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SUPPLY RESPONSE ANALYSIS OF MILLET IN FUNAKAYE LOCAL GOVERNMENT AREA OF GOMBE STATE, NIGERIA: A PROFIT FUNCTION APPROACH

J.R. Mani, A.Y. Abdullahi, L.A. Ibrahim and M. Yusuf

National Agricultural Extension Research and Liaison Services, Ahmadu Bello University Zaria, Nigeria

ABSTRACT

This study focused on output supply and input elasticities of millet crop in Funakaye LGA, Gombe State, Nigeria. The specific objectives determined millet supply response to prices of input and non-price factors. Primary data were collected through structured questionnaire administered to 300 randomly selected millet farmers. Data were analysed using translog profit function approach. Profit of millet production showed that the coefficient of factor prices of labour, seeds and agrochemicals were found to be negative in the profit function as expected. The own-price elasticity of millet supply is in the elastic region. Cost of fertilizer has the highest elasticity compared to costs of seeds, labour and agrochemicals. Among the fixed inputs, millet supply is least responsive to number of household members participating in millet production and most responsive to farmers level of education. The research concludes that price incentives can be an attractive strategy for expanding millet supply, while emphasis should also be put on support price to all input prices and relevant non-price factors such as education and land reforms. It is hence recommended that policy needs to go beyond price interventions as a means for expanding millet supply, as price and non-price incentives are judicious in influencing smallholder farmers' production decision and supply. This could be through encouraging better use of resources and its availability as well as the development of rural infrastructure. The Agency for Adult education and extension agents could consider providing basic education training within farming communities.

Keywords: Supply response analysis; Millet; Profit function; Funkaye

INTRODUCTION

Pearl millet (*pennisetum glaucum*) is the most important and probably having the greatest potential among the millet varieties. It provide food for over 40 million people in northern Nigeria, as such the most important cereal in the dry sub-humid and semi-arid zones of Nigeria (Dawud *et al*., 2017). Pearl millet is well adapted to growing areas characterized by drought, low soil fertility and high temperature, it performs well in soils with high salinity (Malabe *et al*., 2017). According to Izge (2006) in Izge (2013) Pearl millet responds well to management inputs, therefore it has high potential of becoming an important component of intensive agriculture especially in arid and semi-arid regions. The crop is a highly variable small-seeded grass, widely grown around the world as cereal crop or grain for human food and fodder. It is an important crop in the semiarid tropics of Asia and Africa (especially in India, Mali, Nigeria, and Niger). Nigeria ranks second after India in global pearl millet production with an average annual production of 5,000,000 tons between the years 1999 to 2010 (Food and Agriculture Organization Statistics FAOSTAT, 2014). While production was about 1,468, 688 tons in 2016/2017 cropping season (FAOSTAT, 2018). The crop ranks third after maize and sorghum among cereal food crops (Okeke-Agulu and Onogwu, 2014). Millet as a traditional food crop of Gombe State is cultivated on an area of about 108,680 Ha producing about 102.66 million metric tons in 2016, while production increased to about 105.62 MT in 2017, significantly increasing by 2.88% National Agricultural Extension and Research Liaison Services (NAERLS) and Federal Ministry of Agriculture and Rural Development (FMARD, 2017). Thus, the crop is a good source of minerals such as magnesium, iron, calcium and phosphorous. It is also drought tolerant, disease resistant, effective in suppressing weeds and have a long shelf-life (Izge, 2013). Further, the seed can be stored for a longer period without spoilage, has a long shelf life and can be termed as famine reserve. Therefore, pearl millet is very important to the nation's agricultural sector and nutrition, food security and poverty reduction.

The microeconomic concept founded in neoclassical economics that states that firms exist and make decisions in order to maximize profits. Businesses interact with the market to determine pricing and demand and then allocate resources according to models that look to maximize net profits. This firm is a production function personified by an entrepreneur/farmer. Production target can thus, be achieved by considering the production function with the neoclassical properties that describes the transformation of variable and fixed inputs into outputs. The profit function can explain the exact relationships among variables (Chaudhary *et al*., 1998). The profit function approach uses a duality theorem applied to provide comprehensive relationship among inputs and outputs to determine supply. Unlike the production function, the profit function involves only input/output prices and quantity of quasi fixed inputs which are not endogenous. By the duality approach, the assumption of profit maximization and competitive market are assured because the derived input demand and output supply equation are obtained from the profit function (Junaid *et al.*, 2014; Alam, 1992). Additionally, Abrar *et al.* (2004) stated that among the various functional forms, a flexible functional form for the profit function is preferred than translog profit function, normalized quadratic form and the generalized Loentief approach. The translog profit function is an attractive flexible function. Khalil (2005) narrated that this function has both linear and quadratic terms with the ability of using more than two factor inputs.

Emphasis in development policy has been placed on increasing agricultural supply to serve as a base for key economic development. Agricultural supply is thus the result of the decision of many farmers working under different environments with different motivations. Mushtaq and Dawson (2002) noted, however, that empirical understanding of farmers' supply responses to price and nonprice factors affecting production could help in highlighting strategies required for improving production and food security levels. Where low domestic supply of food grains amidst declines in purchasing power, has resulted in consistently declining per capita food production and increased market prices. Thus, Nigeria's major challenges is to identify and put in place policies, institutions and investments that will enable agricultural marketing systems to catalyze supply response or growth on the millions of smallholder farmers in the country. This study used cross sectional data on millet producers in Funakaye Local Government Area (LGA), Gombe State to examine the effects of price and non-price factors on millet farmers within the framework of the profit function approach.

MATERIALS AND METHODS

Study Area

Funakaye LGA is located on latitude 10º 51'00″ N and longitude 11º 26'00″ E, bounded in the east by the Gongola River and Lake Dadin Kowa, beyond which lie Yobe State and Borno State. It has an area of about 1,415 km^2 and a population of 236,087 people (NPC, 2006), the projected population of the area in 2018 stands at 344,687 people using 3.2 percent growth rate per annum. The area is agrarian with intensive production of millet, sorghum, cowpea, pepper and onion. Livestock production including sheep, goats and cattle is also a common practice in the area. The community is blessed with high deposits of solid minerals and therefore hosts the Ashaka Cement Factory.

Sampling Procedure and Data Collection

This study was conducted in Funakaye LGA, Gombe State. A two-stage sampling technique was used in the study. In the first stage, 10 villages were purposively selected based on their intensity in millet farming and proximity to Ashaka Cement Factory. This is because, in prioritizing its corporate social responsibility (CSR), the Ashaka Cement Factory has partnered with other relevant stakeholders in terms of improving the agricultural fortunes for the Nigerian farmers in particular those that are proximate to its operations sites. In Funakaye LGA, the selected villages for the CSR programme include Ashaka-gari, Baddam, Bage, Bajoga, Darumfa, Gwangilas, Jalingo, Juggol-barkono, Lariski and Sangaru. In the second stage, 30 millet farmers were randomly selected from each community for the take-off of the CSR programme, giving a total of 300 millet farmers. It is worth mentioning that only farmers that belong to associations were selected.

Primary data was collected in 2018 production season through the administration of structured questionnaires using computer assisted personal interview (CAPI) to sampled millet farmers in Funakaye LGA, Gombe State.The data collected include costs of inputs, price of output, land size, level of education and number of household farming members.

Analytical Technique

Model Estimation

By assuming that millet farmers maximize short run profit and operate within competitive factors and the product market, the construction of translog profit function required the minimum requisite set of variable inputs and fixed factors of production. From the general function, and following Christensen, Jorgenson and Lau (1973) and Junaid, Ali, Ali, Jan, and Shah (2014) the normalized restricted translog profit function can be stated as;

$$\ln\Pi^* = \alpha_0 + \sum_{i=1}^{4} \alpha_i \ln p_i^* + \frac{1}{2}\sum_{i=1}^{4}\sum_{j=1}^{4} \rho_{ij} \ln p_i^* \ln p_j^* + \sum_{i=1}^{4}\sum_{k=1}^{3} \gamma_{ik} \ln p_i^* \ln z_k + \sum_{k=1}^{3} \beta_k \ln z_k + \frac{1}{2}\sum_{k=1}^{3}\sum_{h=1}^{3} \delta_{kh} \ln z_k \ln z_h + v - u \quad (1)$$

given an inefficiency model as $u = \beta_0 + \sum \beta_d Z_d + \omega$ (2)
Specified in actual variables as;

$$ln\pi_w^* = \alpha_0 + \alpha_1 lnP_l + \alpha_2 lnP_f + \alpha_3 lnP_s + \alpha_3 lnP_{ac} + \alpha_4 lnZ_1 + \alpha_5 lnZ_2 + \alpha_6 lnZ_3 + {}^1/_2\, \alpha_7 (lnP_l)^2 + {}^1/_2\, \alpha_8 \left(lnP_{ff}\right)^2 + {}^1/_2\, \alpha_9 (lnP_{ss})^2 + {}^1/_2\, \alpha_{10} (lnP_{acac})^2 + \alpha_{11} lnP_l lnP_f + \alpha_{12} lnP_l lnP_s + \alpha_{13} lnP_l lnP_{ac} + \alpha_{14} lnP_l lnZ_1 + \alpha_{15} lnP_l lnZ_2 + \alpha_{16} lnP_l lnZ_3 + \alpha_{17} lnP_f lnP_s + \alpha_{18} lnP_f lnP_{ac} + \alpha_{19} lnP_f lnZ_1 + \alpha_{20} lnP_f lnZ_2 + \alpha_{21} lnP_f lnZ_3 + \alpha_{22} lnP_s lnP_{ac} + \alpha_{23} lnP_s lnZ_1 + \alpha_{24} lnP_s lnZ_2 + \alpha_{25} lnP_s lnZ_3 + \alpha_{26} lnP_{ac} lnZ_1 + \alpha_{27} lnP_{ac} lnZ_2 + \alpha_{28} lnP_{ac} lnZ_3 + \alpha_{29} lnZ_1 lnZ_2 + {}^1/_2\, \alpha_{30} (lnZ_1)^2 + {}^1/_2\, \alpha_{31} (lnZ_2)^2 + {}^1/_2\, \alpha_{32} (lnZ_3)^2 + \mu \quad (3)$$

Where; Π- Restricted profit normalized by the price of millet (₦)/kg, P_f- Price of fertilizer normalized by the price of millet (₦)/kg, P_L- Labour (Wage rate) normalized by the price of millet (₦ /manhour), Ps- Price of seeds normalized by the price of millet (₦)/kg, Pac- Price of agrochemicals normalized by the price of millet (₦)/L, Z_1- Land area under millet production (Hectares), Z_2- Level of formal education (years), Z_3- number of household members participating in millet production, $\alpha_1 - \alpha_{32}$ are parameters to be estimated.The partial derivatives of restricted profit function with respect to logs of input price, gives the corresponding share equations are hence estimated using Hotelling Lemma as;

$$S_i = \frac{P_i X_i}{\Pi^*} = \frac{\partial ln\Pi^*}{\partial lnP_i^*} = \alpha_0 + \sum_{j=1}^4 \rho_{ij}\, lnP_j^* + \sum_{j=1}^4 \gamma_{ik}\, lnZ_k \quad (4)$$

$$S_q = \frac{P_q^* X_q}{\Pi^*} = 1 + \frac{\partial ln\Pi^*}{\partial \Pi P_q^*} = 1 - \left(\alpha_0 + \sum_{i=1}^4 \sum_{j=1}^4 \rho_{ij}\, lnp_j^* + \sum_{i=1}^4 \sum_{j=1}^3 \gamma_{ik}\, lnZ_k\right) \quad (5)$$

$$S_i = \frac{P_i X_i}{\Pi^*} = \frac{\partial ln\Pi^*}{\partial lnP_i^*} = \alpha_0 + \sum_{j=1}^4 \rho_{ij}\, lnP_j^* + \sum_{j=1}^4 \gamma_{ik}\, lnZ_k \quad (4)$$

$$S_q = \frac{P_q^* X_q}{\Pi^*} = 1 + \frac{\partial ln\Pi^*}{\partial \Pi P_q^*} = 1 - \left(\alpha_0 + \sum_{i=1}^4 \sum_{j=1}^4 \rho_{ij}\, lnp_j^* + \sum_{i=1}^4 \sum_{j=1}^3 \gamma_{ik}\, lnZ_k\right) \quad (5)$$

Where S_i-share of the ith input in the restricted profit, S_q-share of output in the restricted profit, X_i-quantity of input i, X-level of output. The input and output shares come from a singular system of equations ($S - \sum S_i = 1$), then following Farooq, Young, Russel, and Iqbal (2001), the output share equation was dropped, and the profit and factor demand equations was estimated as a simultaneous system. Own and cross price elasticities were derived to determine responsiveness of both inputs and output.

RESULTS AND DISCUSSION

Profit of Millet Production

As shown in Table 1, homogeneity of the parameter estimates was achieved through normalization of all variables. The translog function ensures global monotonicity in prices but not in outputs since monotonicity in outputs is a function of the parameters of the cost function (Segal, 2003). However, the monotonicity condition was violated at 12 out of 300 observations. Henningsen and Henning (2009) reported that if the monotonicity condition is violated only at a few data points, these are probably random deviations from the “true” monotonically increasing production frontier.

Table 1: Restricted parameter estimate of the translog profit function of millet farmers

Variables	Reg. coeff.	Standard error	t-value
Dependent variable	Normalized profit		
Constant	1.6551	1.5071	1.1
Ps	0.0435	0.3090	-0.14
Pf	0.0164	0.4299	0.04
Pl	1.2358	0.5213	2.37**
Pac	0.405	0.3834	1.06
ps2	-0.04	0.0293	-1.36
pf2	0.027	0.0398	0.68
pl2	-0.0412	0.0081	-5.11***
pac2	-0.0066	0.0379	-0.17
Pspf	0.137	0.0572	2.39**
Pspl	-0.1897	0.0955	-1.99*
Pspac	0.1322	0.0504	2.62***
Pfpl	0.0023	0.1274	0.02
Pfpac	-0.0224	0.0611	-0.37
Plpac	-0.1234	0.1290	-0.96
psz1	0.1589	0.1192	1.33
psz2	0.004	0.0082	0.49
psz3	-0.0059	0.0199	-0.29
pfz1	0.0244	0.1716	0.14
pfz2	-0.0035	0.0120	-0.29
pfz3	-0.0015	0.0329	-0.05
plz1	0.4754	0.1573	3.02***
plz2	0.0125	0.0116	1.08
plz3	0.0184	0.0246	0.75
pacz1	-0.0926	0.1362	-0.68
pacz2	0.0181	0.0096	1.89*
pacz3	0.0123	0.0333	0.37
z1	1.8354	0.9739	1.88*
z2	0.4512	0.1158	3.9***
z3	-0.0804	0.0990	-0.81
z1z1	-0.0995	0.1815	-0.55
z2z2	-0.0519	0.0154	-3.37***
z3z3	0.0006	0.0072	0.09
z1z2	0.0244	0.0180	1.35
z2z3	0.0028	0.0052	0.54

*** significant at 1%, **significant at 5%, * significant at 10%

From the Table, only the coefficient of factor price of seed was found to be negative in the profit function. This means that cheaper and availability of seeds as an input will increase the profit obtained by the millet farmers. This agrees with the findings of Okoruwa *et al*.(2009). Nevertheless, all the coefficients are less than unity except the coefficient of price of labour, indicating that the input prices are inelastic, hence, percentage change in profit is less than the percentage change in prices of the inputs. Intrinsically, only prices of labour was found to be statistically significant and different from zero in the first order derivatives. The own-interactions or the second order derivatives measures how the rate of change of a quantity/cost is changing. The own-interactions of price of labour was significant at 1% but negative, this implies that continuous increase in cost of labour will significantly reduce farm level profit of millet farmers in the study area.

Of the cross derivatives, PsPf, PsPl, PsPac, PlZ1, PacZ2, PacZ3 and z2z2 are significantly different from zero with both positive and negative relationships. The cross derivative indicates the marginal rate of technical substitution (MRTS) of the variable cost inputs. PsPf has an MRTS of 0.14, that is for every 1 unit increase in the cost of seeds, there is a 0.14 unit increase in the cost of fertilizer for profit level to remain unchanged. The negative sign shows a decreasing rate of substitution between the variables. Similarly, the MRTS PsPl is -0.19, that is for 1 unit increase in the cost of seeds there is a 0.19 decrease in the cost of labour for the farmer to maintain the same level of profitability. On the other hand, the MRTS for PsPac was 0.13 and positive, that is for every 1 unit increase in the cost of seeds, there is a 0.13 increase in the cost of agrochemicals. The positive sign of the MRTS in this case showed an increasing rate of substitution. The MRTS for Plz1 is 0.48 signifying that for every unit increase in land area acquired, farmers must increase cost of labour by 0.48. The implication of this is that as farmers acquire certain level of farm-land their demand for labour will increases. On the other hand, Pacz2 and z2z2 have MRTS of 0.02 and -0.05 respectively. Pacz2 gives the rate of change of access to formal education that will cause an increase in the cost of agrochemicals to remain on the same level of maize profitability. Whereas z2z2 indicted the own interaction of education and showed that continuous access to education can increase farm level profit of the farmers. Similarly, z2 had a positive coefficient and showed that access to education can significantly increase profit of the farmers. Thus, based on the number of significant variables, the utilization of most of the specified factors of production have entered stage II although economic optimum has not been reached. Therefore, increase in the use of these inputs might push the production process to the optimal stage of production.

Further insights into the rationality of the profit function are provided by examining own-price elasticities and partial elasticities of substitution at their mean values.

Millet Supply Response

The own-price elasticity of millet has a positive sign and is consistent with apriori and theoretical expectations (Table 2). The supply elasticity is in the elastic region; a 1% increase in the price of millet will result to a 1.57% increase in millet supply *ceteris paribus*. This high elasticity implies that when millet prices are favourable, farmers will significantly increase their supply. This, however, is not consistent with findings of Wijetunga and Economics (2016), they reported the supply elasticity of paddy rice in Sri Lanka with respect to previous year farm gate price to be positive and inelastic.

Table 2: Derived elasticity estimates for millet supply and demand for variable inputs in millet production

	Millet supply	Seeds demand	Fertilizer demand	Labour demand	Agrochemical demand
millet price	1.57	2.31	1.78	1.96	1.94
cost of seeds	-3.74	-3.15	-8.89	-5.17	-5.43
cost of fertilizer	-9.46	-7.90	-2.17	-7.89	-7.89
cost of labour	-5.75	-4.15	-4.18	-2.16	-4.17
Cost of agrochem	-6.00	-4.43	-4.43	-4.43	-2.16
Formal education	5.54	2.25	2.92	3.94	3.13
Hhmmbrs in millet prn	3.25	0.67	0.82	2.00	1.17
Farm size	3.62	1.17	1.20	2.45	1.62

Millet supply response to variable inputs; seeds, fertilizer, labour and agrochemicals were all negative and in the elastic region. The elasticity of millet supply with respect to seed cost is high (3.74), this is likely to reflect the non-adoption of improved seed varieties by the farmers. According to the Consultative Group for International Agricultural Research (CGIR)s Diffusion and Impact Improved Varieties in Africa (DIIVA)Project report of 2010, some improved cultivars were released in Nigeria but adoption by the small-scale farmers are low, with only 24% using improved varieties and 75% using local varieties.

On the other hand, a 1% increase in the price of fertilizer would lead to a 9.4% reduction in millet supply. This implies that increase in fertilizer price may reduce its demand and consequently the supply of millet in the study area. This is in line with the findings of Mukhtar *et al.* (2017), who found that decrease in fertilizer cost would lead to an increase of total profit of millet in North-Western Nigeria. Conversely, a 1% increase in the cost of labour would lead to a 5.7% reduction in millet supply; this indicates that given the prevailing labour wage rate, the productivity of labour in millet production is high agreeing with the results of Rahman *et al.* (2016). Elasticity of millet supply with respect to cost of agrochemical was 6.00. That is, as the cost of agrochemical increases millet supply decreases by 6%. Okam *et al.* (2016) concluded that cost of agrochemicals has a significant influence on the profitability of rice production among men and women in Ebonyi State, Nigeria. Accordingly, the cost of fertilizer has the highest elasticity compared to costs of seeds, labour and agrochemicals. Signifying the importance of fertilizer in agricultural production, this contrasts the conclusion of Ammani *et al.* (2012) they concluded that there is no significant relationship between the aggregate maize output and quantity of fertilizer use in Kaduna State.

Millet supply responsiveness to level of formal education, household members partaking in millet production and land size were in the elastic region. Millet supply is least responsive to number of household members participating in millet production. This is likely to reflect the subsistence nature of millet production and consequently high use of family labour among the farmers. The consumption patterns of pearl millet are very specific and continue to remain region-specific, thus irrespective of availability of labour, there is a dominant production of pearl millet in the study area. However, millet supply is highly responsive to level of education. Weir and Knight (2004) found significant externality benefits of schooling in lifting agricultural productivity in Ethiopia. While, Mani and Hudu

(2018) that higher managerial skills by the farmer can increase maize supply in Kaduna State, Nigeria.

Elasticities of Seed Demand

The own price elasticity of seed is negative (Table 2) as suggested by theory. Seed demand is elastic; a 1% decrease in the cost of seed will substantially lead to a 3.15% increase in seed demand (high/improved seed varieties), *Ceteris paribus.* In Nigeria, the proportion of farmers who recycle millet seeds are high around 75 percent (CGIR/DIIVA project, 2010) due to diverse seed market conditions such as accessibility, availability and affordability of quality seeds Okeke-Agulu and Onogwu (2014). Therefore, these factors must be curtailed, to achieve self-sufficiency in food production. The main reason may be since high yielding seed varieties will give optimum yield and therefore, increase in output price is going to increase improved seed variety use. Nonetheless, cross price elasticities of demand for seed with respect to output price, level of formal education, household members in maize production and land size are positive, elastic and in line with theory. Therefore, their response to increase in seed demand is proportionate. Seed demand with respect to prices of fertilizer, labour and agrochemicals showed that they are complimentary goods with seeds demand. That is, quantity of seeds (improved variety) demand will increase, with a decrease in the costs of these inputs.

Elasticities of Fertilizer Demand

The own price elasticity of fertilizer is negative which is in line with apriori expectations (Table 2). Explicitly, a 1% decrease in the price of fertilizer will increase its demand by 2.17%. This is concordance with the findings of (Junaid *et al*., 2014). Further several studies (Mohammed and Mohammed, 2014; Mukhtar *et al.*, 2018; Sadiq *et al*., 2013) have indicated that fertilizer affects agricultural production at various significant levels. Millet price, level of formal education and land size are also important parameters moving fertilizer use; elasticities of 1.78, 2.92 and 1.20 respectively. Comparatively the elasticity of millet output with respect to fertilizer price is higher than the elasticity of fertilizer demand with respect to output price. This is suggestive of increasing demand for fertilizer with an increase in millet prices than just a decrease in fertilizer price. The elasticity of fertilizer demand with respect to land area indicates that amplifying land hectarage under millet production will be associated with higher fertilizer demand. The cross-price elasticity of fertilizer demand with respect to prices of seeds, labour and agrochemicals are complimentary. That is, higher quantities of fertilizer will be demanded alongside lower prices of seeds, labour and agrochemical.

Elasticities of Labour Demand

The demand for labour with respect to its own price is negative as expected and in line with theory (Table 2). Explicitly, a 1% decrease in the price of labour will increase its demand by 2.16%. Labour demand is quite responsive to changes in wage rate, that is as the wage rate decreases, millet farmers will demand more hired labour. (Mohammed and Mohammed, 2014) reported that access to hired labour can increases production that will tend to increase profit levels. Nevertheless, a 1% increase in the price of millet will raise the demand for labour by 1.96%. This implies that labour is sensitive to price incentives as is fertilizer and seeds, consequently policy tools aimed at enhancing millet production should also target labour. Land size, level of formal education and household members participating in millet production were all found to have an expansionary effect on labour demand with estimated elasticities greater than unity (2.45, 3.94 and 2.00) respectively. Cross price elasticities of seeds, fertilizer and agrochemicals are negative with respect to labour demand suggesting a complimentary relationship with labour demand than substitutes in millet production.

Elasticities of Labour Agrochemical Demand

The demand for agrochemical with respect to its own price is negative as expected and in line with theory (Table 2). Explicitly, a 1% decrease in the price of agrochemicals will increase its demand by 2.16%. Use of agrochemicals to control pests and diseases is of vital importance in recommended millet production practices. Agrochemical spraying is required at regular intervals to allow for high yield, pest and disease resistance. Omotesho *et al.* (2016) concluded that there is a significant relationship between agro-chemical inputs' use and maize yield in Osun State. Nonetheless, a 1% increase in the price of millet will raise the demand for agrochemical by 1.94%. This implies that agrochemical is sensitive to prices of output. Non-price factors affecting agrochemical demand were all in the elastic region. Omotesho *et al.*, (2016) indicated that agrochemical use can be affected by farm size, level of income, and educational status of farmers. Cross price elasticities of seeds, fertilizer and labour are negative with respect to agrochemical demand suggesting a complimentary relationship with labour demand than substitutes in millet production.

CONCLUSION

Price subsidy have been a major policy instrument employed by Nigerian government to achieve agricultural growth and productivity. Attention and focus of the government and other non-governmental organizations have been given to input price of fertilizer only while other factors have been neglected (labour, seed and agrochemical prices, and other fixed inputs) though these too are important in influencing millet production. This study generated elasticity estimates that can shed light on policy-relevant relationships between millet supply, seeds, agrochemicals, fertilizer and labour demand, and other fixed factors of production. The own-price elasticity of millet supply presented a sensitivity of millet supply to millet price. This is an indication that, enhancing producer price can be an attractive strategy for expanding millet supply, while emphasis should also be put on support price to all input prices and relevant non-price factors such as land. Therefore, it is recommended that government intervention should encourage better use of input resources as well as development of rural infrastructure. The Agency for Adult education and extension agents could consider providing basic education training within farming communities. The Ashaka Cement Factory can assist local farmers under its CSR program with facilitation and capacity building activities. High yielding millet seed varieties are another input whose adoption and use could be encouraged among farmers. This could be done through the intensification of provision of extension services to the farmers.

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