# Assessment of Best Practices of Urban and Peri-Urban Irrigation Agriculture in Rigasa, Kaduna Metropolis: An Integrated Nominal Group Technique Approach (NGT)

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## ABSTRACT

*The study assessed the best practices of urban and peri-urban irrigation agriculture in Rigasa, Kaduna metropolis, Nigeria using an Integrated Nominal Group Technique Approach. The study used Focus Group Discussion, Nominal Group Technique (NGT) and interviews to collect data. Random sampling technique was applied in selecting the respondents for the FGD, while purposive sampling was adopted to select those to participate in the NGT interaction due to its conditions that the person must know how to read and write. The study was designed to assess the demographic, irrigation agricultural healthy practices and socio-economic characteristics of the farmers, (level of income increase, ownership of cultivated land, as well as acquisition of the means of transport and house ownership by the farmers). The data was analyzed using Kruskal Wallis test and NGT. The results confirmed that promoting best practice of irrigation agriculture has many health benefits to the farmers and the consumers in different dimensions, the result clearly shows farmers preference for mixed organic and chemical fertilizer. It also shows that water used for the irrigation is perceived to be contaminated by chemical fertilizer, pesticides and domestic wastes dump into the flowing water used by the farmers. The farmers recorded some financial successes such as increase in their income, acquisition of farm lands through purchase, ability to own personal means of mobility, pay health services and knowledge of best practices among others. The study recommends that improving healthy irrigation agricultural best practiceswill ensure more economic and health benefits for both farmers, and communities who consume the products.*

Key Words: Urban, periurban, agriculture, Irrigation, best practices , NGT,

## 1. Introduction

Small holder urban and peri-urban agricultural practices are keyto strengthening food security. With the rise of sedentary and urban sprawl in human habitation, healthy practices of irrigated farming of certain species of plants boost

communities' food supplies and health and supports peoples' livelihoods (Denham, 2003). Dependency on rain fed agriculture has failed short of meeting the ever increasing human demand for healthy food in these cities and communities, and this necessitates the promotion of urban and peri-urban healthy irrigated farming (Bocquet, 2011).

This is made possible today with the availability of modern agronomy and plant breeding. Agrochemicals such as pesticides and fertilizers and technological developments have sharply increased yields from cultivation (Abdullahi, 2021). Mixed and selective breeding and healthy modern practices of irrigated farming, poultry, fishery and animal husbandry have similarly increased availability of healthy organically produced vegetables and hygienic meat(Abdullahi, 2021; Mwendera, 2006).

The development of these types of agricultural healthy practices enables the human population to grow many times larger than could be sustained by the hitherto traditional agricultural practices. (Abdullahi, 2021; Gerritsen, 2008). There is no doubt that healthy practices of urban and peri-urban irrigated agriculture not only provide food and employment but also serves as a source of food and fodder, raw materials, source of savings, employment opportunity, foreign exchange resources, marketable surplus, government income, and basis for citizens economic growth and development (Abdullahi, 2021; Kgomotso & Swatuk, 2006).

Irrigation has been a central feature of agriculture for over 5000 years and is the product of many cultures (Williams*et.al,* 2007). Irrigation helps to grow agricultural crops, maintain landscapes, vegetate disturbed soils in dry areas and during periods of less than average rainfall, frost protection, suppressing weed growth in grain field, preventing soil consolidation, dust suppression among others(Lawton &Wike; Mohammed et al*.,* 2020).

Urban and peri-urban irrigated farming is widely practiced in Nigeria like any other countries of the world and is more popular in the northern part of Nigeria (Nuhu, 2010). The climatic conditions of Nigeria like any other tropical countries of the world suggest a promising future for urban/peri urban irrigated agricultural practices (Mohammed, *et al*., 2020). The use of healthy irrigated farming is necessary in order to improve sufficiency of crops and production of options of agricultural output for the sedentary urban population, (Nuhu, 2010). Thus, urban irrigation practices plays a vital role to urban food sufficiency in the more marginal northern region for the local production of high value perishable

and perhaps non-perishable crops such as rice and some other export crops (Nuhu, 2010).

Several studies have been conducted on the benefits derived from healthy urban irrigation. Urban best practices of irrigation has contributed significantly to poverty alleviation, food security and improving the healthy or quality of life for rural and urban population, (Abdullahi, 2021). Additionally it enhances the income of the farmers through multiple harvest and good returns, (Fakayode*et,al* 2010; Mohammed et al. 2020). Recent studies reveal that farmers' income from irrigated agriculture is significantly higher than income of rainfed farmers, due to the advantage derived from multiple cropping and harvest (Awan & Aslam, 2015). The fact that irrigated farming provides allowance for multiple cropping and harvests suggests its capacity to serve as a tool to change and provide an enabling platform for an endearing livelihood for both urban and rural populations (Brooks & Loevinsohn, 2011). Studies from various countries reveal that irrigation farmers are more amenable to surviving most urban economic dynamics than their counterparts who rely on daily pay or labourers, in terms of rents, water and electricity bill charges in addtionto urban transport fares, (Ayyoub, *et al.,*2011). This assertion was confirmed in Ghana where women irrigation farmers were discovered to be far much better off than labourers working in urban industries (Diao, 2010). Several studies also suggests that an improvement in the quality of urban and peri-urban irrigation practices by reducing use of contaminated water, adulterated chemicals among other will improve socio-economic and health benefits of the farmers and promotes healthy condition of the consumers, (Edwins, 2017; Etea & Obidiechi, 2018; Gollin, 2010; Johansen &Juselius, 1990; Lawal, 2011; Shamsudin, 2010).

The aimof this study is to assess the socio-economic benefits of healthy practices of urban and peri-urban irrigation agriculture in Rigasa,Kaduna Metropolis. Rigasa is important because irrigation agriculture is widely practiced by the farmers living around the rivers that pass through Rigasa.

**The Study Area**

The study area is located in Igabi local government of Kaduna state. Kaduna state is located within latitude $10^0$ 25" 27'N to latitude $10^0$ 35 " 29' N and longitude $7^0$ 22" 27'E to longitude $7^0$ 30" 27'E. The study area constitutes five farming communities; Hayin Mallam Bello, Nariya, Hayin Dan Mani, Keteren Gurgu and Keteren Island. The farming communities use the alluvial plains of River Rigasa and River Afaka for their farming activities. Igabi local government is bounded in the North by Zaria local government, in the west by Birnin Gwari

local government, in the east by Soba local government, in the south-east by Chikun local government, and in south by Kaduna south local government. Its climate is tropical wet and dry. The wet season is between May and October and the dry season is between October to early May. The rainfall is variable with its highest peak in August-September. The study area has about 1500mm of precipitation annually. The humidity follows the pattern of rainfall in the wet season with 60% while in the dry season it fall to 20 – 30%. The temperature ranges between $15^0$ C – $36^0$C with the highest temperature between April and May while the lowest is between December and February. The soils of Kaduna are tropical Ferruginous soils or nitrosols and are heavily leached due to rainfall. They are also sticky when wet and hard when dry (Liman, 2004). The soils support the growth of cocoyam, cassava, maize, rice, Guinea corn, Ground nut, soya beans, millet among others (Liman, 2004).

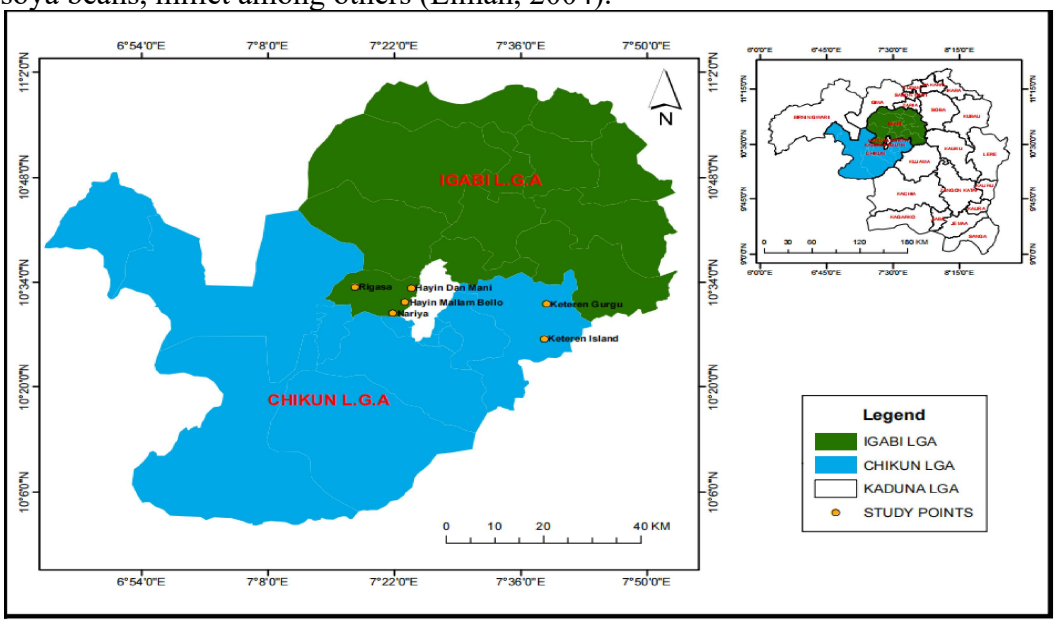


**Figure 1:** Map of Igabi Local Government Source: Geography Department KASU 2019

## Methodology

Reconnaissance visits were made to the study areas to obtain relevant information prior to the detailed field survey. The study used both primary and secondary sources of data. Simple random sampling was used in selecting the respondents. Thus, six (6) respondents were chosen from each of the five study areas. The six chosen respondents were suggested by the farmers from their sample frame. The data was collected through the use of interviews, Focus Group

Discussion (FGD) and Nominal Group Technique (NGT). Focus group discussion is designed to provide information on specific issues from the sample population and it is characterized by explicit use of group interaction to get an insight into the respondent's behavior (Odo, 2008).The Nominal Group Techniques was used to test the educated members to provide an independent opinion on the issues, (Yahya *et al.* 2021)

In analyzing the preliminary data, Kruskal Wallis test is applied in order to establish whether there is significant difference in the income increase of the farmers as one of the socio-economic benefits of irrigation farming in the five study areas using the level of significance at 0.05. The formular for Kruskal Wallis test is expressed as:

$$H = \frac{12}{N\,(N+1)} \sum_{i=1}^{K} \frac{E}{} \left(\frac{R1}{n1}\right) - 3\,(N+1)$$

Where
N = total sample size
$R_1$ = total of the ranks for the height sampled or the sum of ranks for each sample.
n1 = sample size of each group
K = the number of sample.

The Nominal Group Technique (NGT) was used in order to obtain the knowledge of the farmers on healthy and safe techniques to ensure quality output for consumers.

**Nominal Group Technique (NGT) Stages**

The study used a Focus Group Technique and revalidated the data using Nominal Group Technique on the level of healthy practices of irrigation practices in Kaduna State. The research targets the perception of both farmers and consumers on the level of their satisfaction with the products from the urban irrigated farms, use of fertilizer versus organic fertilizer, as well as mixed fertilizer and organic manure. Specifically the research measures the level of healthy irrigation practices among the farmers in the peri-uban setup of Rigasa, Narayi, Hayin Malam Bello, Hayin Danmani, Keteran Island, and Keteren Gurguin Kaduna South, Igabi and Chikun Peri Urban settlements of the State. The responses from FGD were converted to descriptive statistical percentages to make

it easy for interpretation and analysis. The Nominal Group Technique was structured in a five likert scale with 1= less important, 2= Important, 3= neither important nor bad, 4= Very Good and 5= Excellent. The Nominal Group Technique was structured based on stages:

**Stage 1. Present evaluation questions to the large group of learners**

• What were the strengths/highlights of the course?

• What were the weaknesses/suggestions for improvement?

**Stage 2. Silent phase**

• Form small groups of four to eight participants, each with a flip chart.

• Assign a faculty facilitator, or elect a scribe for each group.

• Issue five pink and five yellow "stickers" to each participant.

• Without conferring or group discussion, participant's record one, strength on each pink sticky and one weakness/suggestion for improvement on each yellow sticky.

**Stage 3. Round-robin phase**

- Participants stick one pink sticky in turn on the flip chart without comment or discussion until all ideas are exhausted.
- The facilitator or scribe groups similar comments together.
- Repeat the process using yellow stickers for suggestions for improvement.

**Stage 4. Discussion/item clarification**

- The group clarifies unclear items and edits the grouped items into themes.
- The facilitator or scribe lists and letters items in order of popularity.

**Stage 5. Voting phase**

- Participants rank their top five suggestions in each list from 1 to 5.
- Participants award 5 points to their top item, 4 to the second, and so on.
- The facilitator or scribe collects these lists for data gathering.

**Stage 6. Small-group data gathering**

- Scribes or facilitators add the total points for each lettered item to produce a rank-ordered, weighted list of the groups' opinions of the strengths and weaknesses of the course.
- Scribes or facilitators write this list (with weightings) on the flip chart to present to the large group.

**Stage 7. Large-group data combining**

- Reconvene the large group and examine the results from the small groups.
- Combine the small-group scores. (Small groups in this exercise usually produce very

similar factors and this can be done with minimal discussion).

• Present the cohort's ranked, weighted opinions of the strengths of the course and suggestions for improvement.

**Results and Discussions**

**This section presents the results obtained and a discussion to elucidate its application with previous studies and real life situations**

**Table1. Demographic and Socio – economic characteristics of the respondents.**

| Variable | Hayin m. Bello | Nariya | Hayin Dan Mani | KetarenGurguzu | Ketaren Island |
|---|---|---|---|---|---|
| | Respondents | Respondents | Respondents | Respondents | Respondents |
| Adult | 1 | 2 | 0 | 0 | 0 |
| Old Age | 2 | 0 | 1 | 2 | 1 |
| Primary School | 0 | 1 | 0 | 1 | 1 |
| Secondary School | 0 | 0 | 1 | 0 | 0 |
| Others | 1 | 1 | 2 | 0 | 1 |
| Ann. income < N100,000 | 1 | 2 | 1 | 1 | 0 |
| Annual > N100,000 | 1 | 0 | 1 | 2 | 3 |
| Total | 6 | 6 | 6 | 6 | 6 |

**Table 2: Sizes of farmland cultivated by the farmers.**

| Farm size in Hectare (HA) | Hayin M. Bello Respondents | Nariya Respondents | Hayin Dan Mani Respondents | Ketaren Gurguzu Respondents | Ketaren Island Respondent |
|---|---|---|---|---|---|
| 0.001 – 1.99 | 2 | 1 | 0 | 0 | 2 |
| 2.00 – 3.99 | 3 | 1 | 1 | 0 | 1 |
| 4.00 – 5.99 | 3 | 2 | 1 | 2 | 0 |
| 6.00 – 7.99 | 0 | 1 | 2 | 2 | 3 |
| 8.00 – 9.99 | 0 | 1 | 2 | 2 | 0 |
| Total | 6 | 6 | 6 | 6 | 6 |

**Table 3: Types of fertilizers used by the farmers.**

| Types of fertilizer | Hayin M. Bello (n) | Nariya (n) | Hayin Dan Mani (n) | Keteren Gurguzu (n) | Keteren Island (n) |
|---|---|---|---|---|---|
| Fertilizer | 2 | 3 | 2 | 1 | 4 |
| Manure | 0 | 2 | 3 | 2 | 1 |
| Manure & Fertilizer | 4 | 1 | 1 | 3 | 1 |
| None | 0 | 0 | 0 | 0 | 0 |
| Total | 6 | 6 | 6 | 6 | 6 |

**Source: Field work 2018**

Table 1 represents the demographic and socio-economic characteristics of the respondents. It shows that among the five farming communities, irrigation agriculture is mostly practised by the adults and that farmers' annual income differs among the five farming communities. This could be attributed to the type of crop planted, nature of harvest, size of the farm land among others. Table 2 indicates the sizes of farm lands cultivated by the farmers in the five different communities, and it is apparent that most farm sizes are relatively small, and sizes are varied within the communities.

Table 3 shows how the farmers in the five farming communities use different fertilizers on their farms, and demonstrates that manure and fertilizer are used more than manure only or fertilizer only on the farm. Thus, the farmers that used fertilizer only and manure only are fewer than those that use manure and fertilizer on their farms. It signifies that farmers using fertilizer in Ketaren Island have the highest usage of chemical fertilizer in their farms, making their product non organic which may not be healthy for consumption by those with underlying health conditions.

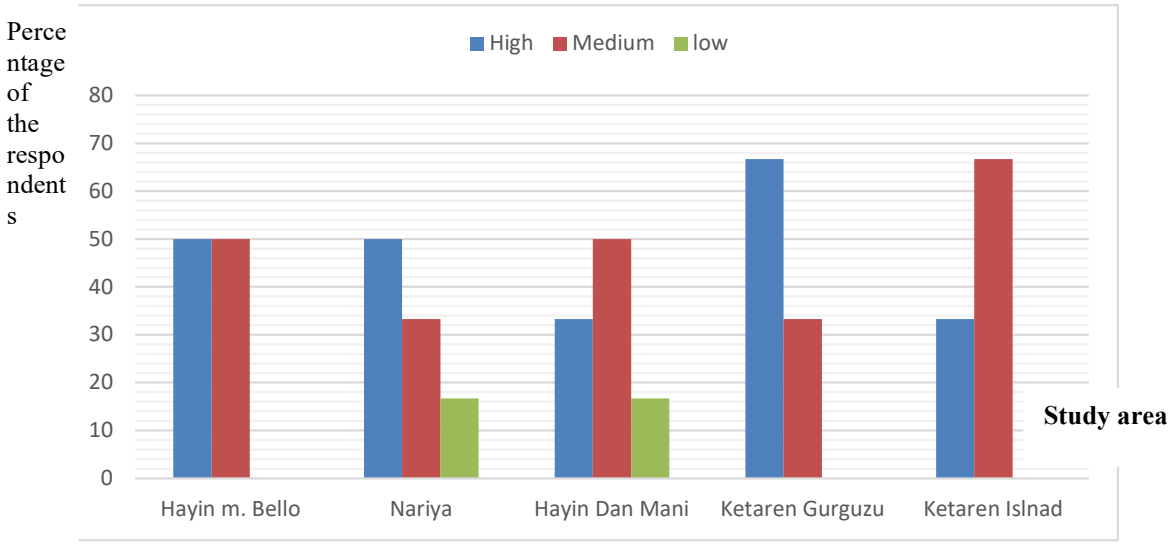


Figure 1: Income increase of the farmers: Source Field Work 2018

The results on Figure 1show the level of income increases on farmers' income. So also is the same case with farmers using mixed organic and fertilizer at Ketaren Islan, Hayin Malam Bello and Narayi whose income is moderately increased with 66.7% also. There is the need for an incentive to the farmers as the study conducted by Cameira, et. al, suggested in Denmark to reduce overuse of chemical fertilizer in Ketaren Island and mixed fertilizer and organic in Hayin Malam Bello and Narayi. However, farmers in Hayin Dan Mani and Nariya got 16.7% each for farmers whose income is low compared to their counterparts. This is because of their high use of organic in place of chemical fertilizer. This shows that a big gap exists between those whose income increase is as a results of usage of mixed fertilizer and organic or organic only. This high income differential if not checked may lead to changing irrigation usage of organic to chemical fertilizer which is against healthy irrigation practices in the area. This results agrees with the Rose grant(1992)on the impact of irrigation on production and income variability in Philippines where the government of Philippines supported those organic farmers with extension services to improve efficient farming for an increase in income.

Test of hypothesis using Wallis test for the increase in income of the farmers.

Ho: there is no difference in the income increase of the farmers in the five different communities.

The level of significance used is 0.05

**The degree of freedom is K = 5** **5= 5-1 =4**

$$H = \frac{12}{N(N+1)} \sum_{i=1}^{K} \frac{E}{ni} \left(\frac{Ri^2}{ni}\right) - 3\,(N+1)$$

**ni =3**

**N = 15**

$$\mathbf{H} = \frac{12}{15(15+1)}\ X \left(\frac{23^2}{3} + \frac{21^2}{3} + \frac{21^2}{3} + \frac{22^2}{3} + \frac{22^2}{3}\right) - 3\,(15+1)$$

$$= \frac{12}{15(15+1)}\ X\,(17\ .3 + 147 + 147 + 161.3 + 161.3)\ - 48$$

$$= \frac{12}{24}\ X\,(176.3 + 147 + 147 + 161.3 + 161.3)\ - 48$$

**= 0.05 X 792.9 - 48**

**= 39.645 - 48**

**= -8.355**

The critical value is 9.49, therefore the hypothesis is accepted that there is no significant difference in the income increase of the farmers in the five different communities because the value calculated is less than the critical value**.**

**Table 4: Nominal Group Technique Results**

| S/ NO | AILMENT TREATMENT/CURE INTENTION | RANKING SCORE | ABSO LUTE WEIG HT | RELA TIVE WEIG HT | RAN K |
|---|---|---|---|---|---|
| 1 | That some percentage of farmers uses mixed chemical and organic fertilizer | 5,5,5,5,3,3,5,2,4, 5,4 | 51 | 0.121 | 1 |
| 2 | That most of the urban and peri-urban irrigation farmers uses chemical fertilizer | 5,3,5,5,5,3,4,5,5, 5,4 | 49 | 0.116 | 2 |
| 3 | That most of the farmers using mixed chemical and organic fertilizer make more profits compared to fertilizer only | 4,5,5,5,5,4,4,3,3, 5,3 | 46 | 0.0109 | 3 |
| 4 | That most of the vegetables from this irrigation are contaminated with this | 5,1,1,5,5,5,1,5,5, 5,5, | 43 | 0.102 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| | unhygienic water through plants intake | | | | |
| 5 | That the water for urban and peri-urban irrigation is not hygienic | 5,3,4,4,4,5,2,3,4, 4,4, | 42 | 0.100 | 5 |
| 6 | That means of transportation of input to the farm and output to the market is the farmers serious challenge to making a fruitful livelihood | 5,2,5,2,5,3,5,5,4, 4,2 | 42 | 0.100 | 5 |
| 7 | That those farmers that uses organic fertilizer only make less profit compared with those using mixed or chemical fertilizer only | 4,3,5,4,3,3,4,2,2, 5,4 | 39 | 0.093 | 6 |
| 8 | That urban and peri-urban irrigation farmers make more profits using chemical fertilizer only | 4,1,2,5,3,3,2,5,4, 5,3 | 37 | 0.088 | 7 |
| 9 | That those farmers who owned their parcel of land make more profits, with evidence that they owned their personal houses | 5,3,5,4,4,3,3,3,1, 3,2 | 35 | 0.083 | 8 |
| 10 | That some of the farmers uses organic fertilizer only to irrigate their crops | 5,1,3,3,0,2,3,5,5, 3,5 | 35 | 0.083 | 9 |
| | TOTAL | | 419 | | |

From the NGT Table 4, the result supports the idea that most farmers use mixed organic and chemical fertilizer in their irrigated farm, this statement was supported by all participants at the NGT session, ranking it number 1 factor in the analysis. Both the questionnaire response and the NGT session agree that farmers make the most profit using mixed organic and chemical fertilizer. While the NGT session results that was ranked 2 also supported and reveals that most farmers uses chemical fertilizer to irrigate their crops. This is not in tandem with best practices, as the residues from fertilizers may percolate and contaminated both the surface water and the soil and the irrigated crop may contain residues. The NGT session ranked number 3 aligned with session 1, and in this case the results suggest that that because farmers make the most profit using both organic and

chemical fertilizers, their preference become exceptional on the mixed fertilizer usage.

The question item ranked 4 in the NGT session demonstrates thatthe vegetables from this irrigation are contaminated with this water through plant intake from the soil and water contaminated with both domestic waste and chemicals from irrigation processes. The questionnaire items that were ranked 5 reveal that the water for urban and peri-urban irrigation is not hygienic. The results also shows that those farmers that uses organic fertilizer only make less profit compared with those using mixed or chemical fertilizer onlywas ranked 6, that urban and peri-urban irrigation farmers make more profit using chemical fertilizer only was ranked 7, That those farmers who owned their parcel of land make more profits, with evidence that they owned their personal houses was ranked 9, which shows it is not likely that ownership of land affects profit or improves best practices in the urban irrigation practices. |The results ranked 9 and the also reveals that is not likely that some of the farmers use organic fertilizer only to irrigate their crops. This shows that there is need to encourage the practices of using organic for those consumers with underlining health conditions.

**Conclusion and Recommendations**

This study was able to identify that the use of chemical fertilizer as an input is perceived to be counter to healthy urban irrigation best practices. However, those farmers using chemical fertilizer only made more income compared with those using organic manure only and mixed fertilizer and manure. The study concludes that there is the need to encourage the farmers in the use of organic manure with at least higher percentage as against the use of chemical fertilizer in area to reduce water and soil contamination characterising the present situation. Extension services provision promotion could boost the internalization of healthy irrigation best practices and as well increase the income of the farmers and their livelihood. The study reveals that these peri-urban farmers have benefited immensely from irrigation agriculture, therefore, to further increase their income, extension services, adult education, fertilizer formulation specifically for peri-urban agriculture, financial support should be provided in a form of support to them. Despite the variations in the land acquisition by the farmers, most of the land cultivated by the farmers was acquired through purchase. This is an indicator of how beneficial irrigation agriculture is to the farmers.

However, means of mobility is an essential part of the farmers' activities from home to farm and farm to market.The present use of motorcycles could be

upgraded to tricycle for healthy transport to the market and consumers and as well to use to transport fertilizer and other input to their farms. The study was able to ascertain that there is no significant difference in the income increase of the farmers in the five farming communities, and this suggests that though there is improvement in their income, it alone is not expected to attract more people to the business. An improvement in the practices will attract more income and promotes best practices in addition to enlisting new farmers into the profession.

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