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IMPACT OF CLIMATE CHANGE ON FRUITS AND CROPS PRODUCTION IN SOUTH PUNJAB: FARMER'S PERSPECTIVE

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Abstract *Pakistan is an agricultural economy. According to the Pakistan Bureau of Statistics, Pakistan earns most of its capital through production of crops and fruits. Approximately 53% of Pakistan's total labor has been employed by this sector. Pakistan's 22.67% of GDP comes from agriculture. According to World Bank 2020 report, 47.64% of total land is occupied by agriculture which was 47.9% back in 2018. This change in cropped land may be due to various reasons like land use in residential schemes or climate change. Punjab is the most important province, especially Southern Punjab, regarding agriculture. Punjab covers 69% of the total cropped area of Pakistan, thus providing crops like Wheat 75.5%, Rice 70.2%, Cotton 68.5%, Sugarcane 67.8%, similarly fruits like Mango 79.6%, Banana 5.8%, Citrus 96.5%, Guava 76.8% and Dates 8.1%. Wheat and rice are included in the daily diet of the world's population. Rice is an essential staple of the world that influences the livelihood and economies of a country. According to Statistics 2023 report, Pakistan is 4th largest country in the world that exports rice, with a total of 3.8 million metric tons.*

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Introduction

Climate change occurs worldwide through which atmospheric patterns change, leading to global eco and biosphere changes through slow natural processes (Shahid and Adnan, 2021). Climate change is occurring due to natural methods as well as human activities. In recent era, the discussion about climate change has gained momentum (Shahid and Adnan, 2021). The discussion has included factors causing climate like human activities, and the measures to cope with climate change and have less damage due to the changing climate patterns. Climate change has affected developing countries as it caused flooding, global warming, and cyclones which caused adverse effects on the world economies (UNFCCC). In short, the alternation in climate patterns is not good for the world. Climate change is a major issue for Pakistan and the world, affecting the economies. According to BBC 2022 (Mahmood and Hassan, 2022), Pakistan received nearly 390.7mm of rain this year in the last 30-years average from June to August, almost 190% more. This condition led to floods in various areas of Pakistan, impacting agriculture and tourism. Pakistan has been ranked 12th among the countries with agriculture and livelihood affected by climate change (Angelakis et al., 2023). Agriculture is the one sector most affected by climate change. Studies suggested that increases in temperature will shift the cropping seasons of Pakistan and permanently put an end to the ability to grow some crops (Darwin, 1995)

Climate change is alarming for the crop production system of major crops like wheat, maize, cotton, rice, and sugarcane (Shahzad et al., 2021). It is predicted that the temperature will rise by 3°C by 2040, and it has also been anticipated that at the end of the century, the temperature will be increased by 5-6°C will cause damage to up to 50% of their wheat productivity in Asian countries. And due to its geographical position, Pakistan is at risk of greater loss (Cammarano et al., 2022). Wheat and rice are the main crops and leading staple food of the agriculture sector that

Pakistan produces and exports. Due to climate change, the production of wheat and rice has reduced by 14.7% and 20.5%, with their market price shooting up (Ali et al., 2017). This decreased crop production rate is unfavorable for Pakistan being an agricultural economy as Pakistan is the 4th largest exporter of staples (Rehman et al., 2015). Climate change adversely affects agricultural production in the district of Lodhran, with rising temperatures and changes in rainfall patterns leading to reduced crop yields and increased pest attacks (Abbas, 2020).

Materials and Methods

Study Area

The study was conducted in various districts of South Punjab, Pakistan, including Multan, Bahawalpur, Dera Ghazi Khan, Khanewal, Vehari, Rajanpur, Lodhran, Layyah, Muzaffargarh, and Bahawalnagar, as shown in Figure 1. These districts were selected due to their significant contribution to fruit and crop production and vulnerability to climate change's effects.

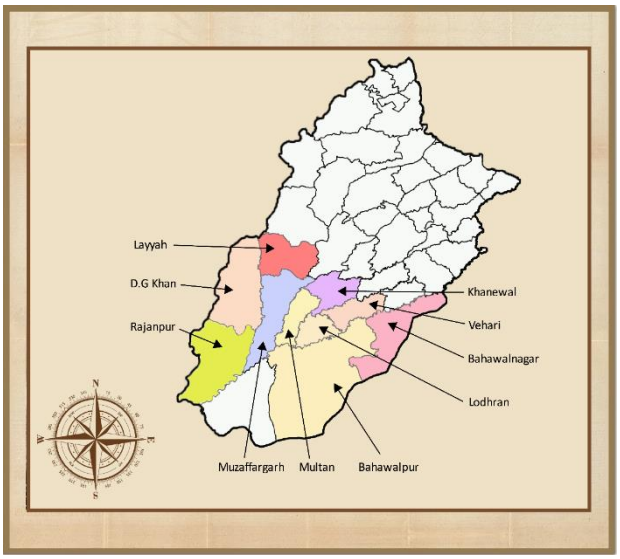

Figure 1: Location of South Punjab Districts for data collection

Data Collection

Sampling Strategy

A purposive sampling technique was employed to select farmers from the districts mentioned above. The selection criteria included the farmers' engagement in fruit and crop production, and willingness to participate in the study.

Data Collection Tools

Structured questionnaires were developed to gather quantitative and qualitative information from the participating farmers. The questionnaire consisted of sections related to demographic information, farming practices, climate-related experiences, perceptions of climate change, adaptation strategies, and challenges faced due to changing climatic conditions.

Survey Administration

Trained enumerators conducted face-to-face interviews with selected farmers, ensuring informed consent and confidentiality. These interviews, conducted during planting and harvesting seasons, aimed to capture seasonal variations. Additionally, a team of six members utilized virtual methods, such as Google Sheets, to digitize questionnaires, enabling real-time data entry, collaborative work, and remote supervision, thereby enhancing the efficiency and accuracy of the data collection process for the sample size of 300 farmers.

Qualitative Research Questionnaire

Climate change is a pressing global challenge that has far-reaching implications on agriculture, particularly in regions heavily reliant on farming, like South Punjab. As temperatures rise and weather patterns become increasingly unpredictable, farmers in this region have been grappling with the adverse effects of climate change on their fruit and crop production. This qualitative research seeks insights from an experienced South Punjab farmer who has been actively engaged in fruit and crop production for over two decades. By delving into their first-hand experiences and perceptions, we aim to understand the specific challenges posed by climate change, the adaptations implemented, and their concerns and expectations for the future of agriculture in the face of changing climatic conditions. The following questionnaire sheds light on the farmer's observations and responses, providing valuable information for policymakers, researchers, and fellow farmers striving to manage agriculture amid the challenges of climate change.

Results

This research study investigates the impact of climate change on fruits and crop production in South Punjab region. The data was collected through surveys from various districts, including Multan, Bahawalpur, Dera Ghazi Khan, Khanewal, Vehari, Rajanpur, Lodhran, Layyah, Muzaffargarh, and Bahawalnagar. Most respondents (27%) had 10-15 years of experience, with (32%) having 15-20 years of experience. Additionally, (22%) of farmers had 5-10 years of experience, and (20%) had less than 5 years of experience. Climate change observations were evident among the farmers, with (50%) reporting experiences for more than 20 years. Within the last decade, (28%) of respondents noticed significant weather changes, while (15%) observed minor

changes, and only (7%) reported no noticeable changes. Various crops are cultivated in the region, including wheat (27%), cotton (15%), sugarcane (12%), maize (10%), rice (12%), potato (12%), and other crops (13%). These crops face different impacts due to climate change (DaMatta et al., 2010). The farmers' perspective on the impact of climate change on fruit and crop production in South Punjab revealed significant challenges. Erratic rainfall patterns, droughts, and flooding were reported as major climate-related issues affecting (15%) of respondents, alongside concerns about extreme temperatures, pests, diseases, and soil degradation. 46% farmers observed significant shifts in the timing of planting and harvesting seasons, while (37%) noted minor changes (Qazlbash et al., 2021). However, (16%) reported no noticeable alterations. Regarding crop yield, (23%) experienced a significant increase, and (20%) saw a slight increase, but (20%) faced a slight decrease, and (15%) reported a significant decline. Despite these challenges, (19%) managed to maintain a stable yield amidst changing climatic conditions. These insights emphasize the pressing need for climate-resilient agricultural practices in South Punjab to mitigate the adverse effects on fruit and crop production (Aryal et al., 2020). Over half of the respondents (52%) reported a significant increase in pests, diseases, or invasive species affecting their orchards or fields. An additional (36%) noted a minor addition, while (12%) stated that they did not observe any noticeable rise in these challenges (Rwomushana et al., 2019). This indicates the escalating threat of pests and diseases in the context of climate change. Farmers in South Punjab have adopted various measures to adapt to the changing climate and its impact on fruit and crop production. These include changing irrigation practices (21%), implementing better drainage systems (18%), utilizing crop rotation techniques (18%), and introducing pest-resistant varieties (20%). These adaptive strategies are crucial in enhancing agricultural resilience, as Q 1 to 8 are shown in Figure 2.

Figure 2: Response of each question 1 to 8 from framer community during interview

While (43%) of respondents are aware of technological advancements and practices that can mitigate the negative impacts of climate change on fruit and crop production, a significant proportion (57%) stated their lack of awareness regarding such practices. This highlights the importance of knowledge dissemination and extension services to empower farmers with climate-smart strategies. According to the respondents, the government can play a vital role in supporting farmers to mitigate and adapt to climate change. Key measures include providing financial incentives (12%), offering technical support (16%), investing in research and development (21%), and implementing policies addressing climate impacts (20%). Participation in climate change training programs or workshops is limited, with only (18%) of respondents having had such opportunities, while the majority (82%) have not. Respondents' perception of long-term sustainability for fruit and crop production in the face of climate change varies. A significant proportion (63%) believe it is highly vulnerable and at risk. About (28%) consider it moderately vulnerable and facing challenges, while (11%) view it as relatively resilient and capable of adapting to climate change. The study revealed that most respondents (73%) in South Punjab rely on traditional or indigenous knowledge and practices to cope with climate change impacts on fruit and crop production. This highlights the importance of local wisdom in adapting to changing climate conditions. However, a significant portion (27%) does not rely on such knowledge, suggesting opportunities for integrating traditional and scientific approaches. Respondents expressed major concerns and expectations regarding the future of fruit and crop production in the region. The primary worries included decreased productivity and economic losses (41%), increased vulnerability to pests and diseases (18%), and water scarcity and irrigation challenges (26%). These findings underscore the urgent need for climate-resilient agricultural practices and strategies. Interestingly, (84%) of respondents have additional information or insights to share regarding climate change and its impact on fruit and crop production, indicating a strong interest in the topic (Ali and Erenstein, 2017). Conversely, (16%) stated that they do not have any additional information to contribute. Moreover (38%) of respondents said that government plays a vital role in supporting farmers to provide training programs related to climate change, as Q 9 to 16 shown in Figure 3.

Figure 3: Response of each question 9 to 16 from the framer community during the interview

Discussion

The discussion on the impact of climate change on fruit and crop production in South Punjab, based on the farmer's perspective, provides valuable insights into the challenges faced by agricultural communities in the region (Habib et al., 2022). The results highlighted in the study shed light on the current state of agriculture, its vulnerabilities, and the adaptations farmers undertake to cope with changing climate patterns (Ali et al., 2020). One of the key findings was the heavy reliance of farmers on traditional or indigenous knowledge and practices to mitigate the effects of climate change. This emphasizes preserving and integrating local wisdom into modern farming practices (Khilji, 2002). The long-established methods of soil preparation, crop selection, and water management passed down through generations have proven effective in dealing with varying weather patterns (Qasim, 2012). However, the study also identified a percentage of farmers who do not rely on traditional knowledge, indicating a need to bridge the gap between generations and combine conventional practices with scientific advancements for a more robust climate adaptation strategy.

The major concerns and expectations for the future of fruit and crop production in the region were revealed through the study. Many farmers expressed fears of decreased productivity and economic losses, highlighting the potential risks climate change poses on the region's agriculture-based economy (Anik et al., 2017). Increased vulnerability to pests and diseases emerged as another pressing concern, which could threaten food security and the livelihoods of farming communities. Water scarcity and irrigation challenges were among the top concerns, as changing climate patterns lead to altered rainfall and reduced water availability, necessitating efficient water management practices (Bano and Arshad, 2018). The respondents acknowledged the role of government support as crucial, with various measures proposed to aid farmers in adapting to and mitigating climate change impacts (Khan et al., 2020b). These measures included providing financial incentives, technical support, investment in research and development, and implementing climate-sensitive policies. Government-led initiatives and support can empower farmers with the necessary resources, knowledge, and technologies to implement climate-resilient practices, enhancing agricultural productivity and sustainability (Khan et al., 2020a). The study also brought attention to the limited access to climate change training programs or workshops among farmers in South Punjab (Majeed et al., 2021). This highlights a potential gap in awareness and knowledge dissemination, hindering farmers' ability to respond to climate change challenges. To address this issue, efforts must be made to improve access to training and extension services, enabling farmers to acquire valuable information and skills to adapt successfully to changing climate conditions(Ferris et al., 2014). The perception of long-term sustainability for fruit and crop production in the face of climate change varied among the respondents. While a majority expressed concerns about high vulnerability and risks, a significant proportion also acknowledged the potential for adaptation and resilience. This reflects the complex nature of climate change impacts and the need for tailored solutions that consider the specific context and challenges individual farmers face.

Conclusion

The farmer's perspective on climate change impacts fruit and crop production in South Punjab provides critical insights into the challenges faced by agricultural communities and the adaptations necessary for building resilience. By leveraging traditional knowledge alongside scientific innovations and enhancing government support and awareness, South Punjab's agriculture can become more climate-resilient and sustainable. Collaborative efforts involving farmers, governments, researchers, and agricultural institutions are vital in addressing climate change challenges and ensuring a sustainable future for agriculture in the region.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

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Not applicable

Conflict of Interest

Regarding conflicts of interest, the authors state that their research was carried out independently without any affiliations or financial ties that could raise concerns about biases.

Reference

Abbas, S. (2020). Climate change and cotton production: an empirical investigation of Pakistan. *Environmental Science and Pollution Research* **27**, 29580-29588 https://doi.org/10.1007/s11356-020-09222-0.

Ali, A., and Erenstein, O. (2017). Assessing farmer use of climate change adaptation practices and impacts on food security and poverty in

Pakistan. *Climate Risk Management* **16**, 183-194 https://doi.org/10.1016/j.crm.2016.12.001.

Ali, S., Liu, Y., Ishaq, M., Shah, T., Abdullah, Ilyas, A., and Din, I. U. (2017). Climate change and its impact on the yield of major food crops: Evidence from Pakistan. *Foods* **6**, 39 **https://doi.org/10.3390/foods6060039**.

Ali, U., Wang, J., Ullah, A., Tan, Y., Nurgazina, Z., and Khan, Z. A. (2020). Determinants of farmers'choice adaptation strategies to climate change: evidence from Khyber Pakhtunkhwa Pakistan. *Pakistan Journal of Agricultural Sciences* **57 https://doi.org/10.5194/esd-6-225-2015** .

Angelakis, A. N., Capodaglio, A. G., Valipour, M., Krasilnikoff, J., Ahmed, A. T., Mandi, L., Tzanakakis, V. A., Baba, A., Kumar, R., and Zheng, X. (2023). Evolution of Floods: From Ancient Times to the Present Times (ca 7600 BC to the Present) and the Future. *Land* **12**, 1211 https://doi.org/10.3390/land12061211.

Anik, A. R., Rahman, S., and Sarker, J. R. (2017). Agricultural productivity growth and the role of capital in South Asia (1980–2013). *Sustainability* **9**, 470 **https://doi.org/10.3390/su9030470**.

Aryal, J. P., Sapkota, T. B., Khurana, R., Khatri-Chhetri, A., Rahut, D. B., and Jat, M. L. (2020). Climate change and agriculture in South Asia: Adaptation options in smallholder production systems. *Environment, Development and Sustainability* **22**, 5045-5075 https://doi.org/10.1007/s10668-019-00414-4.

Bano, I., and Arshad, M. (2018). Climatic changes impact on water availability. *Perspectives on Water Usage for Biofuels Production: Aquatic Contamination and Climate Change*, 39-54 https://doi.org/10.1007/978-3-319-66408-8_2.

Cammarano, D., Jamshidi, S., Hoogenboom, G., Ruane, A. C., Niyogi, D., and Ronga, D. (2022). Processing tomato production is expected to decrease by 2050 due to the projected increase in temperature. *Nature Food* **3**, 437-444 https://doi.org/10.1038/s43016-022-00521-y.

DaMatta, F. M., Grandis, A., Arenque, B. C., and Buckeridge, M. S. (2010). Impacts of climate changes on crop physiology and food quality. *Food Research International* **43**, 1814-1823 https://doi.org/10.1016/j.foodres.2009.11.001.

Darwin, R. (1995). "World agriculture and climate change: Economic adaptations," US Department of Agriculture, Economic Research Service https://www.jstor.org/stable/2117682.

Ferris, S., Robbins, P., Best, R., Seville, D., Buxton, A., Shriver, J., and Wei, E. (2014). Linking smallholder farmers to markets and the implications for extension and advisory services. *MEAS Brief* **4**, 13-14 https://doi.org/10.1016/j.worlddev.2009.06.009.

Habib, N., Alauddin, M., and Cramb, R. (2022). What defines livelihood vulnerability to climate change in rain-fed, rural regions? A qualitative study of men's and women's vulnerability to climate change in Pakistan's Punjab. *Cogent Social Sciences* **8**, 2054152 https://doi.org/10.1080/23311886.2022.2054152.

Khan, I., Lei, H., Shah, I. A., Ali, I., Khan, I., Muhammad, I., Huo, X., and Javed, T. (2020a). Farm households' risk perception, attitude and adaptation strategies in dealing with climate change: Promise and perils from rural Pakistan. *Land use policy* **91**, 104395.

Khan, N. A., Gao, Q., and Abid, M. (2020b). Public institutions' capacities regarding climate change adaptation and risk management support in agriculture: the case of Punjab Province, Pakistan. *Scientific Reports* **10**, 14111 https://doi.org/10.1016/j.landusepol.2019.104395.

Khilji, E. (2002). Modes of convergence and divergence: An integrative view of multinational practices in Pakistan. *International Journal of Human Resource Management* **13**, 232-253 https://doi.org/10.1080/09585190110102350.

Mahmood, S., and Hassan, Q. (2022). CLIMATE CHANGE: ITS IMPACTS ON PAKISTAN. *International Research Journal of Social Sciences and Humanities* **1**, 20-32 https://doi.org/10.52567/pjsr.v5i02.1223.

Majeed, M., Tariq, A., Anwar, M. M., Khan, A. M., Arshad, F., Mumtaz, F., Farhan, M., Zhang, L., Zafar, A., and Aziz, M. (2021). Monitoring of land use–Land cover change and potential causal factors of climate change in Jhelum district, Punjab, Pakistan, through GIS and multi-temporal satellite data. *Land* **10**, 1026 **https://doi.org/10.3390/land10101026**.

Qasim, M. (2012). "Determinants of farm income and agricultural risk management strategies: The case of rain-fed farm households in pakistan's Punjab," kassel university press GmbH.

Qazlbash, S. K., Zubair, M., Manzoor, S. A., ul Haq, A., and Baloch, M. S. (2021). Socioeconomic determinants of climate change adaptations in the flood-prone rural community of Indus Basin, Pakistan. *Environmental Development* **37**, 100603 DOI : 10.5958/0974-0279.2018.00026.5.

Rehman, A., Jingdong, L., Shahzad, B., Chandio, A. A., Hussain, I., Nabi, G., and Iqbal, M. S. (2015). Economic perspectives of major field crops of Pakistan: An empirical study. *Pacific science review b: humanities and social sciences* **1**, 145-158 https://doi.org/10.1016/j.psrb.2016.09.002.

Rwomushana, I., Lamontagne-Godwin, J., Constantine, K., Makale, F., Nunda, W., Day, R., Weyl, P., and Gonzalez-Moreno, P. (2019). Parthenium: impacts and coping strategies in

Central West Asia. *Parthenium: impacts and coping strategies in Central West Asia doi cabdirect.org/cabdirect/abstract/20193363038i* .

Shahzad, A., Ullah, S., Dar, A. A., Sardar, M. F., Mehmood, T., Tufail, M. A., Shakoor, A., and Haris, M. (2021). Nexus on climate change: Agriculture and possible solution to cope future climate change stresses. *Environmental Science and Pollution Research* **28**, 14211-14232 https://doi.org/10.1007/s11356-021-12649-8.