

## RESOURCE USE EFFICIENCY IN SMALL SCALE IRRIGATED RICE PRODUCTION IN TUNGAN KAWO, WISHUSHI L. G. A OF NIGER STATE, NIGERIA

\*Sadiq, M.S. and \*\*Yakasai, M. T.

\*Department of Agric. Economics and Extension Tech., Federal University of Tech., Minna, Niger State, Nigeria.

\*\*Department of Agric. Economics and Extension, Kano University of Science and Tech., Wudil, Kano, Nigeria.

\*Correspondence author: [sadiq.sanusi@gmail.com](mailto:sadiq.sanusi@gmail.com)

### ABSTRACT

*In this study efficiency of resources used in small scale rice production under irrigation system in Tungan Kawo, Wushishi Local Government Area of Niger State, Nigeria, was determined, Using simple random sampling technique. Forty two (42) respondents were sampled and used for the study. Pre-tested questionnaires, interview schedules and field observations were used to obtain information from the respondents with respects to their inputs and outputs. Semi-logarithmic functional form gave the best fit out of the four (4) functional forms used. Findings of the study revealed that farmers were not optimally efficient in their use of improved seeds, farm size, labour and capital, with most of these resources been under-utilized. This suggests that for the farmers to increase rice output under irrigation system in the study area, they should employ more of their productive resources.*

**KEYWORDS:** Rice, Irrigation, Resources use, Efficiency

### INTRODUCTION

Irrigation would not be necessary, if rainfall, the most important source of agricultural water, were ideal for the growing of crops (NFDP, 2010), such perfection is rarely attained as rainfall varies from one place to another (Abubakaret *al.*, 2009). Mbanasor and Obioha(2003), reported that irrigation even if supplementary, is *sine-qua non* in almost all parts of Nigeria, if agricultural resources are to be exploited fully as a means of achieving self-sufficiency in food and fibre production.

It is believed that irrigated agriculture came into Nigeria in 9<sup>th</sup> century through trades routes by Arabs (Tsoho, 2005). The first recorded government attempt at irrigation dates back to 1918, following a study conducted by a military Engineer on Sokoto River and Rima River (Erhabor, 1982); a new start was made in 1949 with the establishment of irrigation division in the then Northern Province's Agricultural Department, and Irrigation Training School in Sokoto.

Ojoet *al.* (2011) outlined that 1970s marked the beginning of Federal Government involved in irrigation development; establishment of River Basin Development Authorities and Ministry of Water Resources at the Federal level. From 1990s till date several efforts were made by both Federal and some state governments so support small-scale irrigation under the World Bank assisted programme (Dogon daji and Baba, 2009). Effective irrigation development in Nigeria is very mandatory; frequent drought, desertification, desert encroachment, increasing population pressures on food demand etc. (WARDA and NISER, 2001). Ojoet *al.* (2011)

reported that FAO inferred that Nigeria is among the nations where irrigation is the only way left to grow enough food for the populace, the size which exceeds the limit capacity of traditional rainfed farming. Adekalu and Ogunjimi (2001), reported there was interest shift in policy in 90s towards the development of small-scale irrigation due to poor performance of large-scale schemes. NRDS (2009), reported that the presidential initiative sought to reduce Nigeria's reliance on rice imports by stimulating domestic production and offering new incentives for corporate investments in value chain function that would increase domestic value-added. The initiative focused on productions, inputs and crop protection; irrigation and land development; processing and marketing; and program management.

The Tungan Kawo Irrigation scheme in Niger State is under the Upper Niger River Basin Development Authority (UNRBDA) and has a commendable irrigation area of 800ha (UNRBDA, 2010).Efficiency of resources utilization among small-scale irrigation farmers has remained an unanswered question in the quest for increased rice production in Niger State. The objective of the study is to determine the efficiency of the resource use in irrigated rice production in the study area.

### METHODOLOGY

The study was conducted in TunganKawo, Wushishi LGA in Niger State, Nigeria. Using a proportionate sampling technique, forty-two (42) respondents were selected from the list of 80 functional farmers' provided by UNRBDA Extension Department.

The primary data used involved the use of pre-tested questionnaires, while the secondary data involved the use of journals, textbooks, internet etc. Data collection was done during the off season in 2011.

Data collected were analyzed using the Multiple Regression Model (OLS).

**Model Specification:**

The implicit form of the production function is specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, \dots, e_1) \dots \dots \dots (1)$$

Where,

Y = Output of paddy rice (kg)

X<sub>1</sub> = Farm size (ha)

X<sub>2</sub> = labour (manday)

X<sub>3</sub> = Improved seeds (kg)

X<sub>4</sub> = Fertilizer (kg)

X<sub>5</sub> = Fuel (litres)

X<sub>6</sub> = Capital (₦); Depreciation on equipment, interest on loan

e = error term

Four functional forms were tried (liner, semi-log, exponential and double-log) and the lead equation was chosen on the basis of the co-efficient of multiple determination (R<sup>2</sup>), as well as the signs, *a priori* expectation and significance of the regression co-efficients. Semi-log gave the best fit and was chosen as the lead equation. It is specified as follows:

$$Y = b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 \dots \dots \dots + b_n \log X_n + e_i$$

Where: X<sub>1-n</sub> is as stated above;

b<sub>0</sub> = Constant

b<sub>1-n</sub> = Regression co-efficient

**Efficiency model**

$$r = MVP/UFC$$

Where;

$$MVP = MPP \cdot P_y$$

$$MPP = b/x$$

$$UFC = Px_i$$

$$Ep = b/y \quad (Ep = dy/dx \cdot x/y)$$

Where:

r = Efficiency index

MVP = Marginal value product

UFC = Unit factor cost

MPP = Marginal physical product

Ep = Elasticity of production

P<sub>y</sub> = Unit price of output

Px<sub>i</sub> = Unit price of input x<sub>i</sub>

y = mean of the output

x<sub>i</sub> = mean of the respective input.

**RESULTS AND DISCUSSIONS**

The results in Table 1 shows that almost all the co-efficient of the inputs included in the model carried positive signs, except for fuel which carried negative sign. However, the co-efficient of farm size (X<sub>1</sub>), fertilizer (X<sub>2</sub>) were significant at 1%; improved seeds (X<sub>3</sub>), labour (X<sub>4</sub>) and fuel (X<sub>5</sub>) were significant at 5%. Capital (X<sub>6</sub>) was significant at 10%.

The results also indicate that, 73% (R<sup>2</sup>) of the variation in the output of rice is jointly explained by the explanatory variables included in the model; the F ratio (93.43) is significant at 1%, thus indicating the overall significance of the model.

Elasticities of production (Table 2) with respect to the inputs were, 0.4, 0.37, 0.56, 6.38, -0.48 and 0.46 for seed, farm size, fertilizer, labour, fuel

and capital respectively. Fertilizer was found to be the most important determinant of rice output in the area. The sum of elasticities (1.69) shows that the farmers were operating at the region of increasing returns to scale; they are still in stage one of the production process.

Table 3 shows that estimate of allocate efficiency of inputs used by rice farmers in the study areas. The results indicate that all the resources were inefficiently utilized as the MVPs for improved seeds (X<sub>3</sub>), farm size (X<sub>2</sub>), fertilizer (X<sub>3</sub>), labour (X<sub>4</sub>), and capital (X<sub>6</sub>) were greater than their respective unit costs, except MVP for fuel (X<sub>5</sub>) which is less than it's respective unit cost.

The allocation efficiency indices of all the resources are AEI>1, except for fuel (AEI<1); indicating that the resources were under-utilized.

**Table 1: Estimated Semi-log Function for Rice**

Factor Inputs	Regression Co-efficients	t-values
Constant	-132.567 <sup>x</sup>	2.42
Improved seeds (kg)	1120.288 <sup>xx</sup>	5.61
Farm size (ha)	2037.991 <sup>xxx</sup>	1.21
Fertilizer (kg)	1544.673 <sup>xxx</sup>	1.31
Labour (manday)	1045.830 <sup>xx</sup>	0.47
Fuel (litres)	1330.28 <sup>xx</sup>	0.72
Capital (₦)	1270.484 <sup>x</sup>	0.01
R <sup>2</sup>	0.73	
F-cal	93.43 <sup>xxx</sup>	

Source: Field survey, 2011

Note: <sup>xxxxx</sup> = significant at 1%, 5% and 10% level of probability respectively.

NS: Not significant

**Table 2: Elasticities of Productive Resource/ Return to Scale**

Inputs	Elasticities
Improved Seeds	0.4
Farm size	0.37
Fertilizer	0.56
Labour	0.38
Fuel	-0.478
Capital	0.457
Return to scale	1.69

Source: Field survey, 2011

**Table 3: Estimated efficiency ratio**

Resources	MPP	MVP	MFC	AEI
Improved seeds	18.61	1767.95	400	11.40
Farm size	842	79990	7050	11.42
Fertilizer	27.98	2658.90	230	11.56
Labour	8.36	797.20	600	1.32
Fuel	-0.24	-22.80	65	-0.35
Capital	0.081	7.695	118	6.52

Source: Fieldsurvey, 2011

### CONCLUSION AND RECOMMENDATIONS

Findings from this study revealed that the farmers were generally inefficient in their use of improved seeds, farm size, fertilizer, labour and capital in the study area. The improvement in the optimal and efficient utilization of these

resources is the responsibility of individual farmer's, government and non-governmental organisation. It is recommended that the farmers should be advised to use their resource to the optimal point, a point where  $MVP = P_x$ .

### REFERENCES

- Abubakar, I.R., Kyiogwom, U.B. and M.A. Maikasuwa (2005). Impact Assessment of Small-Scale Irrigation Scheme on Resource Productivity in Onion Production. A case study of National Fadama Development Programme in Zamfara State, Nigeria. *Proceedings of the 23<sup>rd</sup> Annual Conference of Farm Management Association of Nigeria*, held at UsmanDanfodiyo University Sokoto on 14<sup>th</sup>-17<sup>th</sup> December. Pp. 348-357.
- Adekalu, K.O. and Ogunjimi, C.A.O. (2001). *Cost Recovery Strategies for Large-scale Irrigation in Nigeria*. Technovation 2001 (in press).
- Erhabor, P.O. (1982). Efficiency of Resource use under Small-scale Irrigation Technology in Nigeria. Purdue Lafayette, Indiana. *Technical Paper Report*, No. 148:30-33.
- Mbanasor, J.A. and Obioha, L.O. (2003). Resource Productivity under Fadama Cropping System in Umuahia North-local Government Area of Abia State, Nigeria. *Tropical and Sub-tropical Agrosystems*, Vol.2(2):81-86.

- National Fadama Development Programme (2010). Environmental Impact Assessment of the National Fadama Development Programme. *Technical Committee Report*, Federal Ministry of Agriculture and Rural Development.
- Ojo, O.D., Connaughton, M., Kintomo, A.A., Olajide-Taiwo, L.O. and Afolayan, S.O. (2011). Assessment of Irrigation Systems for Dry season Vegetable Production in Urban and Peri-urban Zones of Ibadan and Lagos, South-western Nigeria. *Africa Journal of Agricultural Research*, Vol.16(2):236-243.
- Tsoho, B.A. (2005). Economics of Tomato-based Cropping Systems under Small-scale Irrigation in Sokoto State, Nigeria. Unpublished *M.Sc Thesis* submitted to the Department of Agricultural Economics and Farm Management, University of Illorin, Nigeria. Pp.85-95