



## Factors Affecting Maize Production in Jema'a Local Government Area, Kaduna State, Nigeria

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### ABSTRACT

*This study aimed at an assessment of the factors affecting maize production in Jema'a Local Government area, Kaduna State, Nigeria. The specific objectives were to examine farmers' socio-demographic characteristics, identify factors affecting maize production and determine the challenges of maize production in the study area. A multistage method of data collection was used to obtain data for the study through questionnaire administration. Overall, a total of 204 questionnaires were administered to respondents. Results obtained were summarized and presented in simple percentages and chart, while multiple Regression analysis was used to analyse the data. The result from Atuku district shows an inverse relationship between the cost of maize seed and labour with maize output, while herbicide was positive. Fertilizer was not significant at 5% confidence level even when run separately. In Jagindi district, the cost of maize seed and herbicide were positive, while labour shows an inverse relationship to maize output. Fertilizer was significant at 5% level of significance. In Kusom district, the cost of maize seed and herbicide were positive. The result of labour was inversely related to maize output, while fertilizer was not significant when run separately at 5% alpha level. The study revealed that the major factors affecting maize production in Atuku, Jagindi and Kusom districts are poor soil fertility, windstorm, soil erosion and seed variety. The soil fertility status for maize production in the study area was found to be low, hence necessitating the use of chemical fertilizer. There is therefore, need to make fertilizer available to maize farmers at subsidized rates. The study also recommends adoption of labour saving technology and the use of herbicides to control weed.*

**Keywords:** Challenges, Factors, Maize Production, Relationship,

### 1. Introduction

Maize is one of the oldest and most important crops in the world (Babangona, 2015). The average yield of maize in Nigeria in 2014 was 10.1 million tons and 10.6 million tons in 2015 (Babangona, 2015). Maize grows across a range of agro-ecological zones in Nigeria. Being photoperiod sensitive, it can be grown anytime of the year giving greater flexibility to fit into

different cropping patterns (International Institute of Tropical Agriculture, 2012). It is one of the most dominant cereal crops in the southern and northern Guinea Savannah (Onyibe *et al.*, 2006). Nigeria is the 10th largest producer of maize in the world and the largest maize producer in Africa, followed by South Africa (International Institute of Tropical Agriculture, 2012). Both yellow and white varieties of maize are grown in

the entire country, with the North and North Central regions as the main production areas (United States Agency for International Development, 2010).

About seventy percent of maize farmers in Nigeria are smallholder farmers, with an average of 5 hectares of cultivated land accounting for 90 percent of total farm input (National Agriculture Imagery Programme, 2010). Maize in Nigeria is usually intercropped, with yam, cassava, guinea corn, rice, cowpea and soyabean (Babangona, 2015). The Nigerian agricultural policy places the small scale farmers in the central focus. This is because the nation's agriculture has always been dominated by the small-scale farmers, who crop less than 3 hectares but represent a substantial proportion of the total population and produce about 90-95% of the total agricultural output in the country (Oyeyika and Bolarinwa, 2009). These small scale farmers are the major actors in maize production in Jema'a Local Government Area of Kaduna State. Maize is a heavy feeder that requires sustainable amount of nutrients uptake (Kimeli, 2013). The enormous potentials for maize production can be realised with the use of fertilizer, improved seeds, hectarage expansion and adequate weed control. With adequate supply of these inputs and the provision of adequate storage facilities, the rapid expansion of maize could be sustained (Buba, 2005).

Kaduna State has rich agricultural resource endowment, yet the agricultural sector has been growing at a very slow rate (Kaduna State Government Development Plan, 2013). Even then, smallholder and traditional farmers who use rudimentary production techniques, with resultant low yields, cultivate most of the land in the production areas (Manyong *et al.*, 2005). High instability is a hallmark of the agricultural production of maize with a wide display of periodic fluctuations from good performance to bad performance and vice versa. In fact, it may be stated that a very unstable growth pattern characterizes maize production and points to the need to address the causes of this instability (Akaito and Saleh, 2017). To this end, this research focused on the factors of maize production in Jema'a Local Government Area, Kaduna State. This was achieved by characterizing the socio-economic attributes of maize farmers in the study area, examining the effects of input prices on maize production and identifying the challenges of maize production in the study area.

## 2. Materials and Method

### 2.1 The Study Area

Jema'a Local Government Area is located between latitudes 9°11' to 9°30'N and longitudes 8°00' to 8°30'E (see Figure 1). The Local Government Area is bounded in the East by

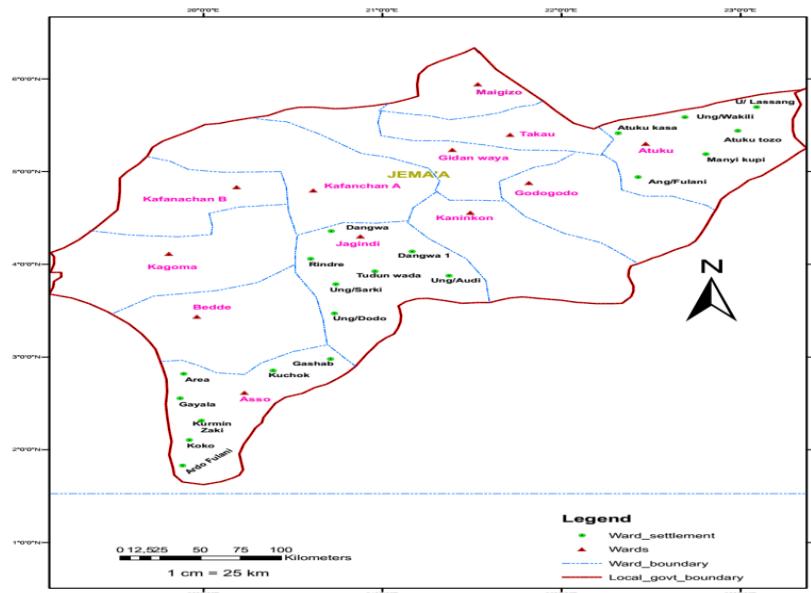


Figure 1: Jema'a Local Government Area.

Kaura, in the North by Zangon Kataf, to the West by Jaba and in the South-East by Sanga Local Government Area. The Local Government Area has twelve wards as: Kafanchan A, Kafanchan B, Maigizo, Takau, Atuku, Godogodo, Gidan Waya, Kaninkon, Jagindi, Kagoma, Bedde and Asso wards. The Local Government Area has an area of approximately 1,707km<sup>2</sup> and a total population of 278202 people with a population density of 163per km<sup>2</sup> (Chori, 2003).

The study area is underlain with basement complex. The relief of the Local Government Area is made up of high plains with a height of 180m to 600m (Chori, 2003). The Local Government Area is drained by several rivers including Rivers Assow, Okwa and Kogum (Joyce, 2011). The area enjoys a warm tropical climate with relatively high temperature throughout the year and two seasons—the rainy or wet season that lasts from May to October and the dry season which covers the rest of the year from November–March. The annual rainfall is up to 1500mm (Ishaya and Abaje, 2008). The study area is covered with ferruginous tropical soils. Alluvial soils are also found along the river banks of Jema'a (Mohammed-Saleem, 2015). The vegetation of the study area is that of the Guinea savannah type. It is characterized by tall grasses and woodland with species like *Daniela oliverii* (Maje), *Vitex domana* (Dinya), *Diospyros mespiliformis* (Kanya) etc. Species of grasses include the carpet grass, goat weed, elephant grass, gamba grass etc. (Rabi'u *et al*, 2013). Farming and trading are the major economic activities in the study area as their major source of livelihood. Cash and food crops are produced and their farm produce include yam, cassava, maize, beans, millet, sorghum, rice, ginger, and groundnut. Animals reared include poultry, cattle, sheep, goats and swine.

## 2.2 *Methodology*

The research made use of data generated from questionnaire on socio-economic data, farming production/activities, cost, input quantity and amount, area under production from 2011-2015, and major crops grown. The questionnaire was made up of open and close ended questions and farmers' population from the selected districts offices. Map information update and climatic data were obtained from the Local Government

Department of Agricultural Extension and the Kaduna State Agricultural Development Project respectively.

### *Sampling frame and sampling techniques*

A multi-stage sampling technique was used in selecting respondents for the study. The first stage involved the stratification of the study area into three zones to ensure geographical spread as: North East, Central and South West and the listing of wards in each zone while the second stage involved the random selection of one ward in each zone and one district from each selected ward with two communities in each district to ensure that each ward, district and communities has an equal opportunity of being represented. Finally, a convenient sampling technique was used to administer 34 copies of questionnaires to the farmers in each selected community at their farms with the help of field assistance to give a total of 204 administered in the sampled districts; this was so because the farmers were met directly on their farms. The three selected districts gotten from the district offices as: Atuku district 3920, Kusom district 6180, and Jagindi district 9340 to give a total of 19440 farmers. Cochran's 1963 formula was used to determine the sample size:  $n = N / [1 + N (e)^2]$ . Based on this formula, the sample size was 204 at 7% degree of precision. Where;  $n$  = sample size,  $N$  = Population size and  $e$  = Degree of precision.  $n = 19440 / 1 + 19440 (0.07)^2 = 204$ .

Descriptive statistics was used to summarize the data collected while the multiple regression analysis was used to test for association between parameters examined. A linear Cobb Douglas was fitted on the maize input and output levels. The input prices covered 2011 - 2015 data generated from the maize farmers. The model was specified as;

$$Y_t = f(X_{1t} X_{2t} X_{3t} X_{4t} U_t) \dots \dots \dots \quad (1)$$

Where:-  $Y_t$  = Total output of maize supplied in year<sub>t</sub> (Kg)  $X_{1t}$  = Price of Nitrogen, Phosphorus and Potassium (NPK) fertilizer in year<sub>t</sub> (Naira/50kg bag)  $X_{2t}$  = Price of maize seed in year<sub>t</sub> (Naira/1Kg bag)  $X_{3t}$  = Price of herbicide in year<sub>t</sub> (Naira/Litre)  $X_{4t}$  = Cost of Labour in year<sub>t</sub>  $t = 1 - 5$  years (i.e. 2011 - 2015).

The apriori expectations about the independent variables are as follows:- X1 (Fertilizer Price): This was expected to have an inverse or negative relationship with maize output. X2 (Price of Maize Seed): This was expected to have an inverse or negative relationship with maize output. X3 (Price of herbicide): This was expected to have an inverse or negative relationship with maize output. X4 (Labour cost):

This was expected to have an inverse or negative relationship with maize output.

### 3. Results and Discussion.

#### 3.1 Socio-economic characteristics of maize farmers.

The results from Table1 showed that Jagindi had the highest proportion of male respondents at 88% while Atuku has the highest proportion of female respondents at 25% respectively.

**Table 1:** The Distribution of Maize Farmers by their Socio-Economic Characteristics

Variable	Atuku Freq	(%)	Jagindi Freq	(%)	Kuson Freq	(%)
<b>Gender</b>						
Male	51	75.0	60	88.2	58	85.3
Female	17	25.0	8	11.8	10	14.7
<b>Total</b>	<b>68</b>	<b>100</b>	<b>60</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Age</b>						
$\leq 20$	8	11.7	6	8.8	5	7.4
21 – 30	10	14.7	9	13.2	11	16.2
31 – 40	14	20.6	18	26.5	15	22.1
41 – 50	17	25.0	10	14.7	19	27.9
51 – 60	10	14.7	13	19.1	10	14.7
$> 60$	9	13.2	12	17.6	8	11.7
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Education level</b>						
No Formal Education	6	8.8	8	11.8	9	13.2
Quar'anic/Nomadic	8	11.8	10	14.7	5	7.4
Primary	30	41.1	25	36.7	5	7.4
Secondary	19	27.9	18	26.5	25	36.7
Tertiary	5	7.4	7	10.3	6	8.8
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Occupation of respondents</b>						
Farming	40	58.8	35	51.5	43	63.2
Civil servant	12	17.6	14	20.6	10	14.7
Business	16	23.5	19	27.9	15	22.1
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Marital Status</b>						
Single	10	14.7	12	17.6	8	11.8
Married	36	52.9	41	60.3	40	58.8
Widow/Widower	15	22.1	11	16.2	14	20.6
Divorced	7	10.3	4	5.9	6	8.8
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Membership of Farmers Cooperative</b>						
Yes	0.0	0.0	0.0	0.0	0.0	0.0
No	68	100	68	100	68	100
<b>Household size</b>						
$<5$	14	20.6	16	23.5	13	19.1
<b>6-10</b>	<b>37</b>	<b>54.4</b>	<b>39</b>	<b>57.4</b>	<b>35</b>	<b>51.5</b>
<b>11-15</b>	<b>13</b>	<b>19.1</b>	<b>10</b>	<b>14.7</b>	<b>15</b>	<b>22.1</b>
$>15$	4	5.9	3	4.4	5	7.3
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>
<b>Farming Experience</b>						
<b>1-5</b>	<b>4</b>	<b>5.9</b>	<b>7</b>	<b>10.3</b>	<b>6</b>	<b>8.8</b>
<b>6-10</b>	<b>15</b>	<b>22.1</b>	<b>12</b>	<b>17.6</b>	<b>13</b>	<b>19.1</b>
<b>11-15</b>	<b>32</b>	<b>47.1</b>	<b>35</b>	<b>51.5</b>	<b>29</b>	<b>42.6</b>
$>15$	17	25.0	14	20.6	20	29.4
<b>Total</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>	<b>68</b>	<b>100</b>

**Source:** Field Survey, 2016.

The results imply that maize production in the study area is male dominated, attributable to the influence of tradition which grants men more access to land. This finding is in line with Quisumbing and Pandolfelli (2009) who argued that women often are disadvantaged in both statutory and customary land tenure systems, keeping women at a disadvantage. Abrahamsson *et al.*, (2013) further reported that the low productivity within Africa's female dominated agriculture could be seen within a framework of unequal gender structures where men are regarded as heads of households, with more rights to land.

The results show that a large proportion of the farmers engaged in maize production are within the active ages of 31 to 50 years. This age bracket is important especially in terms of the adoption of innovations and the ability to cope with the challenges associated with maize production. The findings agree with the report of Ali (2014) who reported that young people who have a proper education and the initiative to work in agriculture are called the 'New Farmers' and one of the characteristics of these New Farmers is their eagerness to adopt new technologies.

The study revealed that majority of the farmers in Atuku, Jagindi and Kusom districts had formal education which can help them in their farming business in terms of understanding and adoption of any new technology in order to improve on their farming practices. Literacy has been found to influence adoption of better farming technology (Rogers, 2003). Rogers (2003) reported that farmers who have adequate knowledge of technology use are more likely to adopt it and their production tends to be better. The rate of innovation diffusion and acceptance will be high among such farmers.

Respondents' marital status across the study area shows that majority are married. These findings showed that a good number of married people engaged in farming activities which revealed a high level of responsibility in meeting up with their roles as head and bread winners of the family. The significance of marital status on agricultural production can be explained in terms of the supply of agricultural family labour. This is in line with Yusuf *et al.*, (2014) who opined

that more farming activities will be carried out by people with many dependents.

Across the study area, 100% of the farmers did not belong to any active maize farmer group or cooperative. This is because the farmers are not well informed on record keeping and other marketing outlets, they only depend on open market for the sales of their produce and as a result, are not eager to find out information on these areas. Farmers' membership of social organization help to encourage extension workers who can provide assistance to individual farmers and groups in establishing links with formal and semi-formal financial institutions, and help them manage their money efficiently. The result agrees with Akpan *et al.*, (2013) who reported that farmers' membership of social organization and extension agent visits are important determinants of access to credit.

Household sizes are generally large at 6-10 in Atuku, Jagindi and Kusom wards. A household size of 6-10 implies that family size helps in providing labour in maize cultivation. Availability of labour has a positive relationship to the frequency of adaptation in hybrid variety. This was also argued by Aman (2003) who reported that large household sizes encourage good labour input which appears to encourage the adoption of more labour-intensive technology such as hybrids seeds.

In Atuku, Jagindi and Kusom Districts, farmers with 11-15 years have the highest farming experience. The study revealed that about 68% of the respondents have practiced farming for over 10 years. Ajagbe (2012) reported that farming experience is among the essential factors needed for agricultural production as this helps farmers adequately utilize resources for maximum yield.

### **3.2 Effect of input prices on maize production**

The linear form of the specified regression model had the best fit based on the adjusted coefficient of multiple determinations ( $R^2$ ), T – Statistics and the regression coefficients. The results in Table 2 shows that the independent variables (price of maize seeds, price of herbicides and cost of labour) accounted for about 99% of the variability in the maize output ( $R^2$  0.99). The F – value was significant at 5% level of probability meaning that the model was well specified.

**Table 2:** Results of Regression Analysis (Atuku)

Variable	Regression Coefficients	Standard Error	P value
Constant	79	.5433	.241
Seed (X2)	-.007	.000	.038
Herbicide (X3)	.007	.000	.015
Labour (X4)	-.002	.000	.027

*Source: Field Survey, 2016.*

n = 5 years

R<sup>2</sup> = 0.99

P= Significant at 5%

The price of maize seeds has an inverse relationship with maize output, implying that the quantity of seeds demanded will decline as the price of maize seeds increases in the market. This is because most farmers might not be willing to purchase hybrid maize seeds at a high price. This ultimately leads to the usage of local varieties which might not give very good output as expected and may consequently result in decline in production level. Herbicide was positive which was contrary to the apriori expectation. This could be due to insufficient quantity of herbicides used during maize cultivation. The result of labour was inversely related to maize output and

n = 5 years

R<sup>2</sup> = 0.99

P= Significant at 5%

In Table 3, the prices of maize seeds and herbicides were positive; this was contrary to the apriori expectation implying that as the prices of seeds and herbicides increase, maize production will increase. The reasons for the observed behaviour may be due to the low quantity of herbicides applied by maize farmers while that of seed could be because of the way most of the small scale farmers often use seed from their previous harvests without buying from the market. The result of labour was inversely related to maize output. This could be due to the cost of family labour that was captured in monetary form, resulting in the cost of labour.

**Table 3:** Results of Regression Analysis (Jagindi)

Variable	Regression Coefficients	Standard Error	P value
Constant	27	.244	.471
Seed (X2)	.009	.000	.007
Herbicide (X3)	.003	.000	.005
Labour (X4)	-.000	.000	.010

*Source: Field Survey, 2016.*

may due to the high cost of labour as captured by both hired and family labour in monetary form during cultivation.

Fertilizer (X1) was included in the model but was run separately due to its competition for significance with other independent variables; however the result was not significant at 5% confidence level (0.96). This could be due to the increase in its price in the market and poor access to government subsidized fertilizers. This can have a negative effect on maize output since maize is a heavy feeder of fertilizer especially in most lands in the study area due to the impoverished nature of the land as a result of continuous cultivation over the years.

Fertilizer which was run separately, (X1) was significant at 5% level (0.019) when compared with yield, implying that as the price of fertilizer increases maize production will increase contrary to the apriori expectation. The reasons for the observed behaviour may be due to the farmers' use of government subsidized fertilizers as compared to what most other farmers are pay in the market. Therefore, maize farmers must efficiently utilize the fertilizers by increasing the per unit yield as the price increases.

n = 5 years

R<sup>2</sup> = 0.99

P= Significant at 5%

In Table 4, the prices of maize seeds and herbicides were positive; contrary to the apriori expectation, implying that as the prices of seeds and herbicides increase, maize production will increase. The reasons for the observed result may be due to the low quantity of herbicides applied by the maize farmers. For maize seeds, the results reflect the practice by most of the small scale farmers who use seeds from their previous harvests without buying from the market. The result of labour was inversely related to maize output. This could be due to the cost of family labour that was captured in monetary form, resulting in high cost of labour.

fertility (28% in Kusom), windstorm (highest in Kusom at 24%), excessive rainfall (22% across all the wards) and seed variety respectively.

Soil infertility is related mainly to the low nutrient status of the soils while the quality of some soils have declined in the study area due to continuous cropping without remediating strategies adopted. This is in line with report by Byth (1993) who attributed decline in maize yield to two main reasons; declining soil fertility and rise in world fertilizer prices. The major contributory factors are soil degradation and low use of fertilizers.

**Table 4:** Results of Regression Analysis (Kusom)

Variable	Regression Coefficients	Standard Error	P value
Constant	33	.030	.769
Seed (X2)	.008	.000	.016
Herbicide (X3)	.007	.000	.008
Labour (X4)	-.000	.000	.012

*Source: Field Survey, 2016*

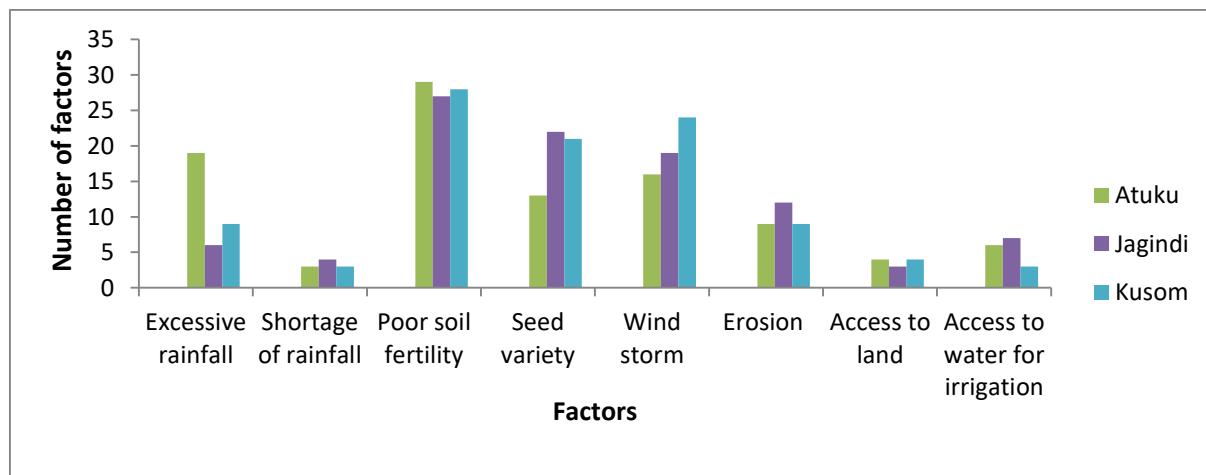
Fertilizer was excluded in the model due to its competition for significance with other independent variables; however it was not significant at 5% alpha level (0.86) when compared with yield, this could be due to the low application of fertilizers by the maize farmers in the wards.

### 3.3 Factors affecting maize production in the study area

The major factors affecting maize production are presented in Figure 2. These include poor soil

High rainfall was also identified as one of the factors affecting maize production in the study area, especially areas close to rivers which are liable to flooding. This can cause a total loss of maize production due to flood. Reshid *et al.*, (2000) indicated that high rainfall at the beginning of growing periods and later stages of crop maize growth could significantly reduce yields.

Wind storm is directly related to the amount of stalk breakage. This can lead to a loss directly



**Figure 2:** Factors Affecting Maize Production in the Study Area

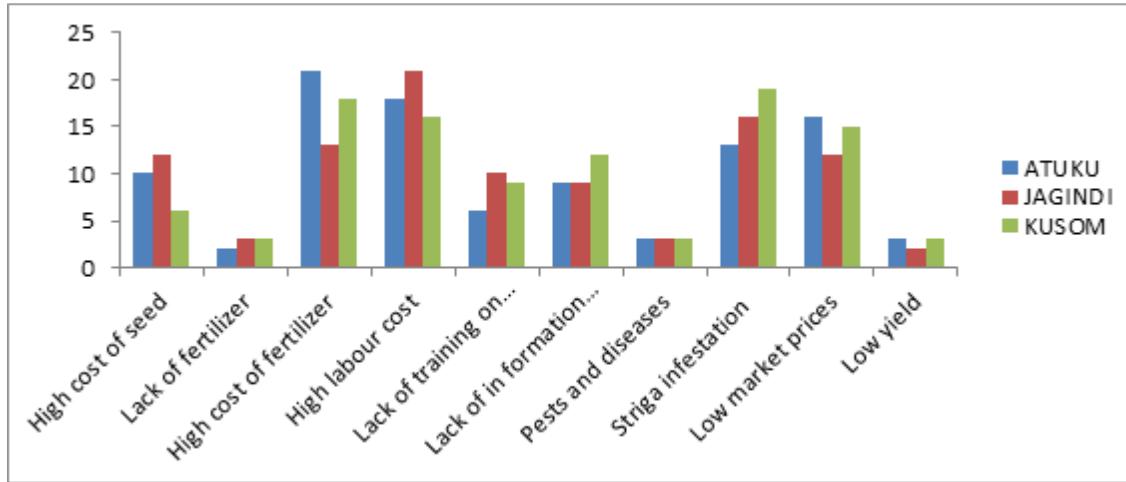
*Source: Field Survey, 2016.*

proportional to the breakage. Plants affected by green-snap can break anywhere along the stalk, often at the node just below the primary ear or below the ear and in the internodes. Broken plant may still be able to produce a nubbin, a small non-productive ear; this implies that there would be a loss in the expected output in the maize production. As noted by Agronext (2016), maize plants have high susceptibility of breakage when there is high Nitrogen, Phosphorus and Potassium

marginally fragile soils with negative consequences for crop yield.

### 3.4 Constraints of maize production in the study area

The major constraints of maize production are shown in Figure 3. The major challenges of maize farmers identified in the study area high cost of fertilizer, Striger infestation, low market prices, high cost of seeds and lack of information on improved seed.



**Figure 3: Constraints of maize production in the study area**

*Source: Field Survey, 2016*

(N.P.K.) rates, tillage and organic matter thereby reducing yield.

Seed variety was identified as a factor affecting maize production. Most farmers use open-pollinated varieties. Farmers usually save a certain quantity of their harvest for future planting. Kimeli (2013) found that in most regions in Nigeria, more than 50% of their maize productions are estimated to be using unimproved local varieties. This tends to reduce the maize yield expected by the maize farmers during harvest.

Erosion reduces the crop productivity of a soil by altering soil chemical and physical properties such as water retention. Therefore, rainfall amount and distribution are critical for rain fed maize crop production on eroded soils. This is in line with Ayuba and Dami (2011) who reported that most northern agricultural soils are inherently low in nutrients and have poor structure that cannot withstand the high erosive power of rain and wind thereby constituting some

The findings showed that fertilizer cost was inherently high. Fertilizer, both in terms of availability and affordability was a major problem in the study area because of infrastructural and marketing constraints. Delay in arrival of the government subsidized fertilizers often leave maize farmers are left with no option than to obtain their fertilizers in the markets where prices are significantly higher. This can create a relatively rapid increase in the fertilizer-maize price ratios, thereby increasing the cost of maize production. These results agree with the report of Ariga *et al.*, (2006) who have attributed maize yield decline to declining soil fertility and increase in world fertilizer prices.

The high labour cost incurred by farmers in maize cultivation was due to land preparation, planting, weeding, harvesting, transportation and processing which were mostly done using manual labour with low efficiency making farming activities to be more tedious and time consuming. This agreed with Vissoh *et al.*, (2014) who

reported that land preparation through conventional mouldboard tillage is labour intensive and for smallholder farmers, often possible only during a short time window in connection with the onset of the rains or shortly after harvest of the preceding crop. Many farmers therefore have to submit to the back-breaking drudgery of working the land with hand tools. Also, for farmers who can afford to hire draught animals, land preparation and planting may be delayed due to low availability of animals which will affect the yield of the maize crop.

Striga infestation shows that the cost of production will be high in terms of herbicide application, fertilizer and labour which will be demanded as most farmers who cultivate high yielding varieties are expected to weed twice against those with local varieties who mostly weed once.

The study also revealed that seeds were part of the major constraints to maize production in the study area. Other constraints were pest and diseases, low market prices and obsolete technology. The implication of this finding is that maize farmers in the study area are producing under little profit, resulting from high costs of production inputs and low output prices. Farmers are largely price takers who have little or no control over the market for their products and the low cost of maize invariably forces them to produce mainly for subsistence.

#### 4. Conclusion and Recommendations

The study assessed factors of maize production in Jema'a Local Government Area, Kaduna State, Nigeria. The results from the study showed an inverse relationship between the cost of maize seeds and labour with maize output, while major constraints of maize production are high cost of fertilizer, Striger infestation, low market prices, high cost of seeds and a lack of information on improved seeds. The studies found input prices have been on the increase with a correspondingly weak relationship with output. Similarly, maize production is mostly practiced at the subsistence level with little or no rewards for farmers.

The study recommends better utilization of farm labour, increasing level of fertilizer use by farmers, improvements in credit services; agro-ecology based maize extension programmes and

continuous training as well as follow up on the application of improved soil fertility management practices.

Similarly, complementary use of organic fertilizers should be encouraged while balance application of recommended fertilizer rates should also be encouraged, while the National Agricultural Seed Council (NASC) should always ensure Seed Certification and Quality Control Programme to regulate the various seed varieties in the market.

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