



IMPACT OF TUNGAN-KAWO IRRIGATION SCHEME ON RICE PRODUCTION IN WUSHISHI LOCAL GOVERNMENT AREA, NIGER STATE, NIGERIA

¹IBRAHIM JALALUDEEN S.²M. B. YUNUSA P.HD

³M.A. EMIGILATI P.HD

^{1, 2, 3}Department of Geography Federal University of Technology Minna, Nigeria

Abstract

This study seek to examine the impact of Tungan-kawo irrigation scheme on rice production in Wushishi Local Government Area, Niger state, Nigeria. Tara Yamane's sampling technique was used to derive 400 farmers/respondents from the population of the study. Data was collected through the use of structured questionnaires which was subjected to analysis using frequencies, percentages and Pearson's product-moment correlation coefficient of multiple regression analysis. From a response rate of 91.75% deduced, about 66.8% of the farmers were between the ages of 18 to 38 years. This portends an indication that there is opportunity for more active years in agricultural activities. The study revealed that 93% of respondents were male. The marital status of farmers involved in the study indicated that 92.1% were married. The level of educational qualification of respondents was highly appreciated as a substantial number of them had formal education, where 52.9% had tertiary education. 87.5% of the respondents

embrace farming as a major occupation. Within the demographic characteristics of the farmers, 70.0% of respondents had household size of 6 to 10.

KEYWORDS:

Impact, Tungan-kawo, Irrigation farming, Rice (paddy) production, Wushishi, Nigeria.

Farmers' average experience in paddy production was recorded to be 11-20 years while findings showed that ownership type of land cultivated was majorly through inheritance and rentage with an average farm size of 5 acres. It was recorded that 62% of respondents cultivated rice thrice annually and most of these farmers harvested 4 to 7mt per acre. 90% of the farmers reported to had been visited by agricultural

extension workers but majority of the farmers lamented to have no access to credit facility. Averagely, most of the farmers recorded to have an estimated income within the range of ₦1,000,000 to ₦2,000,000 per annum. More so, the vulnerability index of the farmers relative to the irrigation scheme indicated that 33.6% of the household were lowly vulnerable, 65.9% were moderately vulnerable and 1.1% were highly vulnerable. 98.6% of the farmers used improved seedlings for enhancement of crop yield. All the farmers agreed to the usage of fertilizer. Study further indicated a moderate positive correlation between rice irrigation farming and livelihood of the communities. With good agronomical practices,

production, processing and marketing will be optimally maximized Sustainable management of infrastructures, availability of industrialized processing mills, sufficient energy and patronage of domestically produced rice will result to poverty reduction and subsequently, increase in household income.

Introduction

Africa could irrigate 42.5 million hectares (ha) based on available land and water resources and by far the greatest potential is found in Nigeria, which accounts for more than 2.5 million hectares (FAO Aquastat, 2005) cited by (Lebdi, 2016) for both subsistence and commercial agriculture. As at 2012, Nigeria ranked 69th amongst countries by irrigated land area with 293,000ha of irrigated land (World Bank, 2016).

Irrigation is an important sector of agricultural activities in Nigeria and its utilization has increased slowly, whereas the irrigation sector for a number of reasons has not yet played a major role to curtail the imbalance between food demand and supply, to benefit farmers and generate jobs for the youth in particular.

The rice sector in the country is one of the most remarkable agricultural developments over the decades. It is the most consumed staple food by Nigeria's over 174 million people across States and geo-political zones (Terwase and Madu, 2014).

According to United States Department of Agriculture (USDA) report, Nigeria was the largest net importer of rice in 2013, thus leading the other major importers which include; Indonesia, Bangladesh, Saudi Arabia, Iran, Iraq, Malaysia, the Philippines, Brazil and some African and Persian Gulf countries (USDA, 2013).

Over the years, Nigeria has continued to depend largely on imported rice, a situation that crippled local production and negatively affected the economy. It is to achieve self-sufficiency and boost the economy that the Federal Government of Nigeria (FGN) initiated various agricultural programmes including the rice revolution.

Prior to the programme, Nigeria was spending not less than 5 million U.S dollars per day with its attendant effect on the economy. The FGN decision to therefore ban the importation of rice was a step in the right direction which brought a turn-around in the local production of rice, as over 12 million farmers are producing more than 18 million tonnes of rice across the country. Also, output per hectare have increased from 1tonne to 5 and 7 tonnes per hectare depending on the location (NTA, 2018).

And the state of Niger, endowed with fertile land (Folorunso, 2008) especially along the floodplains of rivers Kaduna and Niger and other rivers that traverse the state has stepped up its effort in this regard. Those that are along the river banks (for example, Tungan-kawo, Badeggi, Jebba, Katcha, Swashi, Lokogoma, Zungeru) produce rice in both dry and rainy season while those that are situated upland produce only during the rainy season.

Rice production in the State has appreciated progressively following the rice revolution initiative. Recent documents revealed that the state of Niger is amongst the six major rice producers in the country, producing between 1.4 and 2 million tonnes each in both wet and dry season (RIFAN, 2018).

Literature Reviews

Merem *et al.*, (2017), investigated rice production by analysing production issues in Niger state via a mix-scale technique of descriptive statistics and GIS to explore changing trends in rice production. The investigation revealed that the state emerged and remains a major contributor to agricultural productivity in the country. Yet very little has been done over the years to assess the trends in local rice production to gauge yield potentials and develop new models for improved decision making capability. It further revealed that, despite notable drops in the 1990s, production and land under rice cultivation for the State surpassed most of its neighbours in every category from 2006 through 2010. During these periods, the land under rice cultivation increased notably as well. The GIS mapping of the trends points to dispersions and changes in land under rice cultivation and production as well as indicators located within the larger agricultural structure

coupled with widespread diffusion of fertilizer usage in the State. With the changes attributed to post-harvest losses and the lack of storage devices and socio-economic and miscellaneous elements from climate change to others. The paper recommended several remedies including the need for storage and bulk handling devices to open up rice markets, the design of geospatial and land information management systems and constant monitoring of ecosystems adjacent to rice farms.

Jibril *et al.*, (2017), study was conducted to evaluate the performance of Badeggi irrigation scheme using efficiency techniques, performance indicators such as conveyance efficiency, application efficiency and system efficiency were considered to give the overall irrigation efficiency. The overall activities around the scheme site were investigated using field observation, interview of beneficiary farmers, and the discharge measurement in the canals, institutional and support services were also investigated. The results obtained showed that overall scheme efficiency was 26% and average efficiencies were as follows; conveyance efficiency 44%, application efficiency 80%, storage efficiency 29%, distribution efficiency 79%, system efficiency 56%, project efficiency 44% and economic efficiency stood at 40%. Only 14,064 bags of un-threshed rice was achieved annually against 35,160 bags expected per season. The competition between irrigated and rain fed crops was usually a setback for the scheme and only one crop of rice can be grown instead of two rice cropping per season. Organizing awareness campaigns among farmers on how to utilize the available resources (land and water) in a way to agree with the accepted standard of practice was recommended.

Materials and methods

The study was conducted in Wushishi Local Government Area of Niger state, Nigeria. It has an area of 1,879.4km² (wikipedia.com, 2012), which lies between Latitudes 9°42'7.20"N and Longitudes 5°56'11.83"E. The study area is generally tropical with marked seasonal and altitudinal temperature with dry and rainy seasons. It experience a mean annual rainfall of 1,302mm (52inches) with September recording the highest down pour of 300mm (11.7inches). The mean monthly temperature is high in March at 30.50°C (85°F) and lowest in August at 22.3°C (72°F) with mean relative humidity ranging between 60% in January to February and 80% between June to September (Niger state facts and figures, 2012). The following statistical techniques adopted were utilized in analyzing data obtained towards examining the relationship between Tungan-kawo irrigation

scheme on rice production and the livelihood of communities within the study area, and this include; Descriptive statistics, Pearson Product moment correlation of coefficient analysis, using Statistical Package for Social Scientists (SPSS) and Microsoft Excel for pictorial representations. These methods are briefly discussed herewith:

Activities of rice irrigation farming in the study area.

This was achieved using descriptive statistics in order to ascertain the percentage and frequency distribution of respondents’ demography. While Microsoft Excel was adopted for graphical representations.

Impact of rice irrigation farming on livelihood of communities in the study area.

Multiple regression anlysis utilizing the Pearson’s Product-Moment Correlation Coefficient eqn (1) was applied to analyze the impact of irrigation farming through the Tungan-kawo irrigation scheme. The Pearson’s ‘r’ was adopted to isolate factors influencing the impact of the irrigation scheme on rice production within the study area.

$$R_{xy} = \frac{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2 \cdot \frac{1}{n} \sum_{i=1}^n (y_i - \bar{y})^2}} \text{eqn (1)}$$

Where, R_{xy} is the correlation coefficient, n is the sample size, x_i and y_i are the variables being correlated and x and y are the mean values of variables being correlated. The computed correlation values were tested for statistical significance at 5% significance level.

This was achieved using Pearson product-moment correlation coefficient using Statistical Package for Social Scientist (SPSS) version 20.0 software package. The test was tested at 0.05 level of significance.

Results and Discussions

Four Hundred (400) questionnaires were administered and three hundred and sixty-seven (367) were returned by the respondents which comprised of rice irrigation famers.

Table 4.1: Response Rate

Statement	Frequency	Percentage (%)
Questionnaire administered	400	100.0
Questionnaire Returned	367	91.75

Source: Author’s work, 2019.

Table 4.1 reveals the response rate of the farmers in the study area. It depicts that out of 400 questionnaires administered, 367 representing 91.75% of the sample population were returned and used to achieve the objectives of the study.

4.1.1 Socio demographic characteristics of the respondents

Table 4.1.1.1: Age distribution of the farmers

Age Range	Frequency Count	Percentage (%)
18 – 38	245	66.8
40 – 60	119	32.4
61 and above	3	0.8
Total	367	100.0

Source: Author’s work, 2019.

Table 4.1.1.1 shows the age distribution of the farmers. The table indicates that 66.8% of the respondents were within the range of 18 to 38 years, 32.4% belong to the age bracket of 39 to 59, while 0.8% were in the range of 60 years and above. This indicated that significant number of the farmers have opportunity for more active years in agricultural activities.

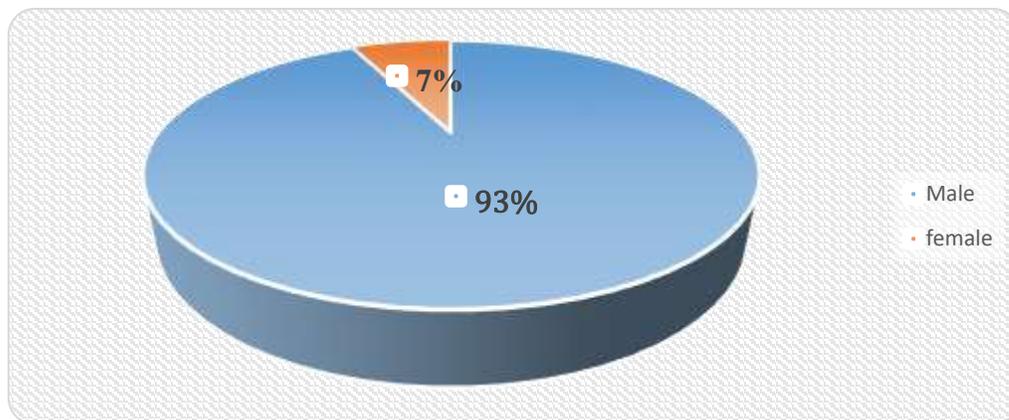


Figure 4.1.1.2: Gender distribution of farmers

Source: Author’s work, 2019.

Figure 4.1.1.2 portrays information on gender distribution of the farmers. It portrays that majority (93%) of the farmers within Tungan-kawo irrigation scheme were male while female was represented by 7%. As such, the ratio of female to male is absolutely low.

Level of education of the farmers

Table 4.1.1.4 Level of education of the respondents

Level	Frequency Count	Percentage (%)
Primary	19	5.2
Secondary	118	32.2
Tertiary	194	52.9
Others	36	9.8
Total	367	100.0

Source: Author’s work, 2019.

Table 4.1.1.3 reveals that about 5.2% had primary education, 32.2% of the farmers had secondary education while 52.9% had tertiary education. And 9.8% had other education such as adult education and religious education.

Household size of the farmers

Table 4.1.1.5: Household size of the farmers

Household size	Frequency Count	Percentage (%)
<6	94	25.6
6-10	257	70.0
11-15	16	4.4
Total	367	100.0

Source: Author’s work, 2019.

Table 4.1.1.5 reveals the household size of the farmers. The result discloses that 25.6% of the respondents have a family size of less than 6, 70.0% had 6–10 dependents, while 4.4% had 11 to 15 dependents. Hence, most of the farmers’ household size is within the range of 6–10.

4.2 Examining the activities of rice irrigation farmers in the study area

Variables	Frequency	Percentage
Farming as major occupation		
Yes	321	87.5
No	46	12.5
Farming experience		
5 – 10	112	30.5

11 – 20	243	66.2
21yrs and above	12	3.3
How many farmers are into rice irrigational farming	367	100.0
Yes	0	0.0
No		
Experience of rice irrigational farming	65	17.7
1 – 5yrs	74	20.2
6 – 10yrs	228	62.1
10yrs and above		
Adopted method in rice irrigational farming	269	73.3
Pumps	93	25.3
Calabash/shadouf	5	1.4
Gravity/natural flow	312	85.0
Type of rice cultivated	5	1.4
Faro 44	38	10.4
Ofada rice	12	3.3
Lowland rice		
Faro 52	17	4.6
Sources of seedlings	335	91.3
ADP	15	4.1
Commercial		
Donor agencies	367	100.0
Application of fertilizers	0	0.0
Yes		
No	168	45.8
Size of irrigation farm lands	85	23.2
1-5 acres	59	16.1
6-10 acres	55	15.0
11-15 acres		
16 acres and above	341	92.9
Visitations of extension workers	26	7.1
Yes		
No	38	10.4
Number of visitation	32	8.7

Once	49	13.4
Twice	248	67.6
Thrice		
Four times and above	356	97.0
Cooperative society/Association	11	3.0
Yes		
No	13	3.5
Access to credit lines/loans	354	96.5
Yes		
No		

Source: field survey, 2019.

The result in table 4.2 shows that 87.5% of the farmers practice farming as a major occupation, while 12.5% exercised it as a secondary occupation. Hence, majority of the respondents were wholly into rice irrigation farming.

About 66.2% had farming experience of 11–20 years, 30.5% had experience of 5 to 10 years, while 3.3% comprised of the respondents with experience of 21 years and above. As such, farmers with experience of 10 years and above were predominant in rice irrigational activities within the study area. The table also shows that 73.3% used pumps method of irrigation, 25.3% utilized calabash/shadouf, and 1.4% used gravity or natural flow.

Most of the farmers representing 85.0% cultivated Faro 44, then 1.4% cultivated Ofada rice, while 3.3% harvested Lowland rice, and 10.4% of the total respondents cultivated Faro 52. Hence, the predominant number of the farmers cultivated Faro 44.

The major sources of seedlings were through commercial medium; this portrayed that most of the farmers purchased their seedlings. The result further revealed that all the farmers/respondents apply fertilizers to enhance crop yield.

Furthermore, 45.8% of the farmers had farm land of 1–5 acres, while 23.2% had 6–10 acres, 16.1% had 11–15 acres, and the least comprised of 15.0% whom had 16 acres and above.

Over 90% of the farmers indicated to had been visited by extension agents, and most of these farmers indicated to had such visits a number of four times and above.

However, (97.0%) of the farmers indicated to having membership of association/cooperative society while those with no membership to any association comprised of (3.0%) at the time of survey.

The table further unveils that majority of the farmers do not have access to any form of loan/credit line.

Ownership types of land cultivated by farmers

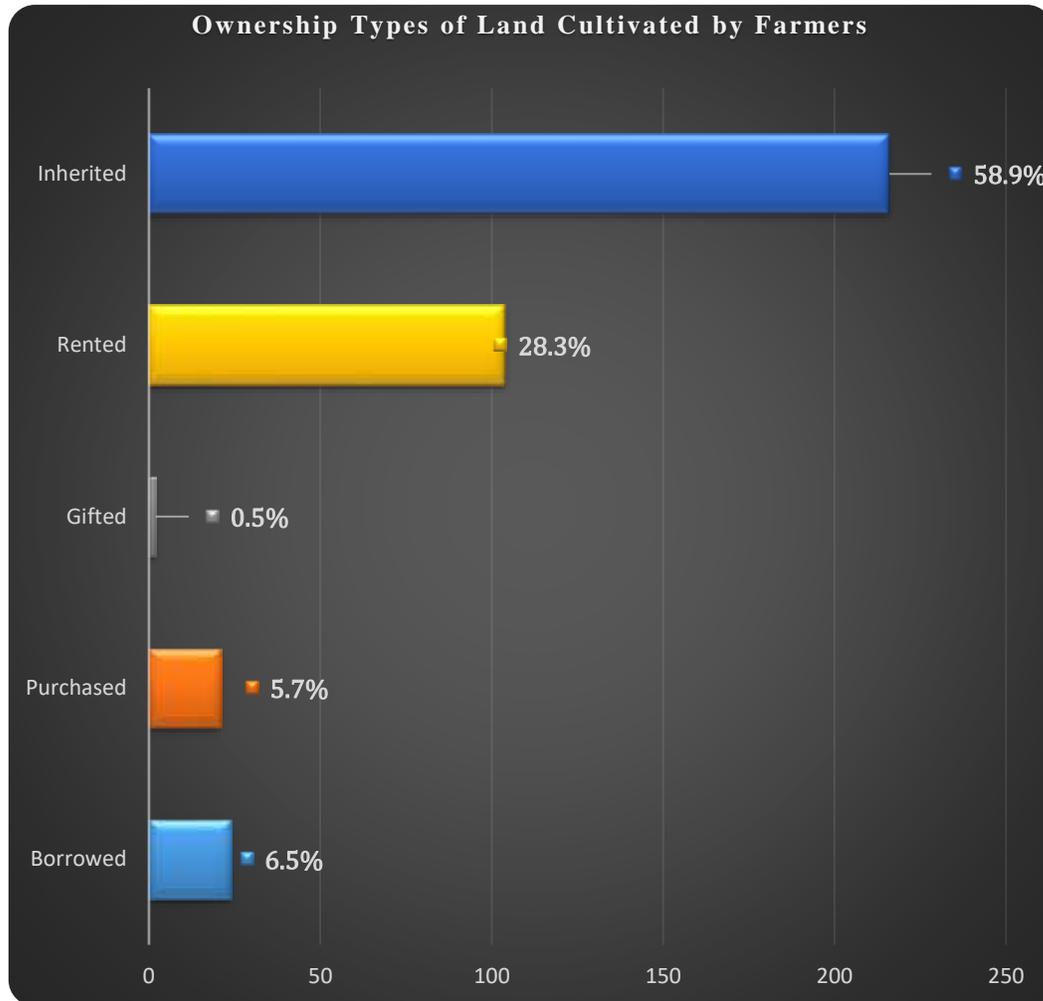
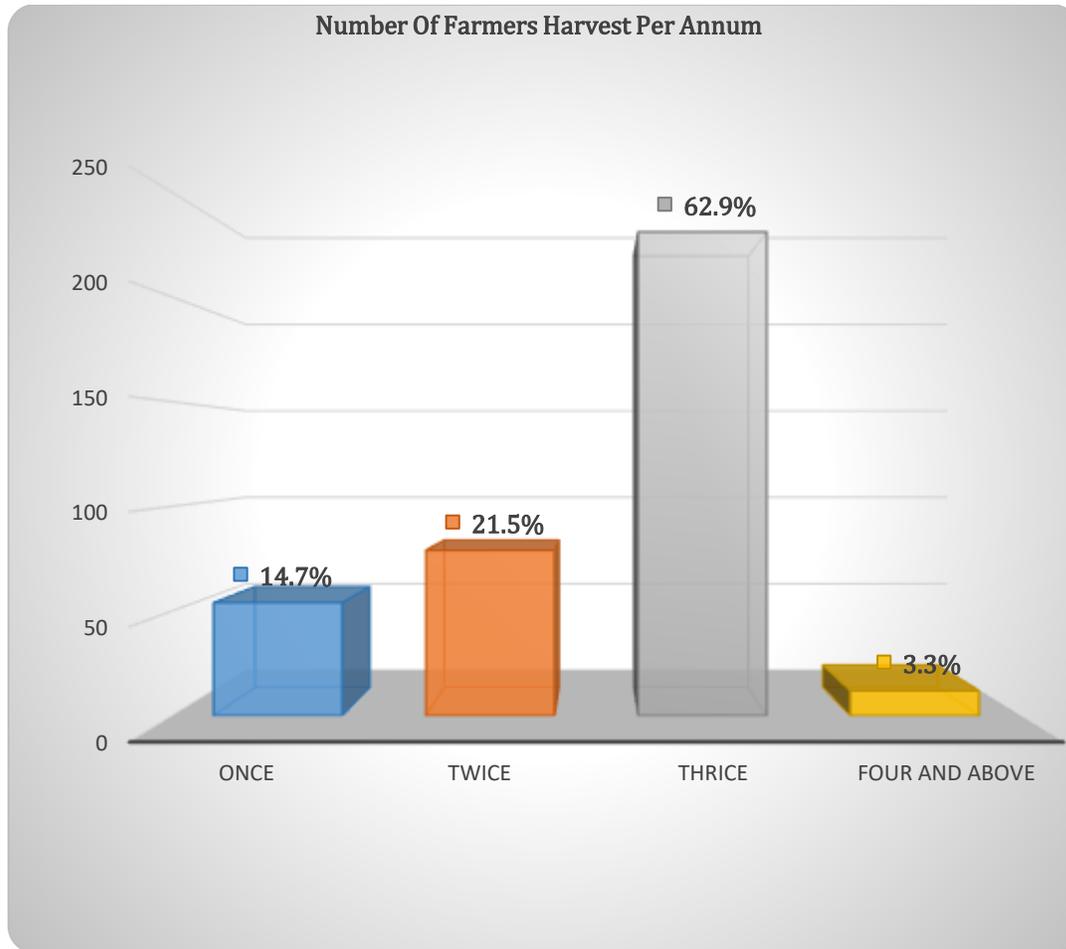


Figure 4.2: Ownership types of land cultivated by farmers.

Source: Field survey, 2019.

Figure 4.3 reveals the ownership types of land cultivated by farmers under Tungan-kawo irrigation scheme, Wushishi Local Government Area. The graph displays that most of the farmers cultivated on inherited lands (58.9%), rented lands (28.3%), borrowed lands (6.5%), purchased lands (5.7%), and gifted lands (0.5%). Hence, majority of the farmers obtained the land either by inheritance or rentage. Majority of the farmers who obtained land through rent, had it at the range of N7, 000 – N 8, 000 for an acre per season

4.3 Impact of rice irrigation farming on livelihood of the community in the study area



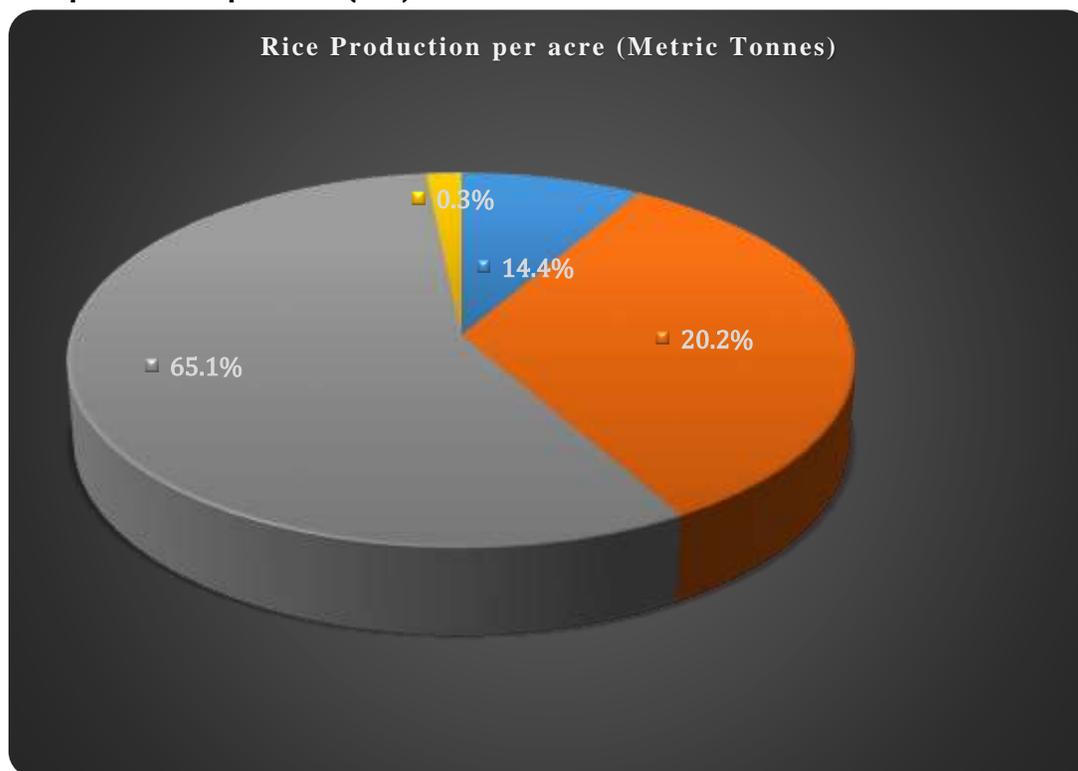
Source: Author's work, 2019.

Figure 4.3.1: Number of harvest per annum

Number of harvest per annum

Figure 4.3.1 shows the number of farmers harvest per annum, the farmers attested to the significance and importance of the irrigation scheme on their annual harvest. A number of farmers representing (14.7%) harvested once in a year, (21.5%) harvested twice in a year, 62.9% cultivated thrice and (3.3%) of the respondents harvested four times and above. The implication of this is that majority of the farmers cultivated their farm lands more than once in a year. This signifies a positive outlook with regards to self-sufficiency in rice production.

Rice production per acre (MT).



Source: Field survey, 2019.

Figure 4.3.2: Production of rice per acre (Metric Tonnes).

The study also revealed that rice production per acre (MT). The result in figure 4.3.2 discloses that 14.4% of the farmers harvested 1 to 3MT/acre, 65.1% harvested 4–7MT/acre, 20.2% had 8–10MT/acre and finally, 0.3% cultivated 11MT and above per acre. This signified that the irrigation scheme has positively influence the harvest rate of farmers in the study area.

Table 4.3.3: Annual estimated income

Estimated Income(N)	Frequency	Percentage
250,000 - 500,000	31	8.4
501,000 - 1,000,000	122	33.2
1,001,000 - 2,000,000	208	56.7
2,001,000 and above	6	1.6
Total	367	100.0

Source: Field survey, 2019.

Annual estimated income

Table 4.3.3 unveil the annual estimated income based on the respondents harvest rate per annum. The result reveals that farmers representing (8.4%) of the total sample had annual income range of N 250,000 to ~~N~~500,000, while (33.2%) estimated income fell within the range N501,000 to ~~N~~1,000,000, about (56.7%) were within the range of N 1,001,000 to N 2,000,000 and finally, (1.6%) were within the range of ~~N~~2,001,000 and above. Needful to note that, majority of the farmers had estimated income within the range of N 1,000,000 to N 2,000,000.

Impact of rice irrigation farming on livelihood of communities in the study area
Pearson Product Moment Correlation Coefficient

Table 4.4 depicts the correlation between rice irrigation farming and livelihood of the community in the study area. The result shows that 0.571 coefficient of correlation indicates that there is a moderate positive correlation between the rice irrigation farming and livelihood of the community. Also, the significance value of 0.000 indicates statistical significance of the relationship. Hence, there is a positive impact of rice irrigation farming on livelihood of the communities within the study area.

Table 4.4 Pearson’s Product Moment Correlation Coefficient test on impact of rice irrigation farming and livelihood of the community in the Study Area

Variables		Rice Irrigation Farming	Livelihood of the Community
Rice irrigation farming	Pearson’s Correlation	1	.571**
	Sig. (2-tailed)		.000
	N	367	367
Livelihood of the Community	Pearson Correlation	.571**	1
	Sig. (2-tailed)	.000	
	N	367	367

* .Correlation is significant at the 0.05 level (2-tailed).

Source: Field survey, 2019.

Strategies adopted to improve rice productivity.

Table 4.5 shows that farmers representing (98.6%) used improved seedlings in order to enhance their crop yield. Worthy of note is that, all the farmers agreed to the usage of fertilizer on the rice fields in order to improve their crop yield. It is as well stated by the farmers to have experienced diseases on their crops emanated from pest/insects.

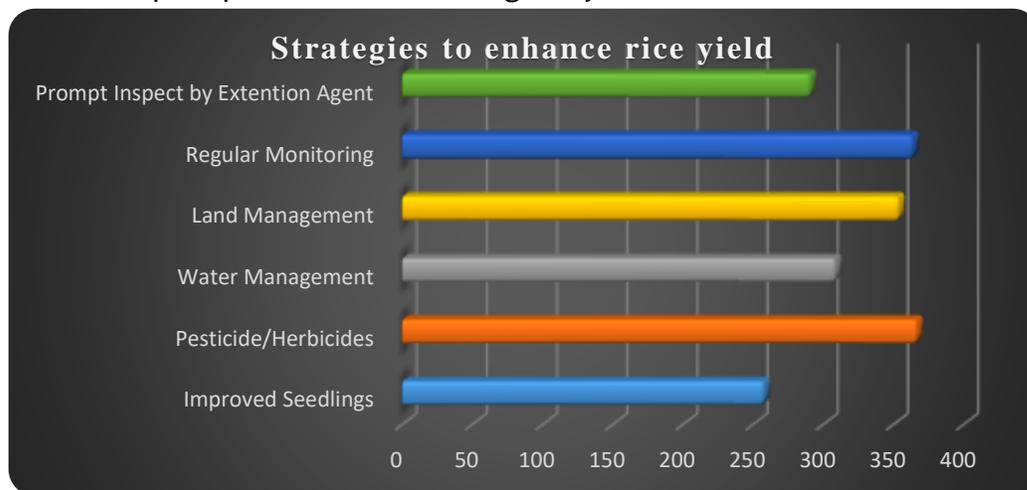
Table 4.5: Strategies adopted to improve farm yield

Statement	Yes (%)	No (%)
Use of specific seeds for improves	362(98.6)	5(1.4)
Fertilizer application	367(100.0)	0(0.0)
Application of pesticides/herbicides	359(2.2)	8(2.2)

Source: Field survey, 2019.

Figure 4.5 reveals the strategies the farmers adopted in order to enhance rice yield in the study area. The result shows that improved varieties, application of pesticide/herbicides, water management, land management, regular monitoring, prompt inspection by extension agents, amongst others were identified to be the adopted practices in enhancing rice yield.

Meanwhile, in figure 4.5, it was observed that improved seedlings/varieties, application of pesticide/herbicides, water management, land management, regular monitoring, and prompt inspection by extension agents were identified to be the adopted practices in enhancing rice yield.



Source: Field survey, 2019.

Figure 4.5: Strategies adopted by farmers to enhance rice yield.

Discussion of results

The purpose to assess the impact of Tungan-Kawo irrigation scheme on rice production in Wushishi L.G.A, Niger state, Nigeria was achieved by collating pertinent information, elicited through questionnaires administered within the study area. Socio demographic information of the farmers were analyzed and the following findings were discovered:

The study reveals that 321 farmers representing 87.5% practice farming as a major occupation, while 12.5% exercised it as a secondary occupation. This proves that majority of the respondents were wholly into farming activities.

The result also revealed that majority of the farmers consisting of 243, that is (66.2%) had farming experience of 11–20years, 112(30.5%) had 5–10years experience, and 12(3.3%) were those with experience of 21years and above. Therefore, the farmers were majorly into rice irrigational practices with a high proportional number of them having experience of rice irrigation farming of 10years and above. The result also showed that 269(73.3%) used pumps method of irrigation, 93(25.3%) utilized calabash/shadouf, while 5(1.4%) used gravity or natural flow. It further revealed that, majority of the farmers which consist of 312(85.0%) cultivated Faro 44. The major sources of seedling for the farmers were through commercial medium; which implied that most of the farmers purchase their seedlings from markets. It was also observed that all the farmers applied fertilizers to enhance crop produce. In addition, over 45% of the farmers had farm lands of 1–5 acres.

Furthermore, about 90% of the farmers were visited by extension agents, and most were visited four times and above. 356(97.0%) of the farmers were members of a cooperative society, while 11(3.0%) were not in any cooperative society at the time of survey. The result also unveiled that majority of the farmers had no access to loans/credit lines.

With regards to the ownership types of land cultivated by farmers within the study area. The research disclosed that 24(6.5%) borrowed the land, 21(5.7%) purchased the land, 2(0.5%) were gifted the land, 104(28.3%) rented the land and finally, 216(58.9%) inherited it. Hence, majority of the farmers obtained the land either by inheritance or rentage. However, a prominent number of the farmers whom obtained land through rentage, had it at the range of N6, 500 – N 8,000 for an acre of land per season.

Nevertheless, 62% of the respondents harvested at least thrice in a year. The result further disclosed that most of the farmers harvested 4–7MT per acre. This implied

that the irrigation scheme has positively influence the harvest rate of farmers. This phenomenon was further attested to by an absolute majority of the farmers who recorded to have an estimated income within the range of N 1,000,000 to N 2,000,000 per annum.

The findings also identified the correlation between rice irrigation farming and livelihood of the communities. The findings reported a 0.571 coefficient of correlation which indicates that there is a moderate positive correlation between rice irrigation farming practiced by respondents with regards to their livelihood. Hence, the significance value of 0.000 indicates statistical significance of the relationship.

The result of the study also disclosed the vulnerability index of the farmers relative to the irrigation scheme. The result depicts that about 33.6% of the household were lowly vulnerable, 65.9% were moderately vulnerable and 1.1% were highly vulnerable. Various challenges encountered by the farmers include: lack of financial support, inadequate irrigable acreage, low patronage of farm produce, absence of processing mills and insufficient power supply.

Further findings emanated from the study stated that farmers, comprising of 362(98.6%) used improved seedlings/varieties in order to improve crop yield. All the farmers agreed to the utilization of fertilizer on the farm lands for optimal productivity. Other strategies adopted include; application of pesticide/herbicides, water management, land management, regular and prompt inspection by agricultural extension agents.

Conclusion and Recommendation

Conclusion

Efforts directed at improving rice production in Wushishi L.G.A, Niger state, Nigeria have started producing dividends as can be witness in the influx of locally produced rice in our homes and markets. Such development if practically sustained across the country will remarkably reduce rice importation, improve the livelihood of citizens and help attain self-sufficiency in rice production the Government so craved for.

There is the need for stability in Government policies in order to keep the momentum on the achievement recorded thus far. The reason why some policies fail is lack of continuity. As such, the Rice Transformation Agenda of which the Agricultural Production Policy was built upon was critically scrutinized and this has not only improved paddy production but has created jobs through the value added

chain facilitated through the sector. Thus, the study lay emphases on the need to enhance paddy production for a sustainable future.

Also, harmony could be created in the study area and benefits derived if opportunities were created for people of the area to participate in the process of production. With good agronomical practices, production, processing and marketing will be optimally maximized. Thus, improving the livelihood of farmers and all involved in the value chain.

Nevertheless, investment in infrastructure is greatly needed to encourage more private investors and small-holder farmers in irrigation practices. Also, one way to increase productivity is to ensure a good water supply to crops. Irrigation is a tried and tested measure. Although, only a small percentage of farms in Nigeria have access to it. Now, though, governments at all levels and donor agencies are developing initiatives for optimal irrigation practices.

Recommendations

Relevant authorities should be deployed to clean up the irrigation dam for optimal productivity.

Relevant agencies should help resuscitate the fallow lands by managing the primary canals and building the secondary canals so that farmers can easily access water to their farm lands.

Industrialized processing mills, sufficient energy, bulk storage facilities and accessible market should be made available for optimal production across the value chain.

Sensitization and enlightenment of the farmers to help the educated-qualified farmers' step-down knowledge to the less educated ones within and elsewhere.

Agriculture should be regarded as business. As such, people from all walks of life should be encourage to embrace it.

A bottom-top approach should be encouraged and implemented to the latter.

Therefore, the time has come to expand the scope of this laudable initiative to cover other crops, such as cowpea which is also of great value to the economy.

References

Isaac Terungwa Terwase & Abdlrzaq Yuguda Madu (2014): The impact of rice production, Consumption and importation in Nigeria. The political economy perspective. www.researchgate.net/publication/283078385. Retrieved online on April 11, 2019.

- Jibril, G., Saidu, M., &Yabagi, A.A., (2017).Performance evaluation of Badeggi irrigation Scheme, Niger State Nigeria, using efficiency techniques.Department of Civil Engineering, Niger State Polytechnic, Zungeru, Nigeria.Department of Civil Engineering, Federal University of Technology Minna, Nigeria. National Cereal’s Research Institute, P. M. B. 8, Badeggi, Niger State Nigeria. ISBN: 2315-6147.
- Lawal A. F., (2008). Assessment of Sustainability of Food Crop Production in the *Fadama* of Southern Guinea Savannah of Niger state, Nigeria. Department of Agricultural Economics and Farm Management, University of Ilorin, Nigeria.Retrieved online on February 12, 2019.
- Lebdi, F., (2010). “Contraintes de l’Agricultureirriguee”, Cahiers du Ciheam, 2010. Retrieved online on October 16, 2018 from www.acetforafrica.org
- Lyne, M.C., Hendricks, S.L., Chitja, J.M. Agricultural growth and food security. In: S L Hendricks and M C Lyne (ed), Does food security improve when smallholders access a niche market? Lessons from the Embo Community in South Africa.The African Centre for Food Security, University of KwaZulu-Natal, South Africa. ISBN: 978-1-86840-687-6, 2009. Retrieved online on May 1, 2019.
- Merem E.C., Twumasi Y., Wesley J., Isokpehi P., Shenge M., Fageir S., Crisler M., Romorno C., Hines A., Hirse G., Ochai S., Leggett S., & Nwagboso E. (2017). Analyzing Rice Production Issues in The Niger State Area of Nigeraia’s Middle Belt. *Food and Public Health* 2017, 7(1): 7-22 DOI: 10.5923/j.fph.20170701.02
- Niger State of Nigeria (2013). Development Action Plan for Niger State. Minna: Niger State, Niger State Government. Retrieved from www.nigerstate.gov.ng
- The World Bank Fact book (2016). Irrigated land. Central Intelligence Agency. Retrieved online on 17 April, 2019
- United States Department of Agriculture, (2013): World Rice Trade. Retrieved on March 20, 2019 Wikimedia.org/wikipedia
- Wikipedia (2013). Retrieved online on October 28, 2018 from <http://en.m.wikipedia.org/wiki/rice> section 14.