



ASSESSMENT OF COMMUNICATION STRATEGIES AND FACTORS LEADING TO DISCONTINUED UTILIZATION OF BIO-FORTIFIED MAIZE IN OYO AND ONDO STATES, NIGERIA

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ABSTRACT

The study assessed the communication strategies and factors leading to the discontinued utilization of bio-fortified maize among selected value-chain actors in Oyo and Ondo States, Nigeria. Information was collected from 320 value chain actors on the sources of information on bio-fortified maize, factors affecting its utilization, and factors leading to its discontinued adoption. Data were analyzed using frequency counts, tables, means, and standard deviations, with hypothesis tested using Pearson Product Moment Correlation (PPMC). Results revealed that 34.1% of respondents received information on yellow maize most frequently through extension agents, 33.0% often through friends/relatives, and 35.3% often through family members. Key factors affecting the utilization of yellow maize included the value chain actors' experiences (mean = 1.70), market availability (mean = 1.66), and economic benefits (mean = 1.54). Additionally, 57.5% of respondents discontinued utilizing yellow maize due to low distribution of seeds by ADP extension agents, 51.9% due to exploitation by middlemen, and 51.0% due to poor market infrastructure. A significant relationship was found between factors affecting utilization and those leading to the discontinuation of yellow maize ($r = 0.364$, $p \leq 0.01$). The study concluded that value chain actors have access to extension services and receive information on yellow maize through multiple sources, including extension agents, friends/relatives, newspapers, drama, and bulletins/handbills. However, challenges such as low seed distribution, middlemen exploitation, and poor market infrastructure persist. It is recommended that extension agents and other stakeholders address these factors to promote the sustained adoption and utilization of bio-fortified maize among value-chain actors.

Keywords: Communication, Discontinued, Factors, Utilization and Strategies

INTRODUCTION

Declining agricultural productivity, food insecurity, and a lack of carotenoid-fortified crops are causes for concern. Vitamin A is important in the human daily diet; any deficiency in this essential nutrient can lead to sickness or death. Vitamin A deficiency is a common phenomenon in developing countries and has proven difficult to combat. According to FAO and WFP (2015), as cited in Muvhuringi and Chigede (2021), micronutrient deficiencies, such as Vitamin A deficiency, affect more than two billion people globally and contribute to about 45% of all child deaths in developing countries. Approximately one-third of children under the age of five are at risk of Vitamin A deficiency (Cashman *et al.*, 2019). Maize, which is well-known in many developing countries, has been fortified with carotenoids to combat this deficiency.

Maize (*Zea mays*, L.), also known as corn, belongs to the grass family Poaceae (Gramineae) (Mazvimbakupa *et al.*, 2015). Maize is one of the three most important crops worldwide and the major staple crop on the African continent (Olaniyan, 2015). In Africa, especially sub-Saharan Africa, maize is a staple food for rural communities, consumed by most household members (Zuma *et al.*, 2018). Due to carotenoids, biofortified maize presents orange



and yellow colours. These colours have been reported to lead to negative perceptions about the biofortified maize varieties. The perceived agronomic traits of this maize by smallholder farmers have not been explored. Adoption and utilization of biofortified maize varieties rely on both acceptable consumer attributes and agronomic traits, including nutritional value (Zuma *et al.*, 2018). Maize grain contains different types of carotenoids in the form of provitamin A (Govender *et al.*, 2015) and is found in yellow and orange maize. Xanthophylls and carotenes result in the carotenoid pigments found in yellow and orange maize and are responsible for the endosperm color (yellow or orange). In biofortified maize varieties, β -carotene and β -cryptoxanthin have been identified as the most abundant carotenoids, while α -carotene is present in smaller quantities.

A number of studies conducted in various parts of Nigeria on biofortified crops suggest several factors (constraints) that are responsible for the low level of agricultural technology utilization and adoption (Esther and Ifeoma, 2017; Irfan, 2021). Some of the major constraints identified are credit facilities, education, inadequate extension services, farm size, land tenure systems, and labor availability. The low utilization of technologies by farmers may also be attributed to inadequate information. Irfan (2021) stated that the lack of information and communication on modern agricultural technologies and innovation is a key factor limiting the adoption and utilization of agricultural development in Nigeria. Low accessibility to agricultural information leads to low adoption and utilization of improved technologies, which invariably affects farmers' productivity and could lead to poverty (Ajayi *et al.*, 2007, as cited in Oloruntoba, 2023). Utilization of improved farm practices requires adequate agricultural information and communication, which must be effectively disseminated so that the client receives it, understands it, and regards it as a valid basis for action.

Information and communication, in a broad context, refer to organized data recorded in various forms (Zhang *et al.*, 2016). They are resources for knowledge. Information could be messages that are perceivable and recognizable in value to the receiver. In the agricultural sector, farmers need information about their agricultural activities. For instance, while it has been established that farmers use various media sources (Oloruntoba, 2023), it is where farmers seek information that they also find information relating to agricultural practices, ranging from agronomy to processing and storage, which are of tremendous importance to the success of most farming businesses. Esther and Ifeoma (2017) cited a study conducted by Kudi *et al.* (2011), indicating that farmers' awareness has a considerable influence on the rate of adoption of agricultural innovation. Kamara (2020) noted that the introduction of improved maize varieties is not enough without suitable complementary practices such as planting distance, seed dressing, fertilizer application methods, weed control methods, and storage techniques to aid better performance of agricultural technologies.

Despite the introduction of biofortified maize as a nutritionally enhanced crop, its adoption and utilization among value-chain actors in Nigeria have been inconsistent, leading to a discontinuation of its use among some farmers, processors, and consumers. The factors contributing to this discontinuation are not yet fully understood, and the communication strategies employed to promote biofortified maize may not be effective in addressing the needs and concerns of the value-chain actors. Therefore, it becomes pertinent to investigate the communication strategies and factors leading to the discontinuation of utilizing biofortified yellow maize in the study area. Hence, the study responded to the following objectives:

- i. identify the source(s) of information on bio-fortified maize to selected value chain actors;
- ii. determine the factors affecting the utilization of bio-fortified maize among the respondents
- iii. investigate the factors leading to discontinued adoption of bio-fortified maize by some farmers in the study area



Hypothesis

H₀₁: There is no significant relationship between factors affecting the utilization of bio-fortified crops and factors leading to discontinued adoption of yellow maize varieties.

MATERIALS AND METHODS

The Study Area

The study was carried out in Oyo and Ondo States in Southwest Nigeria. These states are part of the thirty-six (36) states in Nigeria and are located in the Southwestern region. Ondo State has a land mass of 15,500 km² (6,000 sq mi) with a population estimate of 3,441,024 (census, 2006). Ondo State is divided into four Extension Zonal Offices: Ikare (zone 1), Owo (zone 2), Ondo (zone 3), and Okitipupa (zone 4). Oyo State, on the other hand, is composed of thirty-three (33) local government areas. Oyo State has a total land area of 23,454 km² (10,986 sq mi) with a population of 5,591,589 (census 2006). The Oyo State ADP divides the whole state into four Extension Zonal Offices for operational and administrative convenience: Ibadan & Ibarapa (zone 1), Saki (zone 2), Ogbomoso (zone 3), and Oyo (zone 4).

Sampling Techniques and Sample Size

The target population of the study comprised maize farmers, input dealers, transporters, processors, marketers, consumers and extension agents otherwise known as value chain actors in Ondo and Oyo States. A Multistage sampling procedure was employed to obtain data for the study. The first stage was involved purposive selection of two states in the South Western Nigeria (Ondo and Oyo States) which are predominant in producing and consuming of maize. The second stage was involved purposive selection of two zones from the ADP' Agricultural zones that are prominent in the utilization of fortified maize production from each of the selected states making four zones. Ikare and Owo zones were selected in Ondo State, while Saki and Ibadan-Ibarapa zones were selected in Oyo State. The third stage was the simple random selection of two villages/communities from the four selected zones making eight (8) villages/communities. Purposive sampling procedure was used in stage four to select 15 farmers (that producing bi-fortified cassava and maize), 5 processors, 5 consumers, 5 marketers, 5 input dealers (that selling fortified yellow maize' seeds), 3 extension agents (that were trainers/facilitators on fortified maize) and 2 transporters (that usually transport fortified maize' produce and products). This made up of forty (40) bio-fortified maize selected value chain actors per selected community, and therefore (320) respondents made up for the selected eight communities. Primary data were used for this study.

Analytical Techniques

The data collected for this study were analyzed using descriptive and inferential statistics. The descriptive statistics included simple frequency distribution, percentage, and mean. Inferential statistics like Pearson Product Moment Correlation (PPMC) was used to test the relationship between the stated hypothesis of the study.

RESULTS AND DISCUSSION

Sources and Frequency of Receiving Information on Yellow Maize to the Selected Value Chain Actors

The results in Table 1 reveal various sources of information and their frequency regarding yellow maize for the selected value chain actors, aiming to increase respondents' outputs in their maize production. The sources of information were ranked based on their importance to each value chain actor. The table shows that the majority of the respondents (34.1%) received information on yellow maize most frequently through extension agents. About 33.0% received their information on yellow maize often through friends or relatives, while 35.3% received theirs often through family members.



On the other hand, those who never received information on yellow maize through other less common sources were newspapers (43.4%), drama (60.6%), and bulletins/handbills (61.9%). This finding is contrary to Pannell *et al.* (2006), who reported that newspapers, drama, and bulletins/handbills were significant sources of information that promoted the adoption and utilization of new innovations and technologies.

The findings suggest that extension agents are a critical source of information for yellow maize among the value chain actors. However, reliance on informal sources such as friends, relatives, and family members also plays a significant role. The relatively low utilization of formal sources like newspapers, drama, and bulletins/handbills indicates a gap that needs to be addressed to enhance the dissemination of agricultural information and technology adoption.

Table 1: Sources and frequency of receiving information on yellow maize to the farmers

Source of information (n = 320)	Most time %	Often time %	Rarely %	Never %	Mean	Rank
Extension Agent	34.1	24.1	14.1	26.3	2.63	1 st
Friends/Relatives	18.4	32.5	17.5	31.6	2.38	2 nd
Family members	16.9	35.3	14.7	33.1	2.36	3 rd
Television	10.0	25.0	30.3	34.7	2.10	4 th
Social Group	9.4	19.4	30.6	40.6	1.96	5 th
Training Workshops	8.8	19.7	23.4	48.1	1.89	6 th
Radio	17.2	20.9	27.8	33.1	1.80	7 th
Social Media	5.0	15.9	26.6	52.5	1.70	8 th
Conferences	4.4	17.5	18.8	59.4	1.66	9 th
Oral Media	2.2	16.9	24.1	56.9	1.64	10 th
Exhibitions	2.2	19.7	18.1	60.0	1.64	10 th
Bulletiins/ Handbills	2.8	16.6	18.8	61.9	1.59	12 th
Drama	0.6	15.3	23.4	60.6	1.56	13 th
Others	1.6	13.4	15.6	69.4	1.47	14 th
Newspaper	1.6	24.4	24.4	43.4	1.06	15 th

Source: Field Survey, 2022.

Factors Affecting the Utilization of Yellow Maize

The results in Table 2 reveal various factors affecting the utilization of yellow maize. The table shows that respondents, with a mean score of 1.70, considered the experience of yellow maize by farmers as the most significant factor. This experience could be either negative or positive. Those with negative experiences are less likely to continue utilizing yellow maize.

The second major factor, considered by the respondents (mean = 1.66), was the availability of a market for yellow maize. This corroborates the reports of Ellabban *et al.* (2014), who claimed that market availability boosts the utilization of introduced technologies. Additionally, respondents with a mean score of 1.54 considered the economic benefits of yellow maize as one of the major factors affecting its utilization. Other factors considered significant included environmental influence (mean = 1.53), level of exposure to the use of yellow maize (mean = 1.52), and nutritional benefits (mean = 1.52).

On the other hand, factors considered as minor included motivation from friends and colleagues to utilize yellow maize (mean = 1.18), cultural values (acceptability) (mean = 1.15), tastes of crop varieties (mean = 1.15), texture of varieties (mean = 1.07), and appearance of the yellow maize (mean = 1.05). With these minor factors, respondents may not utilize yellow maize to a great extent.



Table 2: Factors Affecting the Utilization of Yellow Maize

Factors (n = 320)	Major Factor		Minor Factor		Not a factor		Mean	SD	Rank
	Freq.	%	Freq.	%	Freq.	%			
Experience of yellow maize farmer	255	79.7	34	10.6	31	9.7	1.70	0.64	1 st
Availability market	202	63.1	88	27.5	30	9.4	1.66	1.75	2 nd
Profit of yellow maize	202	63.1	89	27.8	29	9.1	1.54	0.66	3 th
Benefits of the yellow maize	203	63.4	86	26.9	31	9.7	1.54	0.67	3 th
Environmental Influence	201	62.8	87	27.2	32	10.0	1.53	0.67	5 th
Level of exposure of the use of yellow maize	194	60.6	97	30.3	29	9.1	1.52	0.66	6 th
Nutritional Benefits	196	61.3	95	29.7	29	9.1	1.52	0.66	6 rd
Awareness towards the use of bio-fortified cassava	190	59.4	101	31.6	29	9.1	1.50	0.66	8 th
High quality of products	191	59.7	97	30.3	32	10.0	1.50	0.67	8 th
Interest towards yellow maize	185	57.8	106	33.1	29	9.1	1.49	0.66	10 th
Income Views	182	56.9	113	35.3	25	7.8	1.49	0.64	10 th
Nutrient value of the crop	182	56.9	105	32.8	33	10.3	1.47	0.68	12 th
Early maturity of yellow maize than Local ones	181	56.6	106	33.1	33	10.3	1.46	0.68	13 th
Availability of the crop variety	173	54.1	109	34.1	38	11.9	1.45	0.88	14 th
Group members' advice on the use of yellow maize	144	45.0	126	39.4	50	15.6	1.29	0.72	15 th
Persuasion of extension agents	121	37.8	154	48.1	45	14.1	1.24	0.68	16 th
Level of education	95	29.7	190	59.4	35	10.9	1.19	0.61	17 th
Motivation from the friends/colleagues	100	31.3	178	55.6	42	13.1	1.18	0.64	18 th
Cultural value (Acceptability)	87	27.2	193	60.3	40	12.5	1.15	0.61	19 th
Taste of the crop product	82	25.6	204	63.8	34	10.6	1.15	0.58	20 th
Texture of the crop (yellow maize)	65	20.3	211	65.9	44	13.8	1.07	0.58	21 th
Appearance of yellow maize	54	16.9	228	71.3	38	11.9	1.05	0.53	22 st
Preference for color	43	13.4	248	77.5	29	9.1	1.04	0.47	23 nd
Membership of social group	74	23.1	182	56.9	64	20.0	1.03	0.66	24 nd
spouse influence	44	13.8	228	71.3	48	15.0	0.99	0.54	25 th

Source: Field Survey, 2022

Grand mean = 1.35



Factors Leading to Discontinued Utilization of Yellow Maize

The results in Table 3 show that most respondents (57.5%) discontinued utilizing yellow maize due to the low distribution of yellow maize seeds to farmers by ADP extension agents. Additionally, 51.9% discontinued utilizing yellow maize due to exploitation by middlemen in the enterprise. About 51.0% of respondents discontinued utilizing yellow maize due to poor market infrastructure in the study area. Other major concerns leading to discontinuation included low market prices for yellow maize products (48.4%), scarcity of yellow maize seeds for planting (45.0%), poor communication on the importance of yellow maize (41.3%), and low derived quantity of fermented yellow maize (ogi) (39.4%).

Furthermore, the findings revealed that factors of less concern leading to discontinuation of yellow maize utilization included limited access to hired labor for yellow maize production (17.5%), low demand for yellow maize varieties (16.3%), high perishability of the crop (14.7%), the effect of low education levels of selected actors on yellow maize varieties (14.1%), and a lack of interest in utilizing yellow maize (13.1%).

These findings indicate that practical issues such as seed distribution, market infrastructure, and exploitation by middlemen are significant barriers to the continued utilization of yellow maize. Addressing these issues through improved seed distribution systems, better market infrastructure, and fairer trading practices could help in promoting the sustained use of yellow maize. Additionally, enhancing communication strategies to highlight the importance and benefits of yellow maize, along with ensuring an adequate supply of seeds, can further support its continued utilization among farmers.

Table 3: Factors Leading to Discontinued Utilization of Yellow Maize

Factors (n = 320)	Yes		No.	
	Freq.	%	Freq.	%
Low distribution of yellow maize to farmers by ADP extension agent	184	57.5	136	42.5
Middle men exploitation	166	51.9	154	48.1
Poor market infrastructure	162	50.6	158	49.4
Low market price of yellow maize products	155	48.4	165	51.6
Scarcity of yellow maize seed for planting	144	45.0	176	55.0
poor communication on the importance of yellow maize	132	41.3	188	58.8
Low quantity of roasted fermented yellow maize flour (Ogi)	126	39.4	194	60.6
Poor Satisfactory communication network	113	35.3	207	64.7
Availability of other crops to substitute the planting of yellow maize	113	35.3	207	64.7
Low level of the crop awareness among farmers	90	28.1	230	71.9
Yellow maize is expensive to buy	89	27.8	231	72.2
Low Income	85	26.6	235	73.4
Land acquisition	87	27.2	233	72.8
High price of processing equipment	75	23.4	245	76.6
Inadequate technical know-how on production and processing	64	20.0	256	80.0
Lack of access to hired labour	56	17.5	264	82.5
Low demand	52	16.3	268	83.8
High perishability of the crop	47	14.7	273	85.3
Low level of education	45	14.1	275	85.9
Lack of Interest	42	13.1	278	86.9

Source: Field Survey, 2022.

Relationship between Factors Affecting the Utilization of Yellow Maize and Factors Leading to Discontinued Utilization of Yellow Maize

Pearson Product Moment Correlation was used to assess the relationship between the factors affecting the utilization of yellow maize and the factors leading to its discontinued utilization. The results in Table 4 show a significant relationship between ($r = 0.364, p \leq 0.01$) these factors. This implies that any unfavorable factor affecting the utilization of yellow maize is likely linked to the factors leading to its discontinued utilization. The significant positive



correlation ($r = 0.364$) indicates that the factors negatively impacting the utilization of yellow maize also contribute to its discontinued use. For instance, challenges such as low seed distribution, market infrastructure issues, and exploitation by middlemen not only affect the initial adoption but also lead to farmers discontinuing the use of yellow maize.

This relationship suggests that addressing the factors affecting the utilization of yellow maize can also reduce the likelihood of its discontinuation. Improving seed distribution, market access, and communication about the benefits of yellow maize can enhance both its adoption and sustained use. Ensuring favorable conditions for yellow maize utilization is crucial for its long-term success and for meeting nutritional needs and improving agricultural productivity.

Table 4: Relationship between the factors affecting the utilization yellow maize of and factors leading to discontinued utilization of yellow maize

Factors affecting the utilization and factors leading to discontinued adoption	r	p-value	Decision
Factors affecting the utilization and factors leading to discontinued adoption	0.364***	0.01	S

Source: Data estimation (2022).

Where; r = correlation coefficient

P-value= significant level at 0.01***

CONCLUSION AND RECOMMENDATIONS

Based on the findings, the study concluded the following:

1. Respondents had access to multiple sources of information on biofortified yellow maize, receiving information most frequently through extension agents, friends/relatives, newspapers, drama, and bulletins/handbills.
2. Mass media (radio programs, television, and newspapers) were the major communication strategies adopted by the research-extension-farmers and other selected value chain actors in adopting and utilizing biofortified yellow maize.
3. Major factors leading to the discontinuation of yellow maize utilization included low distribution of yellow maize seeds to farmers by ADP extension agents, exploitation by middlemen, and poor market infrastructure in the study area.

The study recommended that extension agents should ensure an efficient and consistent distribution of yellow maize seeds to farmers. This will mitigate one of the major factors leading to discontinuation and encourage continuous utilization. Also efforts should be made to improve market infrastructure to facilitate better market access for yellow maize. This includes creating more robust and accessible markets, reducing middlemen exploitation, and ensuring fair pricing for farmers. Communication strategies should be enhanced to better inform farmers about the benefits and importance of yellow maize. This can include more targeted and frequent use of mass media channels like radio, television, and newspapers, as well as leveraging community meetings and agricultural fairs.

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