# ASSESSMENT OF QUALITY PROTEIN MAIZE TECHNOLOGIES ADOPTION AMONG FARMERS IN BAUCHI SOUTH SENATORIAL ZONE

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**L. J. Gizaki*[1], Y. Suleiman[2] and F. B. Filli[1]**

[1]Department of Agricultural Economics & Extension, Federal University Wukari, Taraba State, Nigeria

[2]Agricultural Economics & Extenssion Programme, AbubakarTafawa Balewa University, Bauchi, Nigeria

*Corresponding author: ljgizak@gmail.com

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**Abstract:** The objective of this study was to determine the farmers' adoption of quality protein maize technologies in Bauchi south senatorial zone. Using survey research, a pre-tested structured interview scheduled was used to collect information from 120 QPM farmers that were randomly selected from three Local Government Areas out of the seven LGAs in the zone. Descriptive and inferential statistics were used to analyze the data. In the study the minimum household size was 11 with a total annual income of ₦132,700.00. About 26.3% of the respondents were found to have adopted the QPM variety, 34.3% were at the awareness stage while 21.2 were not aware. The result of multiple regression revealed that income (t = 5.411, p = 0.000) was found to be statistically significant in influencing adoption. Poor access to sources of agricultural information (M = 2.87), poor access credit (M = 2.86), inadequate rural roads (M = 2.84), inadequate extension visit (M = 2.81) and inadequate modern processing and storage facilities were found to be the major constraints to the adoption of QPM production technologies. It is on this background that the study recommended that input support services in the form of fertilizer and chemicals should be provided to enhanced adoption. Farmers should be linked to sources of markets and credits to enable them purchase necessary inputs and extension services should be strengthened so as to teach farmers the need to adopt improved technologies in order to reduce poverty and improve food security.

**Keywords:** Adoption, Bauchi South, protein maize, technologies

## Introduction

Nigeria produces a wide range of agricultural commodities, which could serve as raw materials for industrial production and food for human consumption. The dual nature of these crops makes them to be in high demand and one of such crop is Maize. Maize (*Zea mays*) is a cereal crop that grows across a range of agro-ecological zones in Nigeria, though it is grown slightly more in the Northern part of the country. Some of the major producing states in Nigeria include Adamawa, Bauchi, Borno, Yobe, Jigawa, Gombe, Taraba, Plateau, Sokoto, Kebbi, Katsina, Nasarawa, Niger and Zamfara (http://www.foramfera.com/index.php/membership-zone).

Nigeria has a land area of 98.3 m hectares and at presents about 34 m hectares or 48% are under maize cultivation (Forum for Agricultural Research in Africa, 2013). With this, one would have thought Nigeria would be self-sufficient in Maize production but the reverse is the case. The country presently produces less than the market demand. It is on record that more than 60% of Nigeria's production of maize is consumed by the industrial sector for production of flour, beer, malt drink, corn flakes, starch, syrup, dextrose and animal feeds. In order to meet the local demand for the crop, government placed a ban on the export of maize in Nigeria (International Institutes of Tropical Agriculture, 2010).

The first major effort to promote the massive production of maize was in 1971 when the federal government launched the National Accelerated Food Production Programme (NAFPP) on pilots' basis (Federal Ministry of Agriculture and Rural Development, 2012). The NAFPP design anticipated three major components working together as a system, namely: adaptive research, aimed at developing technologies relevant to the need and practices of farmers in specific ecological areas tested with direct farmers involvement, extension service with the responsibility of taking information on improved maize production practices to small-scale farmers and obtaining feedback on farmers' problems, which in turn helped in refocusing research agenda. The extension agents also had the responsibility of educating farmers through mini-kit, production-kit and mass adoption-kit, agro-service centers for distribution of farm inputs at point close and convenient to farmers (Abubakar *et al.*, 2010).

In the savanna, maize production has since been transformed from the status of a minor crop by being grown around the homestead to a major commercial grain crop, competing with sorghum and millet as a strategic crop in the grain economy of the nation. In fact, about 70% of the maize in Nigeria is produced in the savanna zone (Ado, 2010).

International Institutes for Tropical Agriculture (2009) asserted that the recent achievements by breeders in the development and release of superior maize varieties with higher yield potentials and better resistance to pest and disease have played a central role in increasing maize production in the country. Federal Ministry of Agriculture and Rural Development (2010) noted that improving maize production is considered to be one of the most important strategies for food security in Nigeria. According to Menkir (2003), the bid to address the problem in maize production, necessitated the development and introduction of high yielding varieties of maize crops, together with efficient natural resources, crop management technologies to maize farmers in Nigeria. Some of the improved maize variety in Nigeria include: ACR 97, TZE Comp 3, TZE-WI, SYN, OBA SUPA I, OBA 98 (QPM), SGM I (white), SGM II (yellow), MR (white), MS (yellow), JO I (white), JO II (yellow) and KaiKai Hybrid (Sasakawa Global 2000:2010). QPM (OBA, 98) has special characteristics such as resistant to rust, blight, and streak. Italso performs better than farmers' local varieties in terms of grain yield, protein content and other traits (Akintunde, 2002).

QPM is relatively a new set of varieties of maize developed to improve on the protein content of normal maize, whose crude protein content is generally below 11%. The recent discovery of quality protein maize has made it possible to tremendously improve on the essential amino -acid composition from the plant kingdom. Studies conducted in Ghana by Okolo (2001) has shown that, QPM enhances linear growth in weaning children by 19.3% and children fed on QPM had better chances of escaping death due to diarrhoea and other infectious diseases compared to those fed on normal maize. Also, cost per kilogramme feed was reduced by 29.4% for broilers and by 18.0%; 12.6% and 2.8% at starter, grower and finishing phases for pigs, respectively, when QPM was

substituted for normal maize in these diets. There was significant difference when lysine and tryptophan content in QPM were compared with what is obtained in normal maize. The average of 4.005% / 100 g of protein, for lysine in QPM and 2.96 %/100g of protein for normal maize were observed while that of tryptophan was 1.665 g/100g of protein as against 0.61 g/100g of protein for normal maize.

QPM is a cheap and alternate source of protein for poor who do not have resources to buy eggs or meat to meet their dietary protein requirement. As an added benefit, QPM increased levels of lysine, aid in assimilating zinc and iron from QPM grain. Medium duration QPM hybrids released are either superior or at par in productivity with their similar duration normal maize hybrids. Therefore, cultivation of QPM provides an opportunity tofarmers to produce nutritionally superior maize grains and increase productivity and profitability, one from the high value cereal grain product andthe other from use of feed and fodder in livestock industry. Maize is also a major component of the poultry feed mixture. Use of QPM as poultry feed leads to early development of broilers, save energy and feed, and also the extra cost incurred on lysine and tryptophan fortification (Sabo *et al.*, 2016).

***Problem statement***

Agricultural technology delivery, the main activity of the agricultural extension programme in Nigeria, as in many developing countries, is on the brink of collapse due to poor funding, funding instability and the activities of corrupt officials, none payment of extension agents salaries for months and non-provision of materials for field work and transportation facilities. Even where they are provided, the materials do not get to the officials. All these have increased the cost of monitoring and dissemination of technology to farmers as government incurs additional expenses in order to reach farmers (Adejo *et al.*, 2011).

Unfortunately, the spread of the modern maize production technologies in most of these maize areas, especially the Northern Guinea savanna, which provides the greatest potential, has been much less dramatic. In most areas, yields have been below 2t/ha, and in fact, Nigeria's average yield is 1.4t/ha which is about 1/3 of the World's average of 4.13t/ha Food and Agricultural Organization Statistic, (2014). Higher yield tends to be associated with the large-scale farmers who grow maize on commercial scale and the lowest yields are common with the small-scale farming communities, who grow maize mostly for subsistence but, are often forced to sell the grains soon after the harvest to meet family needs. The key point is that significant maize productivity gains are possible for all classes of farmers, provided they have access to the technological components (Falaki *et al*., 2001).

Despite the fact that maize contributes a significant amount in food requirements of the entire populace in Nigeria, its production is far below the average consumption quantity of 53.20 g/day and 43 kg per year (Food and Agricultural Organization of the United Nations Statistical Database, 2007). Similarly, maize production in Bauchi south senatorial zone has not been sufficient to meet the needs of the people and livestock despite the introduction of improved packages of maize. Currently, a bag of 80 kg-100 kg is sold at 8000-9000 naira in the area which is far above the reach of a common man. The questions that arise are whether the farmers in the area have not been utilizing the recommended maize production technologies? If yes, what is the extent of adoption of the QPM variety by the farmers? What factors determine the adoption of QPM technologies in the area? Were there constraints limiting their adoption? If there were, what were they? It is against this background among others that it becomes pertinent to assess the adoption of QPM technology among farmers in the zone.

***Purpose of the Study***

The objective of this paper is to determine the adoption of quality protein maize (QPM) among farmers in Bauchi south senatorial zone. Specifically the study aimed at the following:

i. Assess the extent of adoption of QPM production technologies
ii. Determine factors affecting the adoption of QPM technologies, and
iii. Identify the major problems confronting the farmers in carrying out these QPM technologies.

**Significance of the Study**

Agricultural research efforts can only be successful when developed technologies by research institutes are adopted by the end users to increase production. This study will elicit information on the usefulness and relevance of the QPM technologies as well as well as elucidate further modifications that are supposed to increase adoption of the technologies.

**Materials and Methods**

***The study area***

The study was carried out in Bauchi South Senatorial Zone. It comprises of seven Local Government Areas (LGAs) namely Alkaleri, Bogoro, Bauchi, Dass, Kirfi, Toro and Tafawa Balewa. Like the rest of Bauchi State, the southern zone is colored by ethnic diversity. The residents are mainly, Za'ar (Sayawa), and Jarawa with pockets of Fulani, Kanuri, Ngas, Boiyawa and Polchi mostly whom are farmers except for a few Igbo traders in the LGA headquarters. Reasons for this occupation span from the speculation that their migration from the east to the present location was in search of security and farmland. Little wonder, they were and are still known for both farming and hunting activities (Dyikuk, 2012). The zone has a population of 2,497,782 people and a land area of 33,161 $km^2$ (National Population Commission, 2006). The major crops grown in the area include maize, sorghum, millet, cowpea, acha, rice and root crops such as sweet potatoes and cassava.

***Data collection***

The population for the study comprised all maize farmers in the senatorial zone. The target population included all the QPM farmers in the zone. A multistage sampling procedure was adopted. First, three Local Government Areas out of the seven LGAs namely, Dass, Ganjuwa and Toro were purposively selected based on their popularity on maize production in the zone In mapping out the communities in the three LGAs a purposive sampling technique was employed to select two communities because the focus is on communities that are popular in maize production. A list of farmers engaged in QPM productions in each of the two communities were obtained from extension agents in the area. Out of these, simple random sampling technique was used in selecting twenty (20) QPM contact farmers, through whom six farmers each were randomly selected, making a total of one hundred and twenty (120) respondents for the study.

***Analytical techniques***

The Linear form of the regression function used in this analysis is given as:

$$Y = a + ß_1x_1 + ß_2x_2 + ß_3x_3 \ldots\ldots\ldots + ß_{10}x_{10}$$

**Where** Y = Adoption of QPM; A = the intercept (constant); $x_1 - x_{10}$ = variables under study where $x_1$= Age, $x_2$ = Years spent in school, $x_3$ = Household size, $x_4$ = Annual income, $x_5$ = Farm size, $x_6$ = Marital status, $x_7$ = Access to credit, $x_8$ = Farming experience, $x_9$ = Extension visit, $x_{10}$ = Farmer organization, μ = Error term and $ß_1$,$ß_{10}$are the regression coefficients of the independent variableswhich was assumed to be evenly distributed across the study population

The data were analyzed using descriptive statistics such as percentages for objective 1, multiple regression for objective 2 and mean score using 3- point Likert type scale and standard deviation for objective 3.

**Results and Discussion**

***Socio-economics of the respondents***

In Table 1 the socio-economic characteristic of farmers were presented. The mean age of the respondents was 37 years. The age factor in traditional agriculture is significant in two ways. The first is productivity while the second has to do with increased rate of adoption of innovation. Many studies revealed that old farmers often tend to be more conservative (traditional) and afraid of taking risk, which the adoption of farm technologies entails (Hamidu *et al.*, 2006). In this study the mean household size was 10 persons, mean years of farming experience was 11, average farm size was 3 hectares and average income from QPM was ₦132,700.00 per year.Household size has positive implication on family labour availability for farming enterprises. Ogundele and Okoruwa (2006) note that household size plays a significant role in subsistence farming in Nigeria where farmers rely on household members for the supply of about 80% of the farm labour requirement. The study also shows that these farmers have a good number of years of experience in farming which will enable them have managerial ability in terms of managing farm risks and uncertainties such as price fluctuation, disease outbreaks and pest infestation in maize. They also reveals that farming in the area is on subsistence level since majority of these farmers cultivated 3 hectares of land with an earning of ₦132,700.00.

***Level of adoption of QPM technologies***

Results on the Table 2 indicate that 26.3% of the farmers have adopted the use of QPM, 34.3 were at the awareness stage, 21.2% were not aware of the technology, while 7.5%, 6.4% and 4.7% of the respondents were at the interest, evaluation and trial stages of the technology respectively indicating that majority of the respondents were aware of the QPM variety. Entries in Table 2 also show that 19.2 of the respondents have adopted the use of planting 75 by 25 cm for planting of QPM while 39.2% were at awareness with only 6.7% not aware indicating that greater proportions of the respondents were aware of the use of planting space of 75 by 25 cm. Similarly Table 2 also revealed that 74.2% respondents preferred the use organic manure to maintain soil fertility. This agree with Ado (2010) who stated that, majority of farmers in Africa applied organic manure at the beginning of farming operation before the onset of rainfall. Also, 39.2% of the respondents were aware of the recommended NPK 20:10:10, but only 19.2% have adopted. Meanwhile, 39.2% of the respondents have adopted the use of pre-emergence herbicide to control weeds. Also, 37.3% were aware of the use of post emergence herbicide in destroying weeds before planting of maize. Table 2 also shows that only 31.3% of the respondents adopted the planting rate of one seed per hole while 46.7% were at the awareness stage. This is due to the fact that it is not easy to maintain one seed per hole when using manual labour in planting. However, any deviation from the planting rate of one seed per hole will definitely affect plant population hence reducing crop yield at harvest. Table 2 also shows that 87.3% of the respondents have adopted the use of maize shelling machine than the use of manual labour in threshing maize.

**Table 1: Distribution of respondents according to age, household size, farming experience, farm size and income from maize**

| Variable | Frequency | Percentage | Mean |
|---|---|---|---|
| **Age** | | **25.8** | |
| < 30 | 31 | 27.5 | |
| 31-40 | 33 | 22.5 | 37 |
| 41-50 | 27 | 17.5 | |
| 51-60 | 21 | 6.7 | |
| 61 and above | 8 | | |
| **Household size** | | | |
| < 4 | 7 | 5.8 | |
| 4-7 | 18 | 15.0 | 10 |
| 8-11 | 51 | 42.5 | |
| 12 and above | 44 | 36.7 | |
| **Years of farming experience** | | | |
| 1-5 | 14 | 11.7 | |
| 6-10 | 53 | 44.2 | 11 |
| 11-15 | 47 | 39.2 | |
| 16-20 | 6 | 5.0 | |
| **Farm size** | | | |
| < 1 | 1 | 0.8 | |
| 1-3 | 77 | 64.2 | 3 |
| Above 3 | 42 | 35.0 | |
| **Income** | | | |
| 10,000-100,000 | 55 | 45.8 | |
| 100,001-190,000 | 38 | 31.7 | ₦132,700.00 |
| 190,001-280,000 | 23 | 19.2 | |
| 280,001-370,000 | 4 | 3.3 | |

**Source:** Field survey data(2015)

**Table 2: Distribution of respondents according to stages of QPM adoption**

| QPM production technologies | Not Aware | Aware | Interest | Evaluation | Trail | Adoption | Rejection |
|---|---|---|---|---|---|---|---|
| Use of QPM variety | 21.2% | 34.3% | 7.5% | 6.4% | 4.7% | 26.3% | - |
| Planting space (75 X 25 cm) | 6.7% | 39.2% | 19.2% | 5.0% | 10.8% | 19.2% | - |
| Use of organic manure | 1% | 0.8% | 2.5% | 3.5% | 10% | 74.2% | 3.4% |
| Use of in-organic fertilizer (NPK 20:10:10) | 6.7% | 39.2% | 19.2% | 5.0% | 10.8% | 19.2% | - |
| Use of pre-emergence herbicide | 6.7% | 39.2% | 19.2% | 5.0% | 10.8% | 19.2% | - |
| Use of post-emergence herbicide | 4.2% | 37.3% | 7.6% | 0.8% | 11% | 17.0% | 22.0% |
| Number of seed per hole (1 seed) | 2.1% | 46.7% | 7.7% | 4.9% | 8.4% | 31.3% | 0.6% |
| Use of shelling machine | - | 0.8% | 3.3% | 3.0% | 4.0% | 87.3% | 0.5% |

**Source:** Field survey data (2015)

**Table 3: Factors influencing the adoption of QPM production technologies**

| Variables | Unstandardized Coefficient B | Standard Error | Standardized coefficient Beta | T | Sig. |
|---|---|---|---|---|---|
| Constant | -1.522 | 0.661 | | -2.304 | 0.023 |
| Age | 0.007 | 0.007 | 0.080 | 1.038 | 0.302 |
| Years spent in School | 0.012 | 0.016 | 0.053 | 0.0770 | 0.443 |
| Household size | 0.022 | 0.034 | 0.050 | 0.664 | 0.508 |
| Annual income | 1.990 E-5 | 0.000 | 0.726 | 5.411 | ***0.000** |
| Farm size | 0.065 | 0.202 | 0.035 | 0.324 | 0.747 |
| Marital status | 0.223 | 0.258 | 0.060 | 0.866 | 0.388 |
| Access to credit | 0.190 | 0.316 | 0.046 | 0.601 | 0.549 |
| Farming experience | 0.030 | 0.034 | 0.065 | 0.874 | 0.384 |
| Extension visit | -0.011 | 0.059 | -0.015 | -1.093 | 0.847 |
| Farmer organization | -0.036 | 0.395 | -0.007 | -0.091 | 0.928 |

**Source:** Field survey data (2015)

Dependable variable: Adoption; R. square adjusted = .541, F value = 12.693; P ≤ 0.05, significant; *The level of significant

***Factors influencing the adoption of QPM production technologies***

Results of the multiple regression analysis on factors influencing the adoption of QPM production technologies on Table 3 show that only income (t = 5.411, p = 0.000) was found to be statistically significant in influencing the adoption of QPM production technologies. Other variables such as age (t = 1.038, p = 0.302), years spent in school (t = 0.770, p = 0.443), household size (t = 0.664, p = 0.508), farm size (t = 0.324, p = 0.747), marital status (t = 0.866, p = 0.388), access to credit (t = 0.601, p = 0.549), farming experience (t = 0.874, p = 0.384), extension visit (t = 1.093, p = 0.847) and membership in social organizations (t = 0.091, p = 0.928) have no significant influence on adoption of QPM production technologies. This finding is in contrast to the earlier findings of Rao and Rao (1996) who stated that factors such as age, farming experience, and training received, socio-economic status, cropping intensity, aspiration, membership of organization, innovativeness, source of information and agent credibility have positive and significant association with adoption. This could be associated to farmers' preferences to income yielding crops due to poverty.

***Constraints to adoption of QPM technologies***

Table 4 reveals that the major constraints to QPM technology adoption were: poor access to sources of agricultural information (M = 2.87), poor access to credits (M = 2.86), inadequate rural roads (M = 2.84), inadequate extension visit (M = 2.81), ignorance of the usefulness of the variety in diet (M = 2.53) and scarcity and high cost of farm inputs (M = 2.62). Similarly, technicalities of innovation (M = 1.67), unavailability of market (M = 1.27), poor income from QPM (M = 1.22) and inadequate land (M = 1.31) were regarded as minor constraints to adoption.The result is in agreement to Bola, Aliou and Omonona (2012) who reported that access to agro-inputs positively influenced the adoption of improved technologies. Also Longtau (2003) reported that inadequate extension visit is one of the impediments to adoption of agricultural innovation.

**Table 4: Mean scores on perceived constraints to QPM production technologies**

| Constraints | Mean | Standard deviation |
|---|---|---|
| Poor access to sources of information | 2.87* | 0.429 |
| Poor access to credits | 2.86* | 0.416 |
| Inadequate rural roads | 2.84* | 0.485 |
| Inadequate extension visit | 2.81* | 0.523 |
| Inadequacy of storage and processing facilities | 2.77* | 0.601 |
| Disease and pest infestation | 1.20 | 0.495 |
| Technicalities of innovation | 1.67 | 0.920 |
| Unavailability of markets | 1.27 | 0.590 |
| Poor income from QPM variety | 1.22 | 0.542 |
| Ignorance of usefulness of the variety in diet | 2.53* | 0.744 |
| Inadequate land | 1.31 | 0.646 |
| Scarcity and high cost of farm inputs | 2.62* | 0.674 |

**Source:** Field survey data (2015)

**Conclusion**

This study has shown that the major influencing factors for the adoption of QPM were income. Based on the findings, it is recommended that input support services in the form of fertilizer and chemicals should be provided to enhanced adoption. Farmers should be linked to sources of markets and credits to enable them purchase necessary inputs and extension services should be strengthened so as teach farmers the need to adopt improved technologies in order to reduce poverty and improve food security.

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