PROFITABILITY OF ARABLE CROP ENTERPRISE UNDER GORONYO DAM IRRIGATION PROJECT IN SOKOTO STATE, NIGERIA

Mohammed, U. S., Baba, K. M. Nmadu J. N. and R. S. Olaleye
Department of Agricultural Economics and Extension Technology, Federal University of Technology, Minna
CORRESPONDENCE E-MAIL: hsshabausman@yahoo.co.uk Tel. No: 07039178744

ABSTRACT
This study estimates the profitability of arable crop production under the Goronyo Dam Irrigation Project. Multi-stage sampling technique was used to sample 246 farmers and the limited cost-route approach was used with the aid of questionnaire to collect relevant information. Farm budgeting technique was used to estimate costs and returns associated with arable crops production. The result of costs and returns estimates revealed mean gross margin per hectare of ₦ 69,245.86, N 53, 444.19, ₦ 11,191.11 and ₦ 82, 308.83 for rice, maize, and cowpea and tomato farms, respectively. The return on naira invested was 0.61, 0.54, 0.53 and 1.40 for rice, maize, cowpea and tomato, respectively. Based on the values of return on investment obtained from the analysis, tomato production was more profitable. The result of cost efficiency estimation indicate that 1 percent increase in the cost of labour input will increase the total cost of production by 0.44, 0.64, 0.43 and 0.21 percent for rice, maize, cowpea and tomato farms, respectively. All the four (4) major arable crop enterprises under the Goronyo dam irrigation project were profitable. Farmers should reduce their cost of production by using more cost saving technologies like improved planting material, agrochemical and tractor in order to increase the profitability of the various arable crop enterprises within the irrigation project.
KEYWORDS: Profitability, Arable crop, irrigation, enterprise, Goronyo.

INRODUCTION
Irrigation may be defined as the science of artificial application of water to land in accordance with the crop requirements throughout the period for full-fledged nourishment of the crops. It is one of the most critical human activities sustaining civilization. The current world population of about 6.8 billion is largely sustained by irrigated agriculture (Michael, 2010). The benefits of irrigation to Nigeria are not limited to food supply alone. Irrigation also serves as a source of income and employment during the slack period of rain-fed agriculture. This slack period normally occurs in the dry (November to March) season. Farmers are usually less busy on the farm during the dry season; therefore, irrigated farming serves as an alternative employment and additional source of income during the period. Irrigated farming practice has increased tremendously because of increasing demand for vegetable and other food items during off farming season. Goronyo Dam Irrigation Project is a fairly new project in Nigeria and billions of fund have been expended on provision of irrigation facilities for the benefit of the arable crop farmers. There are rising cost of various farm inputs and this will impact on the profitability of various arable crop enterprises in the area. Therefore, this study evaluate the cost and return associated with production of arable crop in Goronyo Dam Irrigation Project in Sokoto State, Nigeria

METHODOLOGY
The study area covers a total of 17,080 hectares on both sides of the Rima River between Goronyo dam near the village of Katsire to the north east and about 5km downstream of the village of Shinaka to the south- east between latitudes 13^0 25' and 13^0 31' north and longitudes 5^0 5' and 5^0

39' east according to Middle Rima Valley Irrigation (MRVI, 2001). The climate is sudano-sahel savannah type. The annual rainfall is between 579mm to 674mm while average monthly temperature ranges from 24^0C to 33^0C (Okereke *et al.*, 2007).

According to Muhammad (2010), Goronyo dam impounds the Rima River at Goronyo Local Government Area of Sokoto State in the northern part of Nigeria. It was completed in 1984 and commissioned in 1992. The dam is a sand-filled structure with height of 21metres and a total length of 12.5km. It has water storage capacity of 976 million cubic metres. Crops like rice, wheat, cassava, sweet potato, cowpea, onions, tomato and pepper are also among the crops grown in the area.

The study covered major communities using Goronyo Dam Irrigation Project. The irrigation project was selected for the fact that it is a relatively new irrigation project in the country and not much research work has been conducted in the area on profitability of arable crop. To collect relevant information for this study, multi-stage sampling design was adopted. The Goronyo irrigation project was divided into sectors and the two completed sectors are named after the major villages within each sector which are Falalia and Takakumi sectors. The first stage of sampling involved random sampling of twelve (12) communities out of the twenty three communities identified within the project area. According to the extension office of Sokoto Rima River Basin Development Authority (SRRBDA) attached to the irrigation project, six hundred and forty (640) farm households from the sampled villages used the Goronyo dam irrigation infrastructure for 2013/2014 cropping season. In order to arrive at appropriate sample size, Yamane's (1967) equation for sample size determination as reported by Eboh (2009) was used. The equation for sample size calculation is specified as follows:

$$n = \frac{N}{1 + N\ (e\ 2\ )} \quad \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \ (1)$$

Where n is the sample size, N is the population size and e is the level of precision which is 5%. The appropriate sample size estimate for the study based on the calculation is 246 households.

Data were collected from 246 households sampled in the two irrigation sectors. The limited cost-route procedure which involved collecting data on a fortnightly basis by asking farmer to recall his /her activities on the farm during the past two weeks was used for data collection for this study. This method minimizes memory lapses associated with data collected once at the end of the season. Input information collected include; rental cost of farm land , planting materials, fertilizer, herbicides and labour including family and hired, tractor hiring, amount of animal traction utilized in pre and post planting operations and harvesting. Output data on all the quantities of cereals, legumes and vegetables harvested from each farm were collected at the time of harvest using interview schedule. The prevailing farm gate prices of output and the market prices of inputs were obtained from the farmers.

Estimation of profitability of arable crop enterprises was done using the approach of Dauda *et al.* (2009). The formulae are as shown in equations 2, 3 and 4:

Net Profit (Net Income) = Total Revenue (TR) - Total Cost (TC) .... (2)
Total Cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC) .... (3)
Gross margin (GM) = TR-TVC .... (4)

Fixed cost items includes rental cost of land and depreciated cost of farm tools and other irrigation equipment (hoe, cutlass, sickle and water hose). Variable cost items were Cost of seeds (₦), Cost of fertilizer (₦), Cost of labour (both family and hired labour) (₦), Cost of manure (₦), Herbicide and insecticide cost (₦) and Cost of irrigation water (₦)

Rate of Return on Investment (RRI) was estimated using the formulae as in equation 5

$$RRI = \frac{GI - TC}{TC} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

Where,

GI = Gross income (₦)

TC = Total cost of production (₦)

RRI allows one to determine net returns (profit) per amount of money invested in the business and helps the farmer to form sound and economically viable decisions on the farm.

Operating ratio (OR): Shows the operating efficiency of farm business. A lower ratio is desirable, since it indicate a higher operating profit.

$$OR = \frac{TVC}{GI} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

Where, OR is the operating ratio, TVC is total variable cost and GI is as defined in equation 5

Gross ratio: It measures the ultimate solvency of the farm business

$$GR = \frac{TFE}{GI} \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (7)$$

Where, GR is the gross ratio, TFE is the total farm expenses and GI is as defined in equation 5. A lower and less than one ratio are preferable.

RESULTS AND DISCUSSION
Estimated Costs and Returns in Arable Crop Production

The estimated cost associated with rice, maize, cowpea and tomato under irrigation are as presented in Table 1. Labour inputs are the most critical in the production of all the arable crops under consideration accounting for about 62.54. 65.75, 46.01 and 73.67 percent of the total cost of production for rice, maize, cowpea and tomato production, respectively. The cost of irrigation water per annum and per hectare irrespective of the rate of irrigation was ₦ 4000.00 representing 3.49, 4.02, 17.67 and 6.73 percent of the total cost of production for rice, maize, cowpea and tomato production per hectare, respectively. The result of analysis of return on naira invested in arable crop production shows that tomato had the highest return per naira invested of ₦ 1.38 and therefore the most profitable. This result is corroborated by Usman and Bakari (2013) in their study of profitability of small scale dry season tomato production in Adamawa state, where the return on investment was ₦ 1.33. The result of the study further revealed that production of all the arable crops under consideration in the study area was profitable as indicated by the value of return to naira invested.

The operating ratios for the crop were 0.62, 0.62, 0.65 and 0.42 for rice, maize, cowpea and tomato farms, respectively, which in each case are less than 1. This implies all the arable crops under consideration were all profitable. Similarly, the gross ratios of 0.63, 0.66, 0.70 and 0.42 for rice, maize, cowpea and tomato farms were in each case less than 1 and this implied profitability

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Table 1: Estimated costs and returns of arable crops production in Goronyo Dam Irrigation Project

Items	Cost (₦)/ha			
	Rice	Maize	Cowpea	Tomato
Variable costs				
Cost of labour	71788.00 (62.54)*	65506.45 (65.75)	10414.79 (46.01)	43776.75 (73.67)
Fertilizer cost or manure	27055.63 (23.57)	24756.47 (24.85)	2392.53 (10.57)	6420.99 (10.81)
Agrochemical cost	3128.85 (2.73)	1764.27 (1.77)	1912.46 (8.45)	0
Cost of seed	7617.68 (6.64)	1781.29 (1.79)	2227.55 (9.84)	4717.48 (7.94)
Cost of irrigation water	4000.00 (3.49)	4000.00 (4.02)	4000.00 (17.67)	4000.00 (6.73)
Total variable cost	113590.17	97808.47	20947.33	58915.22
Fixed cost				
Depreciation on capital inputs	1195.99 (1,04)	1820.45 (1.83)	1686.49 (7.45)	505.14 (0.85)
Total fixed cost	1195.99	1820.45	1686.49	505.14
Total cost of production	114786.15	99628.92	22633.82	59420.36
Gross income	182836.03	151252.67	32138.43	141224.07
Gross margin	69245.86	53444.19	11191.11	82308.85
Net farm income	68049.87	51623.75	9504.62	81803.72
Gross ratio (TFE/GI)	0.63	0.66	0.70	0.42
Operating ratio(TOC/GI)	0.62	0.62	0.65	0.42
Return on naira invested(GI-TC/TC)	0.59	0.52	0.42	1.38

Source: Estimated from field survey data, 2015. *Values in parentheses are the percentages of the total cost

CONCLUSION AND RECOMMENDATIONS
The four (4) major arable crop enterprises under the Goronyo dam irrigation project were profitable as the net income were ₦ 68049.87, ₦ 51623.75, ₦ 9504.62 and ₦ 81803.72 per hectare for rice,

maize, cowpea and tomato farms, respectively. The returns on investment were positive as indicated by the values of 0.61, 0.54, 0.53 and 1.40 for rice, maize, cowpea and tomato farms, respectively.

Farmers should reduce their cost of production by using more cost saving technologies like improved planting material, agrochemical and tractor in order to increase the profitability of the various arable crop enterprises within the irrigation project.

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