

Full Paper

ASSESSMENT OF IMPROVED ARABLE CROP STORAGE AND PRESERVATION TECHNOLOGY UTILIZATION IN ONDO STATE: A RE-THINK ON RESEARCH OUTPUT

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ABSTRACT

The article assessed improved arable crop storage and preservation technology utilization by rural farmers in Ondo state in relation to technology research output. A multi-staged sampling technique was used to elicit information from 240 arable farmers and 36 key informants using structured interview schedule and interview guide, respectively. Descriptive statistics (percentage, frequency, mean, and standard deviation) and inferential statistics (regression) were used to analyze the data collected. The findings include identification of 64 improved technologies in selected research outlets with only 19 utilized by farmers in the study area. Also, there was low extent of technology utilization and high perception of improved technology. Regression analysis revealed among others that farmers' age ($r = -2.071$, $p < 0.05$) and years of formal education ($r = 2.808$, $p < 0.05$) had significant relationship with utilization of improved storage and preservation technologies. Therefore, it could be concluded that there is a gap between research output and farmers' technology utilization in the study area.

Keywords: improved technologies, storage and preservation, utilization, rural farmers, research and extension

1. INTRODUCTION

The nucleus of food security in Nigeria is sufficient availability of arable crops which include yam, cassava, legumes, cocoyam, vegetables and spices. The rural farmers are the major food producers for nation's growing population. As a result of increasing demand for food due to population growth and the need to satisfy the nutritional requirements, the existing gap between food and population expansion has widened. Therefore, in the emerging technology propelled agricultural transformation, the role of crop storage and preservation technology in making food available to Nigerians at acceptable quantity, quality, affordable at all times and also minimize losses of arable crops produced is more expedient than ever before. Ngigi, (2004) stated that agricultural technology has been a primary factor contributing to increase in farm productivity in developing countries, Nigeria inclusive. It

apparently offers opportunity to increase production and income substantially (Nweke and Akorhe, 2002).

Technology has been conceptualized by many authors at different times. According to Tepra and David (1985) it is defined as a cultural system concerned with the relationship between humans and its environment. Technology refers to the theoretical and practical knowledge, skills and artifacts that can be used to develop products and services as well as their production and delivery system (Burgelman *et al.*, 1996). Lin, (2003) also viewed technology as being embodied in people, materials, cognitive and physical processes, facilities, machines and tools. The concept of technology as defined by Maskus (2003) is the information necessary to achieve a certain production outcome from a particular means of combining or processing selected inputs which include production processes, management techniques, marketing methods or any of these combinations. Incidentally, most of the information necessary to ensure efficient utilization of technologies are not available to the rural farmers. Appropriate utilization of improved storage and preservation technology for arable crops (food crops) is important for national food security and vibrant rural economy. However, the supply of these arable crops has remained low; hence, the most fundamental challenges facing Nigeria presently is not only ensuring food for her teeming population for a healthy and productive life but also to be food sufficient without depending on other nations.

Consequently, the Federal Government effected several institutional arrangements which include the establishment of several research institutes, units and universities with a special focus on agriculture. Among them are the Federal University of Technology Akure (FUTA), the crop storage unit (CSU) of the Federal Ministry of Agriculture and the Nigeria Stored Products Research Institute Ilorin (NSPRI). They were specifically mandated to develop improved crop storage and preservation technologies and collaborate with the extension agents to communicate such findings to farmers. Similarly, the National Agricultural Research System was divided into three broad groups namely: the National Coordinating Research Institutes with the mandate for the total farming system of the different ecological zones in the nation, the Agricultural Extension and Research Liaison Service and the Non-coordinating Research Institutes (to research into the different areas of agricultural development). Thus, alliance among all agricultural stakeholders (Researchers, Extension, Farmers and Input providers) is essential to provide lasting solution to the problem of food insecurity in Nigeria.

However, these re-organizations notwithstanding, farmers still suffer enormous losses; sell their produce hastily to avoid loss through spoilage while food prices remain high especially during off-season periods. Obviously, research institutes and universities have developed some improved storage and preservation technologies some of which farmers have been using. It is

important therefore, to assess the extent of farmers' utilization of these technologies and how this could be improved. It is on this premise that the objectives of the study were formulated to include: identification of farmers' socio-economic characteristics and improved arable storage and preservation technologies used in the study area based on gender and crops, as well as examined available technology options. It also examined farmers' perception of Village Extension Workers (VEWs) as source of information on innovations and technologies introduced to them. Farmers' constraints to utilization of improved storage and preservation technologies were also identified while the extent of utilization was determined.

2. THEORETICAL FRAMEWORK

Therefore, several models have been tried all over the world for technology generation, development and information transfer. Some operate on complete institutional separation which could lead to isolation of research from farmers (Agbamu, 2000). The traditional view of the inter-relationships among Research, Extension, Farmer and Input is that research is responsible for technology generation, extension to transfer technologies and input to distribute while farmers are to receive. This model is not helpful since none of the stakeholders could operate effectively without the others. The models that form the background for this article are the top-down model, the feedback model, the modified feedback and the farmer-back-to farmer model. The top-down model viewed technology transfer as a one-way process through which developed technology is passed from researchers to the extension workers and then to the farmers without prior knowledge of farmers' constraints, both in testing and re-testing of the developed technologies. The feedback model provides answer to some of the setback of top-down model but do not actively involve farmers in the design of research programme carried out On-station. The modified feedback and farmers-back-to-farmers model unlike the other models actively involve farmers and emphasized that research must start and end with both the researchers and farmers as well as seek farmers' practical knowledge, perception, assessment potential and constraints.

The farmer-back-to-farmer model recognizes 4 distinct activities for assessing effectiveness. These include, problem identification, research into identified problems to develop potential solution, testing of developed solution and evaluation, adoption and monitoring of adopted techniques. Similarly, Roling (1984) mentioned the 4 typical linkage concepts to include dialogue/communication, participation, target group orientation and accountability that must be present in any improved agricultural knowledge system of developing countries. Also, the top-down model is more rigid than flexible whereas only the farmer-back-to-farmer model encourages farmers' active participation in the entire research process of technology development (Stoop, 1988). However, the feedback model and farmer-back-to-farmer model differs only in the degree of farmers' participation and involvement in On-station and On-Farm Adaptive Research (OFAR). Benor and Baxter (1984) emphasized that, for extension service to have an impact, it must work together with researchers and identify farmers' pressing needs for investigation in order to enhance timely and appropriate technology to farmers.

The proposed production solutions introduced to farmers must be need specific, economically feasible, and require only available inputs. Thus, the fundamental objective of extension in bridging the gap between research and farmers is to link farmers with researchers to generate and develop technologies together. It also teach farmers the recommendations from researchers, encourage them to adopt and advise researchers in areas where suitable technologies are lacking as well as proffer solutions to

constraints preventing the adoption of developed technologies by farmers to the researchers. The most critical of the factors affecting technology transfer is the unsuitability of several technologies for farmers' requirement and production environment (Pinstrup-Andersen, 1982) due to the gap between research and farmers. Therefore, to bridge the gap between research and farmers, constant interaction between research and extension is imperative in making research output known to farmers and ensure implementation of farmers' recommendations. Thus, Taylor (1978) concluded that the most important factor affecting technology adoption by farmers is the inadequacies of extension and research liaison services to link the research institution with the farming clientele. However, 39 years after, this condition still, persist. REFILS, is therefore conceived as an integrated system for successful technology generation, development, dissemination and utilization. When each of the components operates individually, it becomes ineffective (Omolehin and Olukosi, 1995; Dwafang and Arokoyo, 1999).

3. RESEARCH METHODOLOGY

The study was conducted in Ondo state, located in the South western Nigeria and lies on 5° 45' and 7° 52' on the North and South, 4° 20' and 6° 5' on the East and West poles respectively, with its headquarters in Akure. The state is predominantly inhabited by the Yoruba ethnic group and various minority groups which include Ijaw-Arogbo, Ijaw-Apoi, the Ebara, Hausa and Fulani. It has a land area of 14,769 square kilometers with a population of 3,441,024 people (NPC, 2006). The temperature (ranges between 21°C and 29°C) with relatively high humidity (of about 78%) and an annual rainfall (varying from 1,150mm to 2,000mm) which support the cultivation of arable crops such as yam, cassava, cocoyam, maize, leafy vegetables, tomatoes and pepper. The state is an agrarian state whose inhabitants depend mainly on agriculture for livelihood and has 18 Local Government Areas. For effective and efficient administration of the Agricultural Development Project (ADP), the state is divided into two zones namely Ondo and Owo with equal (9 each) LGAs.

3.1. Sampling Procedure

Multi-stage sampling procedure was used to select respondents for the study. The first stage was the purposive selection of three LGAs in the major arable crop producing LGAs from each of the two zones, to make a total of 6 LGAs. These represent about 25 percent of the major arable crop producing LGAs. The second stage involved simple random sampling to select two villages from each of the six chosen LGAs, making a total of twelve villages. Lastly, simple random sampling technique was used to select 20 farmers from the list of Agricultural Development Programme (ADP) registered in each of the selected villages to give a total of 240 respondent farmers. Also, periodic observation of arable crop storage and preservation was carried out on the farmers' farms, during transit in vehicles conveying produce to farmers' residence and markets. In addition, key informant interview was conducted using prominent market associations, farmers and community leaders. Three key informants identified through snowball technique were selected from each of the 12 villages studied to make a total of 36.

3.2. Instrumentation and Data Collection

Interview schedule and key informant interview guide were developed in line with the objectives of the study and were properly validated through jury method. It was subjected to test and re-test method of reliability test. A comparison of the results of the test and re-test was subjected to correlation analysis with r

value of 0.73 which was considered high enough to adjudge the instrument as reliable for use.

3.3. Measurement of Variables

Dependent and independent variables were the two broad variables investigated in the study. The dependent variable of the study was farmers' utilization of indigenous arable crop storage and preservation technology. The extent of utilization was measured with the use of responses to standardized selected statements on a five-point scale (Very often (4), Often (3), Sometimes Used (2), Rarely Used (1) and Not Used (0)). The total scores was obtained by multiplying the scores based on the above likert scale by the frequencies and divided by the number of population studied (240) to arrive at the calculated mean as the extent of utilization for each technology. Two (2) was calculated as the mid score (the sum total of the values of the 5 point scale divided by 5) and those who scored above it were rated as having high utilization while those under it were rated as having low utilization. The mean scores for all the technologies were added and divided by the number of technologies listed to obtain the grand mean score while the absolute scores of the respondents were used for regression analysis. The independent variables of the study were the selected variables related to improved technology, farmer's constraints to technology utilization, utilization of technology by gender and by crops were measured directly with the absolute values given by the respondents. These variables are the farmers' perception of improved technology and farmers' personal and socio-economic characteristics such as age, years of formal education, years of farming experience, farm size, number of crops planted and house-hold size.

3.4. Statistical Tools

Simple statistical tools such as frequency, percentages, ranked mean and grand mean scores were used to summarize the data obtained from the population studied. Regression analysis was used to determine the variables which significantly influence farmers' decision to utilize improved arable crop storage and preservation technologies.

4. RESULTS AND DISCUSSION

4.1. Improved Storage and Preservation Technologies Utilized by Farmers

A total of 64 improved technologies were recorded based on personal observation from the research institutes, technology development unit and university (NSPRI, CSU and FUTA) visited. This finding is an indication that the Federal Government (the owner of these research outlets) has invested so much in research with substantial output to show for it. These technologies are expected to be used for agricultural development and national growth. One of the ways to achieve this is accessibility to these technologies by the extension agents (located in 36 ADPs in all the states of the federation and the extension units of the institutions where technologies are developed). Through the use of Small Plot Adaptive Technique (SPAT) used by extension agents, the farmers' interest is aroused in technology innovations. Results presented in Table 1 show the list compiled by farmers on available improved technologies and personal observation in the farmers' farms, market places and transit vehicles. A total of 19 improved technologies (29.7%) were known to and used by farmers. Those used by majority of the farmers include pepper with air tight container (80.4%), air tight container (75.0%), salting (70.0%), wood ash mixture (68.3%), polythene lined-jute bag and basket (65.0%), phostoxin (64.2%) and tobacco powder/solution

(60.4%). Those utilized by fewer farmers include wooden crates (19.2%), cartons (16.3%), cassava trenches (9.2%), pot-in-pot (2.9%) and multipurpose dryer (2.1%).

The inference from this finding is that all technologies known to farmers were used. Notably too, the farmers were making use of all the technologies introduced to them with some more utilized than the others. Further analysis also revealed that technologies that have similarities with farmers' indigenous practices were mostly utilized by farmers (pepper in air tight container, wood ash and tobacco powder/solution). This implies that farmers are more likely to utilize innovations that are not at variance with their cultural practices.

4.2. Utilization of Improved arable Crop Storage and Preservation Technologies by Gender

Data in Table 1 show that all the females (100.0%) utilized 7 of the 19 improved storage and preservation technologies introduced. These are; polythene lined-jute bag, airtight container, fruit and vegetable baskets, wood-ash mixture, airtight container combined with pepper, pest population constant monitoring and salting. In addition, three other technologies (polythene lined-basket, tobacco powder/solution and evaporative coolers) were utilized by 87.5 percent and 56.25 percent respectively. Also, the females recorded lower utilization in phostoxin (31.2%), pot-in-pot (21.9%) and cassava trenches (6.3%) while improved maize crib, yam barn and fumigant were not used. For the male gender, majority (51.7% to 67.1%) utilized 9 of the listed 19 technologies which include airtight container with pepper (67.1%), airtight container only, (61.7%) and fumigant (57.1%). For the remaining 10 technologies, the males recorded between 2.1 percent and 4.8 percent utilization. The above findings showed that the females utilized more storage and preservation technologies than their male counterpart. This may not be unconnected with the fact that the females were traditionally assigned the roles of keepers and food preparers for the household (Deji, 2012).

However, as it was in traditional communities the males continue to enjoy the monopoly of ownership and users of improved maize crib, yam barn, fumigants and the use of multipurpose dryer to the exclusion of the female gender, a situation which may not be unconnected with accessibility to and control of household resources. Traditionally, the men control the crops that fetch money for the family while those for domestic use are kept by the women in small household structure (Faborode, 2011). For instance, yams when kept in barns and maize in cribs are often for commercial, gift and seedling for planting in the next season. Though, gender differences in technology utilization were evident among farmers, with gender conscious response, research and technology development, agriculture provides a great opportunity for both genders to enhance production and turn rural poverty into development. The improved technologies introduced to farmers have without doubt impacted rural agriculture to some extent; they have also created new inequalities or reinforced the existing ones. As it were, women farmers do not automatically benefit from developed technologies and that if actions is not taken, the conditions of many women in poverty group may be worse. The following excerpt from a key informant further supports the finding:

we desire improved technologies in arable crop storage and preservation which presently involves many losses. But the men are likely to take over our roles in storage and preservation of arable crops if new technologies are introduced as it has happened in cassava processing activities ...

Table 1: Gender disaggregation of Improved Crop Storage and Preservation Technologies Utilization by Farmers (N=240)

Technologies*	Gender					
	Farmers		Male		Female	
	F	%	F	%	F	%
Polythene-lined jute bag	156	65.0	124	51.7	32	100.0
Polythene-lined basket	156	65.0	128	53.3	28	87.5
Air tight container	180	75.0	148	61.7	32	100.0
Pot-in-pot	7	2.9	-	-	7	21.9
Improved maize cribs	101	42.1	101	42.1	-	-
Improved yam barn	126	52.5	126	52.5	-	-
Cassava trenches	22	9.2	20	8.3	2	6.3
Fruits and vegetable baskets	79	32.9	47	19.6	32	100
Evaporation coolers	18	7.5	-	-	18	56.3
Cartons	39	16.3	7	29.2	10	31.3
Multipurpose dryer	5	2.1	5	2.1	-	-
Wooden crates	46	19.2	40	16.7	6	18.8
Wood ash mixture	164	68.3	132	55.0	32	100.0
Phostoxin	154	64.2	144	60.0	10	31.3
Tobacco powder/solution	145	60.4	117	48.8	28	87.5
Use of pepper with air tight container	193	80.4	161	67.1	32	100.0
Fumigant	137	57.1	137	57.1	-	-
Pest population constant monitoring	94	39.2	62	25.8	32	100.0
Salting	168	70.0	136	56.7	32	100.0

*Multiple responses, Source: Field survey, 2009.

4.3. Farmers' Utilization of Improved Technologies by Crops

Results presented in Table 2 reveal the distribution of technologies used for storage and preservation of maize, yam, cassava, tomatoes, leafy vegetables and pepper. The findings revealed that different numbers of technology were used for individual crop. For each of the crops, the farmers used less than average number (4 to 9) of available technologies (19) for storage and preservation of arable crops. This may not be unconnected

with what Olaniyi, (2009) attributed to the type of crop. The two crops (cassava and leafy vegetables) had the least (4 each) technology utilization. Also, two of the technologies (wooden crates and salting) were not used for storage and preservation of any of the six listed crops. These two technologies may be used for other crops other than the six crops studied. Evidently, there is low technology utilization in all the crops. Also, technology gap exists between the crops as a result of unequal technology utilization. Notably, cassava is one of the crops having the least technology utilization despite the introduction of improved seedlings which have increased production.

If the high cassava production currently promoted is to make desired impact on the nation's food security and the economic growth, appropriate technologies for its storage and preservation must be developed and disseminated to intending users (farmers).

4.4. Farmers' Perception of Utilization of Improved Arable Storage and Preservation Technologies

Results presented in Table 3 reveal the ranked mean scores for 14 perceptual statements based on the extension characteristics and made up of 8 statements for positive and 6 statements for negative perception. They were used to elicit information from the respondents on the assessment of improved technologies used. All the 8 positive statements had mean scores ranging between 2.9 to 4.1 out of a maximum score of 5.0 points expected of each statement. This implies that they all had high mean scores. This is also an indication of strong positive perception in 8 out of 14 statements. These statements include utilization of improved technology is long overdue, its utilization will reduce postharvest losses, will enhance agricultural profitability, it can store for a long period of time and have enough storage capacity. Further analysis also showed that two out of the 6 negative statements (they do not reduce vulnerability to pilferage and most of them are not affordable) scored 1.2 and 1.7 respectively. This finding indicated that most respondents did not disagree with the statements. The negative statement with the lowest score (0.9) out of a maximum score of 5.0 points is that we do not know the technology developers.

Table 2: Distribution of farmers' utilization of improved technologies by crops

Improved technologies used	Maize		Yam		Cassava		Tomatoes		Leafy vegetables		Pepper	
	F	%	F	%	F	%	F	%	F	%	F	%
Polythene lined jute bag	156	65.0	11	4.6	156	65.0	-	-	-	-	12	5.2
Polythene lined jute basket	65	27.1	102	42.5	96	40.0	-	-	-	-	-	-
Airtight container	180	75.0	-	-	-	-	-	-	-	-	23	9.6
Pot-in-pot	-	-	-	-	-	-	7	2.9	-	-	7	2.9
Improved maize crib	101	42.1	-	-	-	-	-	-	-	-	-	-
Improved yam barn	-	-	126	52.5	-	-	-	-	-	-	-	-
Cassava trenches	-	-	-	-	22	9.2	-	-	-	-	-	-
Fruits and vegetable baskets	-	-	-	-	-	-	38	15.8	31	12.9	29	12.2
Evaporative coolers	-	-	-	-	-	-	18	7.5	-	-	18	7.5
Cartons	-	-	-	-	-	-	16	6.7	14	5.8	19	7.9
Multipurpose dryer	-	-	-	-	-	-	4	1.7	5	2.1	-	-
Wooden crates	-	-	-	-	-	-	-	-	-	-	-	-
Wood ash mixture	-	-	164	68.3	-	-	-	-	-	-	-	-
Phostoxin	149	62.1	48	20.0	-	-	-	-	-	-	-	-
Tobacco powder/solution	43	17.9	145	60.4	-	-	-	-	-	-	-	-
Pepper with airtight container	191	79.6	-	-	-	-	4	1.7	2	0.8	11	4.6
Fumigant	137	57.1	28	11.7	-	-	-	-	-	-	-	-
Pest population constant monitoring	94	39.2	94	39.2	46	19.2	-	-	-	-	-	-
Salting	-	-	-	-	-	-	-	-	-	-	-	-

Source: Field survey, 2009.

The inference from the findings is that only a few people disagreed while more people did not disagree with the statement. This finding is an indication that technologies were developed for farmers, placing them at the receiving end rather than participating in the process of technology generation and development. This is contrary to the bottom up approach emphasized in the national Research and Development (R&D) policy. However, further analysis revealed that the grand mean score for all the perceptual statements was 2.9 out of a maximum score of 5.0 expected for each statement. This implies that the farmers had high perception about technology utilization for storage and preservation of arable crops. Therefore, farmers' favourable disposition to the use of technology would enhance better utilization of research output.

Table 3: Farmers' perceptual scores on utilization of Improved Technology (IT)

Perceptual statement	Mean score	Rank
Utilization of IT is long over due	4.1	1 st
Utilization of IT will reduce production losses	3.6	3 rd
Utilization of IT will enhance agricultural profit	3.8	2 nd
Utilization of IT motivate youth participation in agriculture	2.9	8 th
They enhance the quality of agricultural produce	3.2	5 th
Most of them are not affordable	1.7	10 th
They are compatible with our culture	2.8	9 th
Utilization of IT will change assigned gender roles	2.9	8 th
They do not reduce vulnerability to pilferage	1.2	11 th
They have enough capacity	3.2	5 th
They can store for a long period of time	3.6	3 rd
They cannot enhance prices of farm produce	3.5	4 th
They are not easily understood	3.1	7 th
We do not know the technology developers	0.9	12 th
Grand mean	2.9	

Source: Field survey, 2009.

This is contrary to the bottom up approach emphasized in the national Research and Development (R&D) policy. However, further analysis revealed that the grand mean score for all the perceptual statements was 2.9 out of a maximum score of 5.0 expected for each statement. This implies that the farmers had high perception about technology utilization for storage and preservation of arable crops. Therefore, farmers' favourable disposition to the use of technology would enhance better utilization of research output.

4.5. Farmers' Perception of Village Extension Worker (VEW) as Sources of Information on Innovations

Table 4: Farmers' Perception of VEW as Source of Information on Innovations

Perceptual statements	SA	A	U	D	SD	Mean
VEW has relevant training in extension assignment	151(62.9)	76(31.7)	10(4.2)	2(0.8)	1(0.4)	4.54
VEW has relevant experience	146(60.8)	81(33.8)	10(4.2)	2(0.8)	1(0.4)	4.53
VEW has communication competency	144(60.0)	78(32.5)	12(5.0)	4(1.7)	2(0.8)	4.47
VEW has practical skill	157(65.4)	71(29.6)	8(3.3)	4(1.7)	0(0.0)	4.60
VEW has knowledge of available innovations in storage and preservation	122(50.8)	88(36.7)	18(7.5)	11(4.6)	1(0.4)	4.33
VEW is rural minded	110(45.8)	99(41.3)	8(3.3)	20(8.3)	3(1.3)	4.22
VEW is committed to extension work	165(68.8)	43(17.9)	9(3.8)	18(7.5)	5(2.1)	4.52
VEW is credible in the community	140(58.3)	72(30.0)	11(4.6)	15(6.3)	2(0.8)	4.37
VEW has confidence in self and farmer	134(55.8)	78(32.5)	13(5.4)	14(5.8)	1(0.4)	4.42
VEW is emotionally stable	117(48.8)	80(33.3)	18(7.5)	11(4.6)	14(5.8)	4.12
Grand mean						4.40

Results in Table 4 show the 5 point scale ratings of farmers' perception based on the basic qualities expected of village extension agents. Majority (68.8%) of the farmers strongly agreed with the statement that the VEW is committed to extension work. Also, majority (65.4%, 62.9%, 60.8% and 60.0%) strongly agreed with the statements that the VEW has practical skill, relevant training, relevant experience and communication competency in extension respectively. While 50.8 percent and 36.7 percent strongly agreed and agreed that VEW has the requisite knowledge of available storage and preservation technologies respectively. In addition, majority (58.3% and 55.8%) strongly agreed with the view that the VEW is "credible in the community" and has confidence in self and the farmers respectively. About 45.8 percent and 41.3 percent strongly agreed and agreed that extension agents are rural minded.

Further analysis revealed that the statement that VEW 'has practical skill in his work' ranked highest with a mean score of 4.60 followed by relevant training in extension' and relevant experience' with mean score of 4.54 and 4.53 respectively. The statement VEW 'is emotionally stable' had the least mean score (4.12). The results showed high grand mean score of 4.4 out of a maximum score of 5.0 obtainable for each statement. This indicated positive perception and favourable disposition of the farmers to the VEW as source of information. It implies that they may be willing to work with them and benefit from their knowledge on storage and preservation innovations.

4.6. Extent of Utilization of Improved Arable Crop Storage and Preservation Technology by Farmers

Based on a five point scale, the mean score for each technology utilized was calculated and ranked in descending order as indicated in Table 5. For the extent of utilization, three technologies (polythene lined jute bag, pepper used with airtight container and airtight container) were ranked 1st, 2nd and 3rd respectively. Importantly too, these were the only technologies with high mean scores (3.1, 2.6 and 2.5). It implies that farmers were capable of making use of improved technologies if made available and found beneficial. Notably, these technologies were not new to the farmers; they are simple household structure and materials which they are familiar with and may not require additional cost.

Also, the technologies (cassava trenches, evaporative coolers, pot-in-pot and multipurpose dryer) were ranked least as 16th, 16th, 18th and 19th respectively. These technologies are new and require both additional labour and cost. This implies that, the farmers need better awareness about the benefits of the technologies and the empowerment to own them. Though some improved technologies were available for farmers' use, a very significant number of them had low patronage by farmers.

This affirms the assertion by Calestous (2011) that the challenges facing Africa in its agriculture is managing an abundance of scientific and technological knowledge rather than its scarcity. The use of appropriate technology particularly in storage and preservation of arable crops have been widely adjudged as indispensable for post-harvest loss reduction and increased production capable of enhancing rural household's meal security, national food security and vibrant economy. Thus the necessity to create better awareness through a combination of traditional and modern communication methods (age grades, professional groups, town criers, radio and television, programmes, posters, farmers' day exhibition and better extension service delivery system) is indispensable. Thus, with better knowledge of research findings by the extension agents and farmers, agriculture provides a great opportunity to turn rural poverty into development.

SA= Strongly Agree;
A= Agree;
U= Undecided;
D= Disagree;
SD= Strongly Disagree
Source: Field survey, 2009

Conversely, the low ranked technologies were 16 in number with mean score values ranging between 0.03 to 1.3 out of a maximum score of 4.0 points. Further analysis also revealed the grand mean score (0.9) for the extent of utilization for all the technologies. However, the generally low extent of technology utilization corroborates the earlier works by Jubril *et al.* (1995) and Mijindadi (1989).

Table 5: Distribution of respondents by extent of utilization of improved technologies

Improved technologies utilized	UVO	UO	SU	RU	NU	Ranked Mean
Polythene-lined jute bag	39	63	47	7	84	3.1
Pepper with airtight container	73	89	31	0	47	2.6
Airtight container	76	98	6	0	60	2.5
Wood ash mixture	0	41	82	23	94	1.3
Tobacco powder/solution	0	24	69	52	95	1.1
Pest population constant monitoring	13	29	38	14	146	1.0
Salting	0	0	61	107	72	1.0
Phostoxin	0	0	82	72	86	1.0
Polythene-lined jute basket	9	13	31	103	84	1.0
Improved yam barn	0	0	68	58	114	0.8
Fumigant	0	0	31	106	103	0.7
Improved maize crib	0	11	23	67	139	0.6
Fruit and vegetable basket	0	0	33	46	161	0.5
Cartons	0	0	19	20	20	0.2
Wooden crates	0	0	0	46	194	0.2
Evaporative coolers	0	0	2	16	222	0.1
Cassava trenches	0	0	0	22	218	0.1
Pot-in-pot	0	0	0	7	233	0.03
Multipurpose dryer	0	0	0	5	235	0.02
Grand mean						0.9

Source: Field survey, 2009.

Farmers' Constraints to Utilization of Improved Results in Table 6 show the ranking of the various constraints encountered by farmers in the process of utilization of improved crop storage and preservation technologies. Input related problem was 1st, pilferage and inadequate credit were 2nd while extension-farmers' ratio was 4th. Those ranked 5th, 6th and 7th (77.5%, 64.2% and 60.4%) were illiteracy, inadequate farmers' participation in agricultural decision making and organization related problems respectively. However, the least ranked constraints were problems associated with information flow, inadequate visit by VEWs,

linkage and communication methods. Further analysis revealed that local culture and beliefs were not identified constraints to farmers' utilization of storage and preservation technologies in the study area. The low ranking of information flow, visit VEWs and problem with linkage methods imply that farmers were satisfied with the extension services provided for them. Thus, better linkage between extension and research could be used to address the highly-rated input problem encountered by farmers. Also, the issue of pilferage ranked 2nd could be addressed through the use of joint government and community policing while functional literacy should be promoted among farmers. The present individual ownership of storage facilities practiced in rural communities has undoubtedly increased farmers vulnerability to incessant insecurity of farm produce. The establishment of cooperative ownership of storage and preservation technologies, particularly those requiring additional cost such as the multipurpose dryer, improved maize crib and yam barn would be to farmers' advantage in terms of pulling resources together, sourcing for external assistance and providing security for their farm produce to reduce pilferage.

Table 6: Distribution of respondents based on constraints faced by farmers in utilization of improved storage and preservation technologies

Constraints encountered by farmers	F	%	Rank
Input related problems	236	98.6	1 st
Pilferage	228	94.0	2 nd
Inadequate credit facilities	196	81.7	3 rd
Lack of awareness on available technologies	186	77.5	4 th
Illiteracy	180	75.0	5 th
Inadequate farmers' participation in technology development	154	64.2	6 th
Inappropriate extension ratio	154	64.2	6 th
Rivalry among communities for technology location	154	64.2	6 th
Institutional related problems	145	60.4	9 th
Problems associated with information flow	94	39.2	10 th
Inadequate visit by VEW	79	32.9	11 th
Problems associated with communication methods	18	7.5	12 th
Local belief and culture	5	2.08	13 th

F= frequency; %= percentage

Source: Field survey, 2015

4.7. Results of Regression Analysis

Results of regression analysis in Table 7 reveal that age ($r = -2.071$; $p < 0.037$), years of formal education ($r = 2.808$; $p < 0.005$) of farmers, contact with extension ($r = 0.883$; $p < 0.02$), monthly income ($r = 2.817$; $p < 0.05$) and number of crop grown ($r = 5.134$; $p < 0.05$) had significant relationship with utilization of improved technologies by farmers. The negative significance of age to technology utilization is an indication that the higher the age of farmer, the less likely they are to utilize improved storage and preservation technologies. The summary of the overall results further showed that the regression model accounts for 58 percent variation in the dependent variable, with F value of 14.71 and R^2 value of 0.583. This means that variation in these variables would lead to corresponding variation in utilization of technologies. Thus, the significant variables explain 58.3% of research output utilized by farmers. These imply that these variables (age, years of formal education of respondents, farmers' contact with extension agents, monthly income and number of crop grown) should be given utmost consideration in an attempt to enhance better utilization of improved arable crop storage and preservation technologies.

5. CONCLUSION

Based on the major findings of the study, the following conclusions were reached:

Several improved technologies were developed and found in research centres but only a few were utilized by farmers. Significantly, most of the innovations and technologies developed by researchers were found to emanate from the research institutions and not through interactions with farmers to reflect their needs. This fact, most probably accounted for why many

innovations remained on the researchers' shelves without impacting the farmers. Technologies developed and kept without the knowledge of the intended users are likely to further perpetrate food insecurity and poverty.

Notably, the females utilized more technologies than the male counterpart bearing in mind that they are traditionally assigned to store and preserve crops for household needs. However, as more crops gain economic importance, they are stored and preserved by the men.

Table 7: Summary of results of the regression analysis

Variable	Unstandardized coefficients		Standardized coefficients		
	B	Std. Error	Beta	r	Sig.
Constant	53.201	5.159		10.312	0.000
Age	-2.138	0.66	0.172	-2.071*	0.037
Family size	0.121	0.082	0.101	1.473	0.142
Years of formal education	3.054	0.375	0.225	2.808*	0.050
Farm size	-0.003	0.000	-0.084	-1.245	0.214
Years of farming experience	-0.351	0.551	-0.048	-0.638	0.524
Contact with extension	2.645	2.996	0.057	2.883*	0.020
Frequency of contact	-0.021	0.057	-0.025	-0.365	0.716
Frequency of travel	0.402	0.520	0.050	0.773	0.440
Monthly income	1.08	0.03	-0.340	2.817*	0.050
Numbers of crops grown	2.258	0.70	1.010	5.134*	0.010

*Significant at $p < 0.05$

**Significant at $p < 0.01$

Source: Field survey, 2009

Evidently, there is low technology utilization in all the six crops studied and technology gap exist between the crops. The farmers had high perception (grand mean score 2.9 out of the expected maximum score of 5.0) about utilization of improved technologies for arable crop storage and preservation. Also, farmers encountered many constraints in relation to utilization of technology for arable crop storage and preservation.

6. RECOMMENDATIONS

To enhance adequate and sustainable utilization of technologies for food security and economic growth, all agricultural stakeholders should be jointly involved in technology generation, development, dissemination and its evaluation. However, for technology to serve its desired purpose, it should be compatible with existing practices, experiences and culture of intending users. Farmers for instance, should therefore actively participate in the generation and development of technologies through the use of available tools (SPAT and OFAR) to make developed technologies responsive to farmers needs and situation in order to ensure acceptance and utilization by farmers.

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