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UTILIZATION OF WATER MANAGEMENT PRACTICE FOR IRRIGATION AROUND KAFINCHIRI-GARUN ALI AREA OF GARKO L,G KANO STATE NIGERIA

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Abstract

The Study assesses the Utilization of Water Management Practices for Irrigation in Kafinchiri - Garun Ali areas. Inconsistencies in Utilization of Water Management for irrigation constitute a lot of hindrance to the farmers in the study area which needs to be investigated. The research aimed at assessing the utilization of Water Management practices for effective irrigation practice in the area. Stratified Random and availability sampling techniques were used for selection of the sampling site and respondents respectively. Data was collected through the use of questionnaire, semi- structured interview, field observation and field measurements. Descriptive statistic, X^2Homogeneity and Analysis of Variance (ANOVA) were carried out to analyse the data using SPSS software. The result revealed that, about 70% of the respondents use Dams as their major source of irrigation water.. The study also revealed that, poor management, inadequate machines, improper channels, inadequate implementation of modern techniques were identified as limiting factors hindering effective management of irrigation water. However, there is significant different of limiting factors among the three study site at $p = 0.05$. It was concluded that Dam is the major sources of water for irrigation in all of the areas. Among the recommendation, there is need for the authorities to be organizing sensitizations of workshops to farmers on proper utilization of water for irrigation facilities, so as to conserve irrigation water and consequently avoiding water loses.

Keywords Utilization Water Management, Practice, Irrigation

Introductions

Developing countries are experiencing high rates of population, urban, and income growth which is putting tremendous pressure on available water resources. These information's were ascertain by United Nations,(UN 2015) that the global population is increasing continuously and is expected to reach the 9.7 billion in 2050 from the current 7.4 billion. This 2.3 billion increase in population needs about 60% more foods in the next 35 years Food Agricultural Organisation. (FAO, 2013).

The provision of irrigation is vital for achieving food security (Bowmer and Meyer, 2014, Das *et al*, 2015). At the same time, growing populations make it necessary to ensure that crop yields continue to rise. Therefore, developing countries must find ways to grow more food with the same or less water consumption. There are three principal ways to do this: Improve water use efficiency (yield/water consumed); Reduce water quality degradation; and Reduce return flows into saline sinks. All three options require better on-farm water management, which depends upon improved quality and reliability of water delivery service to the field (Burt and styles, 1998).Water has to be applied in the right amounts, at the right time, in order to achieve the right crop results. At the same time, users of water should avoid waste of this valuable resource and be in sympathy with the environment as a whole. Understanding, measuring and assessing how water flows around the farm, and recognizing how farming practices affect flows, will help farmers to manage water efficiently and reduce

pollution risks in the environment of men. (FAO, 2013).

Utilization of water management will form environmental considerations, as well as helping the farmer to continue producing profitable crops. Farmers aim to guarantee that the safety and quality of the water which they use will satisfy the highest expectations of the food industry and consumers. In addition, on-farm practices should ensure that water management is adopted under sustainable economic, social, environmental conditions (Das *et al*, 2015).

A lot of farmers recognise that water use and supply as essential factors of crop production. A reliable and consistent supply of water is vital to maximize both yield and quality, and it is important that water is applied at the right time, in the exact quantity with the minimal waste. In recent years, supplies of water have frequently become stretched, and everyone now recognises the need to minimize the water lost.

Changes to the arrangements for abstraction, and placing irrigation under licensing control, have meant that farmers and growers need to pay even closer attention to the ways by which they use water (FAG 2013). There are sound business and environmental reasons why water use should be considered carefully at all stages of production cycle. Careful and effective water management will be critical to profitable cropping in the future. However, without appropriate planning and management, the intensification of irrigated agriculture could result in declining agro-ecosystems (Han *et al*., 2011).

The Use of Irrigation Technologies and Water Management Practices have suggested that switching to more-efficient irrigation technologies has often been proposed as a solution to declining water supplies. For example, sprinklers such as centre pivot and drip irrigation could reduce irrigation application rates per unit of land relative to gravity irrigation by distributing water more evenly, reducing percolation below the root zone and eliminating runoff (Negri and Hanchar, 1989 in Huang *et al.,* 2016).

Approaches to Water Management and Development for Irrigation

Various approaches have been utilized in water management in the dry lands from modern introduced concept to traditional approaches. Some of these approaches used in water resources management are identified as follows: impact t matrix, integrated water resources management (IWRM), Ecosystem Approach to water management and traditional approaches use in water management.

Impact Matrix

The impact matrix approach provides an analytical framework for determining the relative success of water development and management projects in dry land areas based on their impact on environment and socio-economic factors (Mtisi and Nicol, 2013). In this approach, water development projects are significantly assessed to determine whether their execution will have an adverse effect on the environment or otherwise improves the environmental condition of the environment to a more sustainable one. If the project has an adverse environmental impact then it results to insecure livelihoods that lead to poor practices like: environmental degradation, insecure livelihoods of farmers and pastoralists, high unemployment, among others. But if the project impacted positively then it leads to more secured livelihoods that lead to livelihoods diversification, improved agricultural production, and better resources governance, among others (Mtisi and Nicol, 2013).

Integrated Water Resources Management (IWRM)

The Integrated Water Resources Management (IWRM) is the coordinated development and management of water, land and related resources, to maximize the resulting economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems (International Institute for Sustainable Development, 2011). It is described as a strategy for the integrated management of land, water and living resource that promotes conservation and sustainable use in an equitable way (Millennium Ecosystem Assessment, 2005). IWRM depends upon three principles: social equity, economic efficiency and ecological sustainability.

The approach is all about comprehensiveness, tool for participatory planning and implementation of

management system in development of water resources that are not detrimental to dry land ecosystem, and also ensures the sustainability of the ecosystem.

In addition a catchment or river basin approach promoted by IWRM-based policies, the establishment of decentralized and participatory water management bodies, and the associated devolution of responsibilities for water management to water users, has provided an effective policy and institutional platform for dry land water management (Mtisi and Nicol, 2013)

It is within this context that countries with significant dry land areas, such as Mali, Niger, Burkina Faso, Zimbabwe and South Africa have implemented IWRM- based water sector reforms. Mali introduced the water code in 2002, which provided for state ownership for all water resources with a very few limited exceptions. Burkina Faso's Water Management policy Act of 2001, amendedin2003 and Niger's Water code of 1998 followed the same IWRM principles.

Ecosystem Approach to Water Management

According to International Union for Conservation of Nature and Natural Resources definition, ecosystem approach is ''a process that integrates ecological, socio-economic, and institutional factors into comprehensive analysis and action in order to sustain and enhance the quality of the ecosystems to meet current and future needs''. The approach promotes a shared vision of a desired future that integrates social, environment and economic perspective for managing geographically defined natural ecological system. As such ecosystem management embraces a holistic, inter-disciplinary approach that recognize the inter-connectivity between ecological, socio-cultural, economic and institutional structures (Mtisi and Nicol, 2013).

This approach is based on the following principles: decentralization of management to the lowest appropriate level in ecosystem management, management of ecosystem resources as a matter of choice to the different sectors of the society, effect of activities on the ecosystem should be considerable, integration of ecosystem management at the appropriate scales, management of the ecosystem within the limits of its function, involvement of all relevant sector of society and scientific disciplines and others.

Ecosystem approach has been used in management of biodiversity of the dry land ecosystem in offering good management principles in water management practices, livestock production, fishery and forestry management and further boosting of the dry land ecosystem service like: food production, Biomass production as well as encouraging participation of indigenous societies in ecosystem management. Hence, maintaining healthy ecosystem to ensure water availability and other ecosystem services is essential for long-term food security (Ibid).

Water Management

Water resources management is essentially the modification of the hydrological cycle for socio-economic development. It involved not only the beneficial use of water resources but also the prevention, avoidance or minimisation of the effect of water excess (flood) or deficiency (drought) (Douglas, 1973). Water management is the activity of planning, developing, distributing and optimum utilisation of water resources under defined water polices and regulations. It includes: management of water treatment for drinking water, industrial water, sewage or wastewater, management of water resources, management of flood protection, management of irrigation, and management of the water table.

The need for water is universal. It is present everywhere, and without water, life, as we know it, will simply cease to exist. Water is constantly in motion, passing from one state to another, and from one location to another, which makes its rational planning and management a very complex and difficult task under the best of circumstances. Water may be everywhere, but its use has always been constrained in terms of availability, quantity and quality. Water problems of the world are neither homogenous, nor constant or consistent over time. They often vary very significantly from one region to another, even within a single country, from one season to another, and also from one year to another (Olokesusi, 2006).

Solutions to water problems depend not only on water availability, but also on many other factors, among which are the processes through which water is managed, competence and capacities of the institutions that manage them, prevailing socio-political conditions that dictate water planning, development and management processes and practices, appropriateness and implementation statuses of the existing legal frameworks availability of investment funds, social and environmental conditions of the countries concerned, levels of available and usable technology, national, regional and international perceptions, modes of governance including issues like political interferences, transparency, corruption, etc., educational and development conditions, and status, quality and relevance of research that are being conducted on the national, sub national and local water problems (Beshah, Pekka and Tapio, 2016).

The current and the foreseeable trends indicate that water problems of the future will continue to become increasingly more and more complex, and will become more and more interweave with other development sectors like agriculture, energy, industry (Biswas, 2004 and Beshah, Pekka and Tapio, 2016).

Utilization of Water Management for Irrigation

The process of determining and controlling the volume, frequency and application rate of irrigation water to plant is planned in efficient manner. However Utilisation of Irrigation water management primarily aims to control the volume and frequently of irrigation water applied to crops so as to meet the crop moisture requirement at minimum losses of water, soil plant nutrients or energy.

Farmers' Participation and Involvement in Utilization of Water Management

The failure of smallholder irrigation schemes in Africa has been linked to weaker participation of water users (FAO, 2015). Farmers 'participation in the establishment, rehabilitation and management of smallholder irrigation schemes in Ethiopia, Zimbabwe, Mozambique, South Africa and Tanzania have largely been peripheral as the engagement of farmers by the development agencies in the sector often lacked materiality (Bastakoti, and Shivakoti, 2009; Awulachewand Ayana, 2011; Averbeke, 2013; Mutambara *et al*., 2014a, b; FAO, 2015). The weak participation of farmers in most African countries left behind debilitating dependency among the farmers, weak water user associations and poor operation and maintenance practices that made smallholder irrigation schemes unsustainable (Gomo, 2010; Namara *et al*., 2011; Mutambara*et al*., 2014a). The long history of irrigation development in Asia reveals that farmers need to be involved in the planning decisions, contribute at least a part of the capital costs, and have full responsibility for operation and maintenance to make the smallholder irrigation schemes sustainable (Mukhenji and Facon,2013).

Increased farmer participation in irrigation has been part of a global trend of devolution in natural resource management from government to the local communities (FAO, 2001). Beginning in the 1980s, this decentralization of management was successfully done in countries such as the Philippines, Indonesia, Madagascar, Colombia and Mexico where irrigation management was handed over to the water user (Mundra and Garg, 2013). Experience in these countries revealed that if properly engaged, farmers could be effective managers of their own affairs in the schemes. It is grounded from these successful examples that participatory irrigation management is increasingly viewed as a means to improve the performance and sustainability of irrigation investments (Mundraand Garg, 2013).

It is only through high level of local community participation that intended beneficiaries share ideas and use their indigenous knowledge to sustain their own projects such as the community irrigation scheme (Ofosu, 2011; Nyong*et al*., 2013). Ostrom (1994), in her study of the community small-holder irrigation schemes in Asia concluded that where community members were actively involved and the traditional management system embraced, most of the schemes were free from threat of inundation and flooding. Greater participation of farmers in running irrigation schemes was also key in reducing recurrent cost and enabling the irrigation schemes to respond flexibly to the changing operating environment and changing needs of the users (FAO,1997).

Purpose of the Study

The aim of this study is to identify the Utilization of indigenous water management practices for irrigation

with the view to identify the best method of irrigation water conservation in the Area.
The major aim of the research is achieved through the following objectives: to

i. Identify the major sources of water for irrigation in the area.
ii. To examine the problems associated with the utilization of managing Irrigation Water.

Methodology

A reconnaissance survey was carried out in order to be more acquainted with the irrigated area under investigation as well as to acquire information on the size and number of farms that are presently under irrigation in the area. Through this survey, information pertaining the number of farmer and size is approximately 700 farmers, 1000 farmers and 350 farmers in Kumfada, Gamji, and Maimanda Dams irrigated area respectively (Table 1).

Table 1 Number of Sample farmers per Dam irrigated area.

S/N	Dam	Total Farmers	Number of Sample Farmers
1	Kumfada	700	114
2	Gamji	1000	163
3	Maimanda	350	57
4	Total	2050	334

Source: Fieldwork, 2024

The research covered three earth Dams addressing the issue of water management practices for irrigation in the areas as: Kafinchiri, around Kumfada amd Gamji earth Dam and Garun Ali around Maimanda earth Dams. These areas have been stratified into three according to the dam's location and user's relationship with the dams.

A sample size indicate the proportion of a research population adequately selected to represent the study population, the population happen to be 2050 farmers as acquired from the authorities in charge of the irrigation system of the area. The sample size of this study was (n = 334) and it was determined using Yamane formula for calculating sample size (Tejada and Punzala, 2012).

Sample allocation to the dam areas (Stratums) proposed by Bowley captured by Pandy and Verma (2008)

$\mathbf{n_1 = n \times Ni/N}$ $\mathbf{n_2 = n \times Ni/N}$ $\mathbf{n_3 = n \times Ni/N}$

= 334 x 700/2050 = 334 X 1000/2050 = 334 X 350/2050

= 114 = 163 = 57

The research employed availability sampling techniques for selecting each farmer in each stratum.

The type of data to be collected and use in this research are field data; which are information collected from the participants through the interviews, observation and data from field measurement. While the achieved data are information that is used in part of the literature review: such as peer review journals, text books, unpublished researches among others.

The data were collected using questionnaire and interviews after pilot study, were information on sources of water for irrigation, method of water application on farmland and problems associated with managing irrigation water in the areas of study were identified.

Results and Findings

Research Question 1

What are the major sources of water for irrigation in the area?

Table 2: Sources of Water for Irrigation in the Areas Location

		Maimanda	Kumfada	Gamji	
Sources of Water	Dam	3.6%	30.8%	31.4%	65.9%
	Stream	2.1%	.6%	2.4%	5.1%
	Open Well	9.3%	1.2%	10.5%	21.0%
	Ditch	.3%	.3%	0.0%	.6%
	Borehole	1.5%	1.5%	4.2%	7.2%
	Others	.3%	0.0%	0.0%	.3%
	Total	17.1%	34.4%	48.5%	100%

Source: Field Work, 2024

The result above reveals that 65.9% of the respondents use dam as the source of their water for irrigation. About 5.1% of the respondents use stream as their source of water and 21% of the respondents use open-well to provide water to their farms. Only 0.6% of the respondents use Ditch as their source of water for irrigation. While 7.2% of the respondents use borehole as their source of water for irrigation. About 0.3% of the respondents use other sources of water

The result implies that Dam is the major source of water for irrigation in the areas. It also shows high usage of dam water for irrigation in Gamji and Kumfada areas with 31.4% and 30.8% respectively and minimal usage of Dam water for irrigation in Maimanda area with only 3.6% usage.

3.6% usage.

Research Question 2

What are the problems associated with managing irrigation water?

Table 3: Limiting Factors Facing Various Irrigation Water Management Practices in the Area.

		Irrigation Area			Total
		Maimanda	Kumfada	Gamji	
Limiting Factors	Inadequate Machines	.9%	1.2%	2.4%	4.5%
	Unreliable Supply	2.1%	.6%	14.7%	17.4%
	Improper Channels	1.2%	.3%	0.0%	1.5%
	Inadequate Implements and Modern Techniques	6.0%	15.0%	19.8%	40.7%
	Lack of Knowledge	.3%	2.1%	9.9%	12.3%
	No Response	6.6%	15.0%	1.8%	23.4%
	Poor Management	0.0%	.3%	0.0%	.3%
	Total	17.1%	34.4%	48.5%	100%

Source: Field Work, 2024

Table (3) above reveals that 4.5% of the respondents are facing challenges of machines inadequacy, where by many farmers use one single machine to water their farms in rotation. 17.4% of the respondents are facing problems in terms of reliability of water supply by irrigation water management practices. Inadequate channels is another limiting factor facing irrigation water management in the area, 1.5% of the respondents are having problems with water channelling from the dam, where by some farmers are sharing single channel from dam to their farms. 40.7% of the respondents are having the problem of inadequate implement of modern technique where by resorting to local method of water application using bucket and wheel-barrow. 12.3% of the respondents lack knowledge to manage the water for irrigation. 0.3% indicated a poor management of water for irrigation. in the study area. About 23.4% of the respondents are silence on the response for limiting factors facing irrigation management This implies that improper water management can have a serious negative implication in socioeconomic development of the dry areas. .

Discussion

From the major finding of the research work discovered that the major sources of irrigation water were identified as Dam, besides stream, open well, ditch and borehole in the area. However Inadequate irrigation facilities such as fond, dumps, sprinkler, inadequate knowledge and skills of crops water regulation by the farmers and erosion as well as siltation were identified as the major problems of water management in the areas.

Conclusion

In conclusion, Utilization of water management practices do have biophysical gains of which communities can benefit from specifically in water generation for irrigation purposes. From the findings it revealed that sources of irrigation water were Dam, Stream, Open Wells, Ditch, and Borehole. Dam is the major source of irrigation water in all of the areas, with borehole been the lowest because of it cost effective. It is also indicated that the inadequate knowledge of water management by the famers as well as the skills for utilization of available water for irrigation were identified as the major hindrances of water management in the area.

Recommendations

i. There is need for government and NGO'S to fully intervene with regard to usage frame work of the dams. There is also the need for government intervention in controls of soil erosion, and siltation so as to restore the dams to their full capacities. The embankment and proper channelization should be protect and conserved to avoid loss of water by over bank full discharge in the areas.
ii. Government and stakeholders such as KTARDA, FADAMA, KTAPU, IFAD, etc. should provide facilities such as pipes, pumping machines, sprayers to avoid use of surface wash which is the major method of irrigation water loss.
iii. The authorities should be organizing sensitizations and workshop to farmers on proper utilization of water for irrigation facilities so as to conserve irrigation water and consequently avoid water losses.

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