NANGARHAR UNIVERSITY
INTERNATIONAL JOURNAL OF BIOSCIENCES
ORIGINAL ARTICLE
e-ISSN: 2957-9988
NUIJB Special Issue, 2024

Received: 27 Dec 2023 Accepted after revision: 22 Jan 2024 Published Online: 10 Feb 2024

Agriculture Water Management is an Important Approach for Mitigating the Effects of Climate Change in Afghanistan

Rahmani Hizbullah[1*] and Abid Mohammad Omar[2]

[1] Department of Biology, Education Faculty, Higher Education Institute of Paktika, Paktika,Afghanistan

[2] Department of Biology, Education Faculty, Nangarhar University, Nangarhar, Afghanistan

*Corresponding author: hezbullah.rahmani@gmail.com

ABSTRACT

As climate change continues to impact Afghanistan, effective strategies for mitigating its effects are crucial to ensuring food security and sustainable agricultural practices. Agriculture's water management plays a vital role in adapting to and mitigating the impacts of climate change. This article aims to highlight the significance of agriculture water management as an approach to addressing climate change challenges in Afghanistan. The study involved 29 farmers, and the approach included surveys and field observations. The findings found that the primary challenges in Paktika were a lack of irrigation water, old irrigation methods, a lack of modern irrigation systems, and farmers' lack of understanding about crop water requirements. To improve sustainable water management in irrigated agriculture, capacity building, and farmer education, providing knowledge and techniques for water-saving practices, sustainable irrigation systems such as drip and sprinkler, rainwater harvesting, integrated water resource management, crop diversification, conservation agriculture, and strong policy frameworks and robust institutional support are necessary to promote agriculture water management.

Keywords: Climate change, Capacity building, Food security, Water resources management

INTRODUCTION

Afghanistan already faces water scarcity, and climate change exacerbates this problem. Erratic rainfall patterns, increased evaporation rates, and the melting of glaciers reduce water availability for agriculture. Agriculture water management practices become essential to ensure optimal use of limited water resources (Saleem et al., 2018). Implementing sustainable irrigation systems can maximize water usage efficiency in agriculture. Techniques such as drip irrigation, sprinklers, and furrow irrigation help deliver water directly to the plant roots, minimizing evapotranspiration losses. Additionally, modernizing irrigation infrastructure can further enhance water efficiency (FAO, 2021). Afghanistan must explore more efficient irrigation techniques and implement water management strategies to ensure a balanced distribution of water resources among the different sectors (SHAMS, 2016). The nation's reliance on imported food emphasizes the ineffectiveness of irrigation infrastructure (Akhtar et al., 2018). Drought and water scarcity worsen Afghanistan's unchecked population growth and inefficient agricultural use. Water-efficient irrigation methods and sustainable water management strategies are critical (Habib, 2014). The water table has decreased almost everywhere in the nation because of drought and improper groundwater management (Alim, 2006). As a result, the purpose of this research was to identify important irrigation-related issues and suggest sustainable solutions. This study addresses the following issues: What are the main issues for farmers in Paktika, Afghanistan, and which irrigation systems might help with agriculture water management.

MATERIALS AND METHODS

Study Area

The study collected data on irrigation issues in Paktika, Afghanistan using both primary and secondary sources. Field observations and questionnaire surveys were used, with descriptive analysis aided by Pashto-language questionnaires. Secondary data was acquired from books, journals, papers, and conference proceedings.

Samples Collection

The questionnaire, which was distributed to 29 farmers in Paktika, Sharana's capital, contained closed-ended questions. Every survey respondent provided the same answers, making the questionnaire reliable and consistent. To learn more about the local population's perceptions of the current irrigation situation, a thorough field study was conducted.

Statistical Analysis

The results were descriptively examined using SPSS 24. Frequency and percentage were selected as the research analysis methods because they are the most effective and acceptable ways to evaluate the test questions.

RESULTS

The questionnaire addressed participants' general questions as well as specifics about their power sources, irrigation system types, crop kinds, agricultural water resources, deep-bore wells, and groundwater management problems, among other things. Table (1) shows the survey findings:

Table 1: Responses of the questionnaire

Questions	**Parameters**	**Survey responses participants**	
		Frequency	***Percentage***
Respondents Gender	Male	29	100.0
	Female	0.00	0.00
	Total	29	100.0
Respondents Education level	Primary school	10	34.5
	High school	9	31.0
	Bachelor	3	10.3
	None	7	24.1
	Total	29	100.0
Crop types	Wheat	5	17.2
	Vegetables	1	3.4
	Alfalfa	4	13.8
	Maize	4	13.8
	All	13	44.8
	None	2	6.9
	Total	29	100.0
Garden type	Apple	11	37.9
	Apricot	3	10.3
	Grape	0.00	0.00
	Peach	1	3.4
	All	13	44.8
	None	1	3.4
	Total	29	100.0
Water Resources for irrigation	Karez	2	6.9
	Spring	1	3.4
	Borewells	26	89.7
	Total	29	100.0
Electricity source	Generator	4	13.8
	Solar panels	25	86.2
	Total	29	100.0
Types of Irrigation	Flood	24	82.8
	Pond	5	17.2
	Drip	0.00	0.00
	Sprinklers	0.00	0.00
	No answer	0.00	0.00
	Total	29	100.0
Public awareness about irrigation systems	Yes	1	3.4
	No	28	96.6
Challenges of irrigation	There is no plan for irrigation	2	6.9
	Lack of modern irrigation system	11	37.9
	Lack of farmers' awareness about modern irrigation systems	3	10.3
	Lack of water for irrigation	4	13.8
	All	9	31.0
	Total	29	100.0
Factors of water decrease	Drought	2	6.9
	Usage of much water for irrigation	23	79.3
	All	3	10.3
	Total	1	3.4
		29	100.0

DISCUSSION

According to the findings of this study, groundwater is used by residents of Sharana, the capital of Paktika, for drinking water and agriculture. Using hand and submersible pumps, Paktika locals draw groundwater for drinking and irrigation purposes. Paktika residents commonly employ two different types of submersibles: one propelled by solar energy and the other by a generator. As shown in Table 1, 86.2 percent of the farmers utilize solar-powered submersibles. The proliferation of solar-powered submersibles poses a serious threat to the groundwater. Farmers use excessive amounts of water, and there is no law prohibiting the use of groundwater. The water table generally decreases because of excessive groundwater use and drought. Numerous water wells in the province of Paktika have dried up owing to the predominance of solar-powered submersibles (Rahmani et al,.2022). Strong policy frameworks and robust institutional support are necessary to promote agriculture water management. Strengthening water user associations and engaging local communities will also contribute to effective implementation (World Bank, 2017). Farmers in Paktika frequently use flood irrigation, and there is an absence of knowledge of the best times to irrigate their fields. Most farmers do not understand how much water crops need, so they plan their watering schedules based on how dry or damp the soil looks on the surface and how long it has been since they last applied water. Climate-resilient agricultural practices like crop diversification and conservation agriculture are critical to mitigate climate change impacts (CIMMYT, 2019) Enhancing the capacity of farmers and agricultural stakeholders through training and education is essential for promoting effective agriculture water management. (Haidari et al., 2020). According to Qureshi (2002), farmers commonly do not understand the water needs of their crops, and overirrigation is a typical practice. Flood irrigation is a common practice that wastes water and is costly for farmers who are remote from water supplies (Azami et al., 2020). According to Table (1) the main irrigation issues in Paktika are traditional irrigation systems, a lack of modern irrigation systems, farmers' lack of awareness of modern-day irrigation systems, and a lack of water for irrigation. According to the Kyr Ministry of Agriculture and Melioration (2015), International firms are interested in drip irrigation since it is good for plant nutrition and requires small intervals of irrigation and fertilizer application. Water supplies must be protected through dams, desalination, sewage treatment, and pipeline monitoring. Furthermore, using sustainable agricultural practices such as crop rotation, organic fertilizers, and accurate irrigation can aid in mitigating the detrimental effects on soil and water resources (SAAD et al. 2020). Promoting rainwater harvesting techniques is another crucial aspect of agriculture water management (CIMMYT, 2019).

CONCLUSION

Climate change poses significant challenges to agriculture in Afghanistan, with water scarcity being a crucial factor. Agriculture water management practices offer a promising approach to mitigate the effects of climate change on agricultural productivity and enhance water efficiency. By implementing sustainable irrigation systems, promoting rainwater harvesting, adopting integrated water resource management, encouraging crop diversification, investing in capacity building, and ensuring supportive policies, Afghanistan can build resilience and adapt to a changing climate. The collaboration of the Afghan government, international organizations, and local communities is vital in implementing these measures and securing a sustainable future for agriculture in Afghanistan.

Conflict of Interest: All authors express no conflict of interest in any part of the research.

Funding: This research received no external funding.

REFERENCES

Akhtar, F., Awan, U., Tischbein, B., & Liaqat, U. (2018). Assessment Of Irrigation Performance in Large River Basins Under Data Scarce Environment—A Case of Kabul River Basin, Afghanistan. *Remote Sensing*, 1-21. Doi:10.3390/Rs10060972

Alim, A. (2006). Sustainability Of Water Resources in Afghanistan. *Journal Of Developments in Sustainable Agriculture*, 53-66.

Azami, A., Sagin, J., Sadat, S., & Hejran, H. (2020). Sustainable Irrigation: Karez System in Afghanistan. *Central Asian Journal of Water Research*, 1-18. Doi:10.29258/Cajwr/2020-R1. V6-2/1-18. Eng

CIMMYT. (2019). Climate-Resilient Agriculture in Afghanistan. Retrieved from https://www.cimmyt.org/climate-resilient- agriculture-in-Afghanistan

Habib, H. (2014). Water-Related Problems in Afghanistan. *International Journal Of Educational Studies*, 137-144.

Haidari, A. H., Saho, F. S., & Noori, M. (2020). Climatic response to the renewable energy transition in Afghanistan. Renewable Energy, 157, 766-775.

FAO. (2021). Afghanistan Climate Change Profile. Retrieved from http://www.fao.org/afghanistan/knowledge-center/accessdata/en/

Qureshi, A. (2002, June). Water Resources Management in Afghanistan: The Issues and Options.

Saad, A., Benyamina, A., & Gamatié, A. (2020). Water Management In Agriculture: A Survey on Current Challenges and Technological Solutions. *Ieee Access*, 38082-38097.

Ministry Of Agriculture and Melioration of The Kyr. (2015). *Modern Irrigation Technologies Modern Irrigation Technologies in Kyrgyzstan.*

Rahmani, H., Abid, M., & Azizi, N. (2022). An Investigation of The Key Challenges and Resolutions for Sustainable Groundwater Management in Paktika, Afghanistan. *Randwick International of Social Sciences (Riss) Journal*, 666-672.

Shams, H. (2016). *Study On Effective Utilization Of Irrigation Water In Afghanistan (Doctoral Dissertation).* Japan.

Saleem, U., Iqbal, A., Khattak, M. N. K., & Hanif, M. (2018). Climate change in Afghanistan: Historical trends, current impacts, and future projections. Renewable and Sustainable Energy Reviews, 82, 1539-1550.