



ANALYSIS OF FARM LABOUR UTILIZATION IN DRY SEASON MAIZE PRODUCTION IN SELECTED LOCATIONS IN KADUNA METROPOLIS, KADUNA STATE, NIGERIA.

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ABSTRACT

This study examined farm labour utilization in dry season maize production in Kaduna metropolis, Kaduna State Nigeria. Purposive and random sampling technique was used in selecting 60 respondents. Primary data were collected using structured questionnaire and analyzed using production function analysis. Results revealed that majority (50.00%) of the farmers are in the age bracket of 36 - 40 year of age; 75.00% were married; 50.00% had no formal education; 58.30% of the respondents had family size of between 6 – 10 persons; 46.67% realized income of between ₦301,000.00 to ₦350,000. The regression analysis shows linear function as the lead equation with an R^2 of 0.771, adjusted (R^2) of 0.754 implying that over 75% the variation in the output of dry season is explained by the independent variables included in the model. Result also revealed that the resources were inefficiently utilized, particularly farm size, family labour with allocative efficiency index of 0.728 and 0.717 respectively signifying overutilization. Furthermore, capital inputs had index value of 3,735 indicating underutilization, all in an attempt to optimize production goals. The study concludes that dry season maize farmers were not efficient in farm labour utilization. It is recommended that farmers be encouraged to expand their farm size so as to absorb the surplus family labour supply.

Keywords: Farm, Labour, Underutilization, Overutilization

INTRODUCTION

Over the years, a lot of studies were carried out to promote maize production and consumption in Nigeria with much emphasis on agronomic practices and vertical recommendations with little or no in-depth study into the factors like land, labour, capital and management that are always involved in its production. Little information is available to farmers or scholars about labour utilization in maize production both for farm family and/or hired labour. Maize plays diverse and dynamic role in global agri-food systems and food/nutrition security (Ulrike *et al.*, 2021; Poole *et al.*, 2021; Ranum *et al.*, 2014; Shiferaw *et al.*, 2011). There has been an increased interest in agri-food systems over the last decade (Brouwer *et al.*, 2020; Fanzo *et al.*, 2021; HLPE, 2017; IFAD, 2021). It is therefore vital that investigation be conducted to appraise the resource requirements for the production of maize, especially labour utilization. Labour is an indispensable resource in agriculture as it influences decision making in agricultural production. Farm households engage in farming either as a primary or secondary occupation. Agriculture employs over 60% of the Nigeria population and most of the farmers engage in the production of arable crops (Ogaji *et al.*, 2023). In doing this, they set goals to direct their farming decisions. The farmer is always confronted with the problem of how to make decisions with regards to how to attain an efficient level of agricultural production. There is no doubt that human labour utilization particularly in the tropics is normally ineffective, inefficient, careless and wasteful due to



inadequate planning and management. Furthermore, labour is often limited on small holdings. As a result, a rise in output needs either more labour or the substitution of capital for labour to meet up with the labour peak.

Land and labour are two factors of production that are likely to be least abundant in agriculture in Nigeria. They most often form the hinderance to increased production with very low capital inputs in farming. It is a known fact that this is the dominant system of agricultural production in Nigeria. The fundamental and critical determinant of production is the effectiveness of the organization of land and labour as factors of production. The broad objective of this study therefore, is to investigate the efficiency of labour resource utilization in dry season production and make policy recommendations towards efficient labour resource utilization to increase productivity in maize production in the study area.

MATERIAL AND METHODS

Area of the Study

This study was carried out in Kaduna metropolis of kaduna State. Kaduna metropolis is the capital of Kaduna State. Kaduna metropolis is located between Latitudes 10°24'39" N and 10°36'40" N and Longitudes 7°21'26" E to 7°30' 3" E of the Greenwich meridian on the high plains of the north central highlands of Nigeria, with a mean elevation of about 620 M amsl. It covers more than 355 square kilometers, Kaduna metropolis is about 912 Km north of the Gulf of Guinea (Atlantic Ocean), about 530 Km from Nigeria's northern border and 180 Km from the nation's capital city, Abuja. The River Kaduna from which the town derived its name tends to divide the town into two unequal parts. Kaduna metropolis cut across four local governments areas in the state thus: Kaduna North, Kaduna South as well as parts of Igabi and Chikun Local Government Areas (LGAs) (Akpu, 2012).

Kaduna metropolis experienced tropical continental climate with distinct seasonal regimes. The seasonality is characterized with the cool and hot dry season. The climate is also characterized between November and March by dust laden harmattan and wind, which is dry cold and often strong blocks, from north-east originating from the Sahara region across the country with maximum intensity between December and January. The area is influenced by the tropical wet and dry climate (AW by Koppen's classification) with seasonal alternation of moist maritime air mass (tropical maritime/SW trade wind), and dry continental air mass (North easterly trade wind/harmattan) (Abaje, *et al.*; 2009). The climatic classification of the study area is the tropical continental climate. It is characterized by two distinct alternating wet and dry seasons. The rainy season usually begins from March/April and runs through September/October. Rainfall begins in April and increases to its peak in August. The rainy season is associated with high intensity of storm and by October, the rain declines. The dry season starts at the end of October to early March of the following year. Average annual rain fall recorded is 1000mm to 1500mm. The rainfall type is convectional with a single regime of maximum peak, which usually occurs in August/September at a stretch (Abaje *et al.*, 2009).

Sampling Technique and Data Collection Procedure

Purposive and random sampling techniques were adopted for this research study. Six locations were selected from the metropolis, namely *Bakin-Ruwa; Hayin-Danmani; Kabala West; Nariya; Raffin-Guza; Rigachukwu*. These locations were purposively selected due to dominance and long-standing records of dry season maize production within the metropolis. From each location, ten farmers were selected using the simple random sampling procedure. A total of 60 farmers were selected to whom copies of well-structured questionnaire were

administered. Data relating to labour utilization by farmers as well as relevant input-output information were collected for this research.

Analytical Technique

The analytical technique used in achieving the objective of the study is the Ordinary Least Squares (OLS) multiple regression analysis. The production function model employed is presented in its implicit form as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, \mu) \dots\dots\dots (1)$$

Where:

Y = total output of maize (in Kg)

X₁ = Farm Size (in Ha)

X₂ = family labour (in Man-days)

X₃ = Hired Labour (Man-days)

X₄ = Fertilizer (in Kg)

X₅ = Improved seeds

X₆ = Agrochemicals

X₇ = Capital (Depreciation on fixed items)

μ = Error term which is assumed to be normally and independently disturbed with zero mean and constant variance.

Various functional forms such as the linear, semi-log, exponential and double log were tried and on the basis of the explanatory power of the model (R²), magnitude of estimated coefficients, conformity of signs with a priori expectation and the F-ratio, i.e., the normal economic, econometric and statistical criteria. The linear functional form was chosen as the lead equation. Consequently, elasticity of output was computed using the following formula:

$$e = \frac{\delta y}{\delta x} \cdot \frac{x}{y} \dots\dots\dots (2)$$

where:

e = Elasticity of output;

$\frac{\delta y}{\delta x}$ = first partial derivative of x with respect to y;

x and y are the geometric means of x and y respectively.

The marginal factor cost (MFC) is the addition to total cost resulting from using an extra unit of input. To examine the efficiency of labour resources utilization, the ratio of MVP to MFC was computed. A firm maximizes its profit with respect to an input if the ratio of MVP to MFC is one. A ratio less than unity shows over utilization of resource and profit would be increased by decreasing the quantity of that input. A ratio greater than unity, indicates underutilization of the input and increasing the rate of use of that input will increase the level of profit of the farm. Allocative efficiency is concerned with choosing optimal sets of input. It is the ability to maximize profit by equating the MVP of respective unit price.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Dry Season Maize Farmers

This section deals with the results of analysis on the socio-economic characteristics distribution of dry season maize farmers in the study area as contained in Table 1.

Age: The results indicate that majority (50.00%) of the farmers are in the age bracket of 36 - 40 year of age. This is line with the finding of Koledoye (2024) that most small-scale arable crop farmers involved in the utilization of family labour were found to be in their age of 40s. Also, this study's finding corroborates Oke *et al.*, (2022) that age distribution of maize



farmers revealed that a cumulative 80.0% of the farmers are less than 50 years in a similar study. These shows that most of the sampled farmers within study areas are in their productive ages contributing to agricultural production in the country.

Marital Status: Analysis of data carried out on marital status of respondents revealed that 45 of the farmers were married representing 75.00% as the majority. This is in consonance with the report of Koledoye (2024); Oke *et al.*, (2022) in similar studies that majority (86.6%); (94.2%) of the respondents were married respectively.

Level of education: Result of this study shows that majority (50.00%) of the farmers have no formal education. This is contrary to the submissions of Koledoye (2024); Oke *et al.*, (2022) that 27.7% of the respondents had no formal education and that majority of the farmers are literate with as high as 97.4% having one form of formal education in separate but similar studies. The implication of this result is that the level of education will affect labour use. This is because level of education affects labour productivity through a choice of better inputs and output, and through a better utilization of existing inputs. In this study, the level of formal education is low. This is in tandem with the submission of Aigbokie *et al.*, (2021) that increase in the level of education will increase labour use.

Family Size: A typical household head was male with family members ranging between 6 – 10 accounting for 58.30% of the respondents. This is an indication that dry season maize production in the study area is male dominated and that there is average number of family labour to carry out dry season maize farming activities.

Farming experience: It was revealed from this study that most, 53.30% of the respondents had between 11 - 15 years of dry season maize farming experience. This agrees with the report of Oke *et al.*, (2022) that large number (56.8%) of the farmers had between 11-20 years farming experience. This implies that most of the farmers possessed sufficient farming experience that is likely to impact positively dry season maize production, as experienced have been found to enhance the use of improved technology. Experienced people are believed to have learned through several years of trials and errors which should enhance their skill.

Farm Size: Furthermore, result of shows that the farm size of majority (76.70%) of the farmers had less than 1ha farm holding. The implication of this finding is that farmers' farm sizes are small which also influenced the use of family labour to meet their small-scale farm operations.

Sources of Labour: Table 1 shows that family labour constituted 71.70% of the respondents' source of labour used in dry season maize production. This is in agreement with the report of Koledoye (2024) where farmers made use of family labour in arable crop production farm operations. The finding of this study also aligns with the submission of Albert *et al.*, (2020) which states that farmers use family labour more in weeding, planting, application of fertilizer, as safe guard for food security in agriculture. This study therefore elucidates the predominant utilization of family labor in dry season maize farming activities in the study area.

Sources of Capital: The study also revealed that farmers' major source of capital is personal savings as representing 78.33% of the respondents in Table 1. The implication of this is that the farmers will not be able to employ modern farming tools and implements including fertilizer and other agro-chemicals nor own large farm holdings. This will in turn affect maize out and subsequently return on investment (ROI).

Level of Income: a large proportion (46.67%) of the farmers realized income in the range of ₦301,000.00 to ₦350,000 and above from dry season maize production per year. This presents dry season maize production in the study area as a venture with good return on investment, given the land area under cultivation by most of the respondents and use of limited capital inputs in farm operations.

Table 1: Socio-economic Characteristic Distribution of Dry Season Maize Farmers in Kaduna Metropolis.

Variable	Frequency	Percentage
Age (Years)		
≤ 25	3	5.00
26 – 30	5	8.30
31 – 35	8	13.30
36 – 40	30	50.00
41 – 45	10	16.70
≥ 46	4	6.70
Total	60	100
Marital Status		
Single	2	3.33
Married	45	75.00
Divorced / Separated	5	8.33
Widowed	8	13.33
Total	60	100
Family Size		
≤ 5	15	25.00
6 - 10	53	58.30
11 – 15	6	10.00
≥16	4	6.70
Total	60	100.00
Level of Education		
No formal education	30	50.00
Primary school education	15	25.00
Secondary school education	10	16.70
Tertiary school education	5	8.30
Total	60	100.00
Farming Experience		
≤ 5 years	7	11.70
6 – 10 years	6	10.00
11 – 15 years	32	53.30
16 – 20 years	5	8.30
≥ 21 years	10	16.70
Total	60	100.00
Farm Size		
≤ 0.5 ha	46	76.70
0.6 – 1.0 ha	9	15.00
1.1 – 1.5 ha	3	5.00
≥ 1.6 ha	2	3.30
Total	60	100.00
Sources of Labour		
Family Labour (man-day)	43	71.70
Hired Labour (Man-day)	17	28.30
Total	60	100.00
Sources of Capital		

Personal savings	47	78.33
Family/Friends	6	10.00
Cooperative loan	5	8.33
Bank loan	2	3.33
Total	60	100.00
Level of Income		
≤ 100,000	2	3.33
101,000 – 150,000	5	8.33
151,000 – 200,000	3	5.00
201,000 – 250,000	6	10.00
251,000 – 300,000	9	15.00
301,000 – 350,000	28	46.67
≥ 351,000	7	11.67
Total	60	100.00

Source: Computed from field survey data 2023.

Regression Estimates of Dry season Maize Production in Kaduna Metropolis.

Labour input was disaggregated into family and hired labour sources and incorporated in the model. The result of the estimated production function is presented in Table 2. It revealed that farm size (X_1); family labour (X_2) and capital inputs (X_7) were significant at 1% level. Labour utilization of labour was positively influenced by farm size (X_1); family labour (X_2) and capital inputs (X_7). This implies that that resultant output in dry season maize production is not by chance, but that it is influenced by the factor inputs. And it means that if more of these inputs X_1 , X_2 and X_7 are utilized in dry season maize production, there is the likelihood of higher output. This in line with the finding of Aigbokie *et al.*, (2021) where farm size was significant at 1% level in a similar study. The lead equation (linear function), has an R^2 value of 0.77, which implies that about 77% of the variation in the output of dry season maize production in the study area is explained by the independent variables ($X_1 - X_7$) included in the model, while the remaining 23% is a result of errors in the estimation and non-inclusion of some explanatory variables. The F-statistics was statistically significant at 1% level. This means that the independent variables adequately explained the dependent variable. For a linear production function, the estimates are not direct elasticities and were therefore computed. The results are presented in Table 2.

Table 2: Regression Estimates of Dry Season Maize Production in Kaduna Metropolis.

Variable	Linear	Semi-log	Double-log	Exponential
Constant	569.863 (7.908) ***	402.484 (0.577)	6.379 (12.622)	6.560 (1117.075) ***
X ₁ (farm size)	208.734 (5.733) ***	338.717 (4.569) ***	0.262 (4.882) ***	0.164 (5.790) ***
X ₂ (family labour)	1.453 (2.151) ***	32.250 (0.827)	6.756E-03 (0.239)	5.790E-04 (1.119)
X ₃ hired labour	0.263 (0.406)	-18.073 (-0.427)	-3.253E-03 (-0.106)	3.8779E-04 (0.769)
X ₄ fertilizer	-0.153 (1.806)	-57.905 (-0.717)	4.498E-03 (0.935)	-1.434E-05 (-0.371)
X ₅ improved seed	2.173E-02 (0.826)	51.735 (1.363)	3.666E-02 (1.332)	1.925E-05 (0.941)
X ₆ Agrochemicals	-0.6203E-02 (-1.247)	-54.353 (-0.717)	4.498E-03 (0.935)	1.831E-05 (-0.371)
X ₇ capital inputs	4.803E-02 (4.406) ***	112.036 (3.415) ***	5.651E-02 (2.375) ***	1.831E-05 2(.160)
R ²	0.771	0.575	0.626	0.751
R ² Adjusted	0.754	0.542	0.597	0.738
F-ratio	44.304 ***	17.60 ***	21.746 ***	40.09

Source: Computed from field survey data, 2023.

Allocative Efficiency of Farm Labour for Dry Season Maize Production in Kaduna Metropolis

The results in Table 3 shows that the resources were inefficiently utilized. Particularly, farm size was over utilized since its allocative efficiency index value which 0.728 is less than 1. The allocative efficiency index of family labour was found to be 0.717, also this is less than 1 implying that farmers in the study area are over utilizing family labour. The excess labour can be productively engaged in other off farm activities during off-peak periods of agricultural production. Looking at capital inputs, the allocative efficiency index value 3,735 which in this case is greater than 1 indicate underutilization. In small scale agriculture, investment in capital inputs is generally very low, due to the poor resource base of the farmers. furthermore, from the analysis in Table 3, hired labour was the resource closest to optimality with an index value of 15.60, the resource with an index value farthest from optimality was capital inputs with the index value of -373,500, suggesting that capital inputs were the most grossly inefficiently utilized resource in the study area.

Table 3: Allocative Efficiency of Farm Labour for Dry season Maize Production in Kaduna Metropolis

Variable	MFC (N)	Elasticity (bi)	MVPi = bi.py	Ki = $\frac{MVPi}{MFCi}$	Percentage deviation from optimality (1- Ki) X 100
X ₁ (farm Size) ha	20,000	0.2913	14,565	0.728	27.2
X ₂ (family labour)	3,500	0.0502	2,510	0.717	71.71
X ₃ (hired labour)	3,500	0.0109	545	0.156	15.60
X ₄ (fertilizer)Kg	25,000	0.0188	940	0.038	96.20
X ₅ (improved Seed	2,500	0.0234	1,170	0.468	53.20
X ₆ (Agrochemicals)	1	0.0495	2,475	2,475	-247.500
X ₇ (Capital)	1	0.0747	3,735	3,735	-373,500

Source: Computed from field survey data 2023. Py = 50,000 (Py = price of a bag of maize, unit of labour in man-days).

CONCLUSION AND RECOMMENDATION

The study concludes that dry season maize farmers were not efficient in farm labour utilization. Given that farm size was found to be significant in explaining the output of maize, the study recommends that farmers should be encouraged to expand their farm sizes so as to be able to absorb the surplus labour to accomplish farm operations. However, surplus labour could be re-allocated into other off-farm profit yielding ventures during off-peak seasons of agricultural production.

REFERENCES

- Abaje, I.B, Ati, O. F. and Ishaya, S. (2009). Nature of Portable Water Supply and Demand in Jema'a Local Government Area of Kaduna State, Nigeria, *Research Journal of Environmental and Earth Sciences*, **1**(1): 16 – 21.
- Aigbokie, S. O., Ibe, G. I. C., Inyang, N. N., Eze, A. A., Bassey, I., Uchendu, C. O. and Umeadi, S. C. (2021). Gender Differentials in Labour Source and Utilization Among Rural Rice Farmers in Enugu State, Nigeria. *Nigerian Agricultural Journal* **52**(1): 181-187. ISSN: 0300-368X; <http://www.ajol.info/index.php/naj> or <https://www.naj.asn.org>.
- Akpu, B. (2012). An Analysis of Spatio-Temporal Growth of Kaduna Metropolis and Its Environmental Consequences in Kaduna, Nigeria, Unpublished PhD Thesis, Department of Geography, Bayero University, Kano.
- Albert U. O., David E. I. & Bishop O. O. 2020. Child Labor in Agricultural Production and Socioeconomic Variables among Arable Farming Households in Nigeria. *Journal of Rural Social Sciences*, **29**(2): 67–81.
- Bekele Shiferaw & Boddupalli M. Prasanna & Jonathan Hellin & Marianne Bänziger (2011). Crops that feed the world 6. Past successes and future challenges to the role played by maize in global food security. *Food Sec.* **3**: 307–327. DOI 10.1007/s12571-011-0140-5.
- Brouwer, I. D., McDermott, J., & Ruben, R. (2020). Food systems everywhere: Improving relevance in practice. *Global Food Security*, **26**, 100398. <https://doi.org/10.1016/j.gfs.2020.100398>



- Gbenga F. Koledoye (2024). Family Labour Utilization among Small Scale Arable Crop Farmers: Evidence from Akoko South West Local Government Area of Ondo State, Nigeria. *Eurasian Journal of Agricultural Research*, **8**(1): 96-106. ORCID 0000-0001-6514-3123
- HLPE High Level Panel of Experts (2017). A report by The High-Level Panel of Experts on Food Security and Nutrition and food systems, HLPE Reports series by Lluís Serra-Majem, <https://www.researchgate.net/publication/327746061>
- IFAD (2021). The 2021 annual report for the International Fund for Agricultural Development. <https://www.ifad.org › annual-report-2021>
- Jessica Fanzo, Alexandra L Bellows, Marie L Spiker, Andrew L Thorne-Lyman, Martin W Bloem (2021). The importance of food systems and the environment for nutrition. *Am J Clin Nutr.* **4**(1): 7-16. doi: 10.1093/ajcn/nqaa313.
- Kay R. D. 1981. Farm Management Planning, Control and Implementation M. C. GrawHill-New York Pp 164-170.
- Ogaji A., Sallawu H., Bako R. U., Oseghale A. I. & Adedokun M. 2023. Effect of Arable Crop Production on Poverty Status of Farmers in Niger State, Nigeria. *International Journal of Research and Innovation in Applied Science (IJRIAS)*, **8**(12): 258 – 271.
- Oke, F. O., Kareem, I.A., Bamigbade-Sanni, S.A., Oose, M.O. and Olayode, A.K. (2022). Economic Analysis and Determinants of Maize Production in Oyo State, Nigeria. *Nigerian Agricultural Journal*, **53**(1): 60-66.
- Peter, R., Juan, P. P. and Maria, N. G. (2014). Global maize production, utilization, and consumption. *Annals of the New York Academy of Sciences* March 2014 DOI: 10.1111/nyas.12396
- Poole, N., Donovan, J., & Erenstein, O. (2021). Agri-nutrition research: revisiting the contribution of maize and wheat to human nutrition and health. *Food Policy*, **100**: 101-106.
- Ulrike Grote, Anja Fasse, Trung Thanh Nguyen and Olaf Erenstein (2021): Food Security and the Dynamics of Wheat and Maize Value Chains in Africa and Asia. Volume 4 - 2020 | <https://doi.org/10.3389/fsufs.2020.617009>.