice yield after the training with a t-value of -34.208 and p< =.000.

Interaction with some farmers indicated that, some of them were experienced rice farmers and had received similar training on rice production from MoFA and other projects before the JICA rain-fed lowland rice development training project. This in a way could have an impact on rice yield, but the focus of this study was limited to the JICA project. Even though the increase in rice yield could be influenced by other reasons, the researchers are confident that the JICA project made the greatest impact as revealed by the results of this study.

Table 2 : Paired Samples Statistics

Paired Samples Statistics	Mean	N	Std. Dev.	T	Df	P
Quantity per hectare: Before	1.252	257	.51751	-34.208	256	.000
Quantity per hectare: After	3.226	257	.73663			

Source: Field survey data **N = 257**

Perceived Contributions of the Training to Yield Changes

All the respondents (100%) accepted that the project had led to increase in rice yield in the study areas. Of the 257 valid responses received, 65% indicated that the project led to very high increase in rice yield whiles 35% said the increase in rice yield is high. The results are shown in Table 3. This is in line with Tsado et al (2014) whose study revealed that training of trainers programme and adoption of improved rice package had mostly impacted participants lives positively. They found that majority (99.4%) of the participants claimed

that their farm output and income increased significantly, 98.8% of the participants also claimed that participation and adoption had led to additional acquisition of property like motorcycles, bicycles, and cars.

Table 3: The Extent of Increase in Rice Yield (n = 257)

Response	Frequency	Percent (%)
Very High	167	65
High	90	35
Total	257	100

Source: Field survey data

The researchers assessed the effect of the training on rice farmers and their yield from the AEAs perspective. This assessment was carried out to ascertain the AEAs personal assessment and opinion on the benefits of the training on farmers whom they supervised and guided by providing extension services during the period. Commenting on the effect of the rain-fed lowland rice development training project on farmers and the rice yield they achieved, Mr. Abdul-Karim Haruna, the AEA at Kpalbe operational area indicated that;

The project objectives were very realistic even though challenging. It was able to impact the farmers with the knowledge from the training which led to increase rice yield in my operational area in the Kpalbe model site. Both women and men worked together in groups that I helped to form for the purpose of synergy. In the Kpalbe operational area, the project on the average helped farmers achieve higher rice yield from the same piece of land they cultivated. The increase in rice yield experienced by the farmers went a long way to change their living conditions through the acquisition of assets and that shows improvement in their lives (idi).

Mr. Iddi Bukari Mahama, an AEA in-charge of the Nyesheigu operational area in the Tamale Metropolis stated that:

Rice yield level of all farmers who participated and adopted the JICA project for sustainable rain-fed lowland rice production technology at least doubled in the area. Emphasising the effect of the training on the farmers in general, he recounted how the training project was perceived in the initial stage as cumbersome and time consuming. The germination rate of rice planted on the rice fields prepared according to JICA specifications encouraged the farmers to intensify the application of the JICA rice cultivation technology. To Mr. Mahama, the practice was rice intensification, and this method reduces cost of rice production drastically to the advantage of the farmers. The project is transforming all farmers who were directly involved as well as other farmers who were not part officially but took keen interest on what the project farmers were doing after the first year. The higher yields experienced after the first year encouraged others farmers to join the project during subsequent years. There is massive transfer of knowledge to other farmers who were not directly involved in the project (idi).

Mr. Adams J. D. emphasised that, The training sharpened the skills of rice farmers on rice intensification, using basic machines to achieve maximum effect and guiding farmers on quality seed production. The project has resulted in increased yield per hectare as a result of high plant population due to rolls planting adopted by the farmers. For me, my happiness is the fact that the farmers are better off in terms of their standard of living, improved food security and acquisition of basic life supporting assets such as bicycles, cell phones and cooking utensils for the female farmers (idi).

Mr. Stephen Agalic, AEA for Kukuazugu operational area, even though retired at the time of the study, could not hide his excitement about the success and benefits of the training to the farmers in general. Mr. Agalic contends that,

The project achieved all its objectives and that the knowledge that farmers acquired from the training was highly valuable. What was necessary for now was to ensure that the farmers do not abandon the JICA technology of rice cultivation and return to their old methods of rice cultivation. If MoFA could ensure that all AEAs under MoFA adopt and teach the JICA rice cultivation technology to all farmers in the districts and the regions, that will go a long way to guarantee rice as food crop to the Ghanaian populace (idi).

Assessing the Correlation between Components (land development and rice cultivation) of the Training Project on Rice Yield in Selected Areas

This objective assessed the correlation between the two main components of the training on rice yield in the selected areas. Association test was run to test the relationship between rice yield and the components of the training using Spearman rho correlations.

The JICA training project was designed to cover four key thematic areas namely; land development, rice cultivation, extension services and farming support services (Baba, 2015). The focus was to ensure that AEAs and farmers are trained on best practices in rain-fed lowland rice cultivation technology that would lead to increase rice yield and quality. To achieve higher rice yield and quality, the training covered rice farmland preparation and rice cultivation techniques in addition to extension services and farming support services.

Correlation between Components of Land Development and Rice Yield

The training on land development covered proper area measurement, bund construction, and good ploughing or land preparation. This area of training constitutes the first step in effective rice cultivation. The parcel of land to be used for rice cultivation must be properly measured since the inputs to be used must be gauged in terms of their accuracy and adequacy. It would therefore be problematic to say for instance that the fertilizer was adequate or inadequate if reference cannot be made to the size of the farm land. Bund construction is seen as a major boost to rice cultivation in Africa and for that matter Ghana and Northern Region, especially in times of very limited rainfall.

Bund construction, as part of the training on land development, sought to teach farmers how to conserve and control water on their rice farms. Bunds constructed enable farmers to regulate water level on their farms and in times when rainfall is sporadic and irregular, they help hold water on the farm for a longer period instead of the water flowing or running downstream.

Another key training area under the land development was good land preparation or ploughing. The farmers were taught how to guide tractor operators for good ploughing. According to JICA rice cultivation handbook (2012), proper land preparation ensures equal distribution of water in the field, adequate use of

water by the plants and enhances the optimum use of fertilizer by the plants. Land, if properly ploughed, would facilitate good yield. For this reason, farmers were taken through proper land preparation techniques. Interaction with the farmers revealed that the specific area of the training on land development is very beneficial if observed as stipulated by the training. According to the farmers, proper measurement allows for adequacy in the use of seeds, application of fertilizer and herbicide. Some rice valleys they cultivate are not flat and therefore the water continuously flows causing leaching and erosion. The bunds helped in preventing that continuous flow of water in such valleys and are particularly helpful in times of drought. On the proper ploughing, they indicated that when the land is well ploughed and the soil is loose, it facilitates proper and even germination of seeds and reduces the effect of weeds on the farm. They indicated that if land for rice farming is prepared in accordance with JICA training programme specifications, there is the high possibility of realising increased rice yield. The results of land development and its relationship with rice yield are shown in the Table 4.

Table 4: Relationship between Increase in Rice Yield and Land Development using Spearman Correlation

Correlation matrix

V/No	Variables (V)	1	2	3	4
1	Increase in Yield	1			
2	Proper Area Measurement	.751**	1		
3	Bund Construction	.719**	.538**	1	
4	Good Land Preparation	.784**	.578**	.581**	1

Correlation is significant at 0.05 level (2-tailed). **n = 257

Source: Field Survey, 2015

In an attempt to establish the relationship between the specific areas of the training on land development and increase in rice yield, spearman correlations were used to test the relationship at 5% significant level. the results on the relationships between increase in rice yield and the three variables – proper area measurement, bund construction and good land preparation - were investigated using spearman's rho correlation coefficient. there was a strong positive correlation between increase in rice yield and the three key areas of the training under land development. the correlation coefficients were computed using two tailed tests at 5% significant level. from the results, there exists a positive strong relationship, rho = 0.751, between increased rice yield and proper area measurement. there was also a strong positive correlation between increased rice yield and bund construction (rho = 0.719). there was also a strong positive correlation, (rho = 0.538) between bund construction and proper area measurement. good land preparation was also established to have a strong positive correlation (rho = 0.784, 0.578 and 0.581) with increased rice yield, proper area measurement and bund construction respectively.

The implication of the results above is that, farmers who measure land accurately and adequately stand the chance of experiencing a corresponding increase in

rice yield on their farms. this is for the purpose of adequate seeds for planting, fertilizer and herbicide application. if the land is not adequately measured, especially if over measured, the quantum of fertilizer and herbicide that is supposed to be applied would be insufficient and that could lead to poor or low rice yield. on bund construction, the implication is that if the bund is not properly constructed to hold the require volume of water, the expected rice yield could be hampered. also, if the land is poorly ploughed, it is likely going to influence rice germination and growth negatively, and the rice in the farm cannot resist drought and this will ultimately lead to low rice yield. the finding supports defoer et al (2009) finding that well-prepared field controls weed and recycles plant nutrients and that of buri, et al (2012) that effective land preparation significantly contributed to increase grain yield in ghana.

Correlation between components of rice cultivation and rice yield training on rice cultivation was considered the core of the rain-fed lowland rice development project. farmers were taken through how to select good seed for planting, the best method of planting rice, how to apply the recommended rate of fertilizer, when to apply fertilizer, when to clear weeds or apply herbicide and how to identify and control pests and diseases on their rice farms.

under the training on rice cultivation, areas covered were selecting and planting good seeds, adopting good methods of planting, applying recommended rates of fertilizer, timely application of fertilizer, weed control and pest and disease control. these areas constituted the core of the rain-fed lowland rice development training project. baba (2015) observed that if farmers pay keen attention to this area of the training, practice and implement what was taught, there is the highest likelihood that the farmers would double rice yield on their farms. interacting with the farmers, most of them were of the view that each aspect of the training on rice cultivation, though difficult, took them closer to realising the jica sustainable rain-fed lowland rice training project prime objective of doubling rice production in the selected areas. result on the association test of rice cultivation aspect of the training and increase in rice yield are shown in table 4.5.

Table 4.5 Relationship between Increase in Rice Yield and Good Agronomic Practices

Correlation matrix								
V/No	**Variables(V)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	Increase in rice Yield	1						
2	Good seeds selection	.820**	1					
3	Good method of planting (drilling in holes)	.815**	.704**	1				
4	Applying recommended rate of fertilize	.776**	.610**	.663**	1			
5	Timely application of fertilizer	.796**	.719**	.687**	.612**	1		
6	Timely weed control	.810**	.643**	.664**	.651**	.621**	1	
7	Timely pests and diseases control	.848**	.731**	.700**	.667**	.739**	.702**	1

Correlation is significant at 0.05 level (2-tailed). **N = 257

Source: Field survey data

From Table 4.5, the relationship between increase in rice yield was investigated against six variables – good seed selection, good methods of planting, applying recommended rate of fertilizer, timely application of fertilizer, proper weed control and timely pest and disease control. These six variables were also tested against each other to determine the significant level of the relationship between them. All these variables were correlated with each other using Spearman correlation at 95% confidence level.

From the results, it was established that there is a strong positive correlation between increase in rice yield and all six variables covered by the training under rice cultivation and the correlations were all significant at 0.05 level (2-tailed). There was a strong positive correlation (rho = 0.820) between good seed selection and increase in rice yield. This gave a coefficient of determination of 67.2% meaning there is about 67% shared variance between good seed selection and increase in rice yield by farmers. In effect, good seed selection helps to explain nearly 67% of the variance in respondents' scores on the increase in rice yield scale.

There was a strong positive correlation between good method of planting (rho = 0.815) and increase rice yield. There was also a strong positive correlation (rho = 0.704) between good method of planting and good seed selection. This strong positive correlation coefficient indicates that good planting method employed is highly associated with increase in rice yield with a coefficient of 0.815. Good seed selection and good method of planting also have a positive association.

Applying recommended rate of fertilizer has a strong positive correlation with increase rice yield with a coefficient of 0.776. The results also showed that there was a strong positive correlation (rho = 0.610 and rho = 0.663) between applying recommended rate of fertilizer and good seed selection and good method of planting respectively. The implication of these results is that if fertilizer is applied at the recommended rate, it has a high relation with increase in rice yield on the farm. This result is in agreement with Azumah & Zakaria (2019); Tsujimoto et al (2019) and Tsujimoto et al (2017) findings that proper use of fertilizer has a positive effect on rice yield in Ghana.

Applying fertilizer on time also has a strong positive correlation (rho = 0.796) with increase in rice yield. This means that if fertilizer is applied timely, there is the likelihood that rice yield of farmers would also increase. With this positive association, one can conclude that if farmers pay attention to the issues on fertilizer in terms of applying the recommended rate, in terms of the right quantity and applying it on time, there would be corresponding increase in rice yield. Applying fertilizer at the right time was also established to have a strong positive correlation with good seeds selection (rho = 0.719), good method of planting (rho = 0.687) and applying recommended rate of fertilizer (rho = 0.612). Proper weeds control was also found to have a strong positive correlation with increase in rice yield (0.810). Proper and timely weed control was also established to have a strong positive correlation with good seed selection (rho = 0.643), good method of planting (rho = 0.664), applying recommended rate of fertilizer (rho = 0.651) and timely application of fertilizer (rho = 0.621).

The relationship between timely pests and diseases control and increase rice yield was analysed and found to be highly and positively correlated. This strong positive correlation between increased rice yield and timely pests and diseases control (rho = 0.848), gave a nearly 92% coefficient of determination. Timely pest and disease control was also positively correlated with the other variables at 0.05 significant level, 2-tailed. Timely pests and diseases control correlation coefficients with other variables are shown in table

4.13. The correlations were significant at 0.05 level (2-tailed). Bucheyeki et al (2011) argued that there would be an increment in rice yield if agronomic practices such as timely planting, proper spacing, timely weeding, timely and correct use of fertilizers and insecticides are improved. Kijima (2014) posits that cultivation practices have positive impact on rice yield. Kijima discovered that marginal effect of applying good cultivation practice on rice yield was about 0.26 tons per hectare in Uganda, and by marginal effect, a yield of about 10% increase can be realised.

Conclusion and Recommendations

Training is the panacea for improved performance especially when poor performance can be attributed to lack of requisite and relevant knowledge. This statement is applicable to the farming vocation especially in Ghana in general and the northern sector of Ghana in particular. From the results and discussions from this study and findings, it is evident that training led to increase in rice among rice farmers in the Northern, Savanna and North-east regions in Ghana where the JICA rain-fed lowland rice production technology was impacted on rice farmers. From the study, we can conclude that there existed a positive relationship between all components of land development and all aspects of the components of rice cultivation as the JICA rain-fed lowland rice production technology.

Through the results of this findings, it is rife to recommend that MoFA should encourage AEAs in the rice production sector in Ghana to teach and encourage all rice farmers in the lowland sector to practices rice intensification as taught be JICA. The JICA rain-fed lowland rice production technology should also be taught in the Agricultural Training Colleges to help graduates acquire such knowledge for onwards spread upon completion.

IV. REFERENCES

[1]. Alfred, S. D. Y., (2000). "Effect of Socio-Economic Characteristics of Farmers in Food Crop Marketing in Yagba East Local Government Area of Kog State," in Agricultural Extension and Poverty Alleviation in Nigeria: Proceeding of the 6th Annual National Conference of Agricultural Extension society of Nigeria, T. A. Olowu, Ed., 151-156.

[2]. Andam, K., Makhija, S. & Spielman, D., (2019). Evaluation of the Impact of a Soil Fertility Training Project on Farm Productivity in the Volta Region of Ghana. International Initiative for Impact Evaluation, (3ie) Grantee. Final Report.

[3]. Asante, B.O., Wiredu, A.N., Martey, E., Sarpong, D.B., and Mensah- Bonsu, A. (2014).NERICA Adoption and Impacts on Technical Efficiency of Rice Producing Households in Ghana: Implications for Research and Development. American Journal of Experimental Agriculture. 4 (3): 244- 262

[4]. Azumah, S. B & Zakaria, A., (2019). Fertilizer Subsidy and Rice Productivity in Ghana: A Microeconomics Study. Journal of Agricultural Studies. Vol. 7(1), 82-102.

[5]. Baba. (2015). Personal Communication.

[6]. Balasubramanian, V., Sie, M., Hijmans, R.J. & Otsuka, K. (2007). Increasing Rice Production in sub-Saharan Africa: Challenges and Opportunities. Advances in Agronomy, 94, 55-133.

[7]. Benin, S & Pender, J., (2001). Impact of Land Redistribution on Land Management Productivity in the Ethiopian Highland, Socioeconomic and Policy Research Working Paper 43. ILRI, Addis Asaba, Ethiopia.

[8]. Bonan, J. & Pagani, L. (2017). 'Junior Farmer Field Schools, Agricultural Knowledge and Spill Over Effects: Quasi-experimental Evidence from

Northern Uganda', Journal of Development Studies, 1-16.

[9]. Bucheyeki, T.L., Shennkalwa, E., Kadadi, D. & Lobulu, J. (2011). Assessment of Rice Production Constraints and Farmers Preferences in Nzega and Igunga Districts, Advances in Developmental Research, 2, 30-37.

[10]. Buri, M. M., Issaka, R. N., Wakatsuki, T. & Kawano, N. (2012). Improving the Productivity of Lowland Soils for Rice Cultivation in Ghana: The Role of the 'Sawah' System. Journal of Soil Science and Environment, 3 (3), 56-62.

[11]. Defoer, T., Wopereis, M.C.S., Idinoba, P., Kadisha, T.K.L., Diack S. & Gaye, M. (2009). Curriculum for Participatory Learning and Action Research (PLAR) for Integrated Rice Management (IRM) in Inland Valleys of Sub-Saharan Africa: Facilitators' Manual, Module1, 1-7. African Rice Centre (WARDA). http://www.warda.cgiar.org/publications/PLAR/manuel/Module7.

[12]. Demont, M., and Stein, A. J., (2013) Global value of GM rice; a review of expected agronomic and consumer benefits, New Biotechnology – volume 30.

[13]. Dibba, L., Zeller, M. & Diagne, A., (2015). The Impact of NERICA Adoption on Household Food Security and Health in The Gambia.

[14]. Islam, S., Islam, J., Faruk, O. & Kabir, A. (2012). System of Rice Intensification (SRI) - A Supplementary Way for Sustainable Rice Production, Mimeo

[15]. Kadiri, F. A., Eze, C. C., Orebiyi, J. S., Lemchi, J. I., Ohajianya, D. O and Nwaiwu, I. U. (2014). Technical Efficiency in Paddy Rice Production in Niger Delta Region of Nigeria. Global Journal of Agricultural Research Vol.2, No.2, pp. 33-43, Published by European Centre for Research Training and Development UK (www.ea-journals.org)

[16]. Kijima, Y. (2014). Enhancing Rice Production in Uganda: Impact Evaluation of a Training Programme and Guidebook Distribution in Uganda. An Empirical Analysis of Expanding Rice Production in Sub-Sahara Africa. JICA-RI Working Paper, JICA Research Institute.

[17]. MoFA/JICA, (2008). The Study on the Promotion of Domestic Rice in the Republic of Ghana, Final Report.

[18]. Nakano, T., Tanaka, Y. & Otsuka, K., (2014). To What Extent Do Improved Practices Increase Productivity of Small-Scale Rice Cultivation in A Rain-fed Area? Evidence from Tanzani. National Graduate Institute for Policy Studies.

[19]. Noltze, M., Schwarze, S. & Qaim, M., (2013). "Impacts of Natural Resource Management Technologies on Agricultural Yield and Household Income: The System of Rice Intensification in Timor Leste", Ecological Economics 85, 59-68.

[20]. Oyebanji, O. O., (1997). "Assessment of the Impact of Extension Activities in Agricultural Production," in The Nigerian Agricultural Research Strategy Plan and Extension Delivery Policy Concept and Consensus to the Year 2010, N. O. Adedipe, J. S. Bakshi, and A. Aliyu, Eds., NARP Monography, no. 7, pp 322-333.

[21]. Rahman, M. S., Khatun, M., Rahman, M. I. & Haque, S. R. (2018). Assessment of Training Needs on Crop Production for Farmers in Some Selected Areas of Bangladesh. Bangladesh Journal of Agricultural Research, 43(4), 669-690.

[22]. Sinha, S. K. & Jayesh T., (2007). "Productivity Impacts of the System of Rice Intensification (SRI): A Case Study in West Bengal, India," Agricultural Water Management, 2007, 87(1), 55-60.

[23]. Styger, E., Malick Ag A., Hamidou, G., Harouna, I., Mahamane, D., Ibrahima, A. & Mohamed, T., (2011). "Application of System of Rice Intensification Practices in the Arid Environment of the Timbuktu Region in Mali," Paddy and Water Environment, 9(1), 137-144.

[24]. Takahashi, K. & Barrett, C. B., (2014). "The System of Rice Intensification and its Impacts on Household Income and Child Schooling: Evidence from Rural Indonesia." American Journal of Agricultural Economics, 96(1), 269-289.

[25]. Tiamiyu, S. A., Eze, J. N., Yusuf, T. M., Maji, A. T. & Bakare, S. O. (2015). Rainfall Variability and its Effect on Yield of Rice in Nigeria. International Letters of Natural Sciences, vol. 49, 63-68. www.scipress.com/ILNS.49.63 SciPress Ltd., Switzerland

[26]. Tiamiyu, S. A., Lawal, A. F. & Yusuf, T. M. (2015). Trend Analysis of Production and Consumption of Rice (Oryza sativa) in Nigeria: A Multi-Period Approach. Nigeria Journal of Agricultural and Development Economics, 3(1), 63-70.

[27]. Tsado, J. H., Ojo, M. A. & Ajayi O. J., (2014). Impact of Training the Trainers' Programme on Rice Farmers' Income and Welfare in North Central, Nigeria. Journal of Advanced Agricultural Technologies, Engineering and Technology Publishing; 1(2).

[28]. Tsujimoto, Y., Rakotoson, T., Tanaka, A. & Saito, K., (2019). Challenges and Opportunities for Improving N Use Efficiency for Rice Production in sub-Saharan Africa. Plant Production Science, pp. 1-15.

[29]. Tsujimoto, Y., Inusah, B., Katsura, K., Fuseini, A., Dogbe, W., Zakaria, A. I., & Sakagami, J. I., (2017). The Effect of Sulphur Fertilization on Rice Yields and Nitrogen Use Efficiency in a Food Plain Ecosystem of Northern Ghana. Field Crops Research, 2(11), 155-164.

[30]. USDA (2018). Production, Supply and Distribution Online. Retrieved from https://apps.fas.usda.gov/psdonline/app/index.html#/app/home.

[31]. Van Oort, P. A. J., Saito, K., Tanaka, A., Amovin-Assagba, E., Van Bussel, L. G. J., van Wart, J., & Wopereis, M. C. S. (2015).

[32]. Assessment of Rice Self-Sufficiency in eight African countries in 2025. Global Food Security, 5, 39-49

Cite this article as :

Adams Issahaku, Francis K. Obeng, Richard W. N. Yeboah, "Assessing the effects of training on rice farmers' yield. The case of JICA training on sustainable rain-fed lowland rice production technology in the Northern, Savanna and North-east Regions in Ghana", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 9 Issue 1, pp. 41-54, January-February 2022. Available at doi : https://doi.org/10.32628/IJSRSET22913
Journal URL : https://ijsrset.com/IJSRSET22913