

Impacts of Climate Change on Food Security in Pakistan



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(2024)

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INTRODUCTION

Food security, the ability of a nation to ensure access to affordable, nutritious food for all its citizens, is a critical cornerstone of national stability and development (Food and Agriculture Organization, 2023). Pakistan, with a population exceeding 220 million, faces significant challenges in achieving food security. While the country is largely self-sufficient in staple crops like wheat, factors like poverty, malnutrition, and unequal distribution already create vulnerabilities (World Bank, 2021). Climate change presents a new and growing threat, risking food production, access, and affordability, with potentially devastating consequences.

BACKGROUND

Historically, Pakistan's food security has been shaped by factors like reliance on rain-fed agriculture, limited water resources, and a growing population (Janjua et al., 2010). While the Green Revolution of the 1960s improved agricultural productivity, social inequalities and land distribution issues persist (Pakistan Bureau of Statistics, 2023). Today, despite being a net food producer, Pakistan struggles with malnutrition, particularly among children and women (World Bank, 2021). These pre-existing vulnerabilities make the country particularly susceptible to the disruptions caused by climate change.



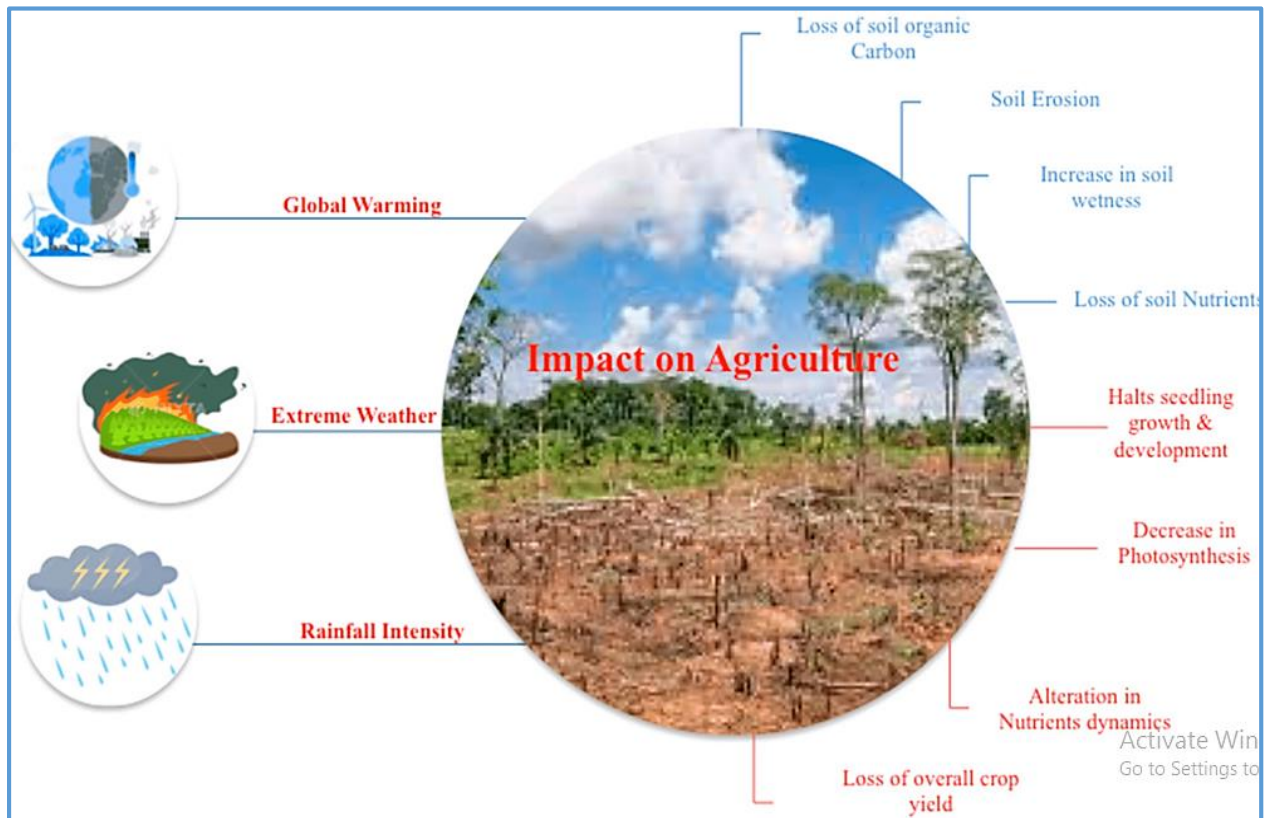
Climate Change in Pakistan

Pakistan is the 5th most vulnerable country to climate change, despite contributing minimally to global greenhouse gas emissions (Intergovernmental Panel on Climate Change, 2022). Rising average temperatures, more frequent and intense heatwaves, and changing precipitation patterns are already being observed (World Bank, 2021). These trends are projected to continue, with potentially catastrophic consequences for agriculture.

- **Rising Temperatures:** Increased heatwaves shorten growing seasons, stress crops, and reduce yields. Wheat, a staple food source, is particularly sensitive to rising temperatures (Mitra & Bhatia, 2008). Heat waves 2022 has declined 60% of the mangoes yield.
- **Changing Precipitation Patterns:** Erratic rainfall patterns lead to unpredictable weather events. Droughts devastate rain-fed agriculture, while intense monsoon rains cause flash

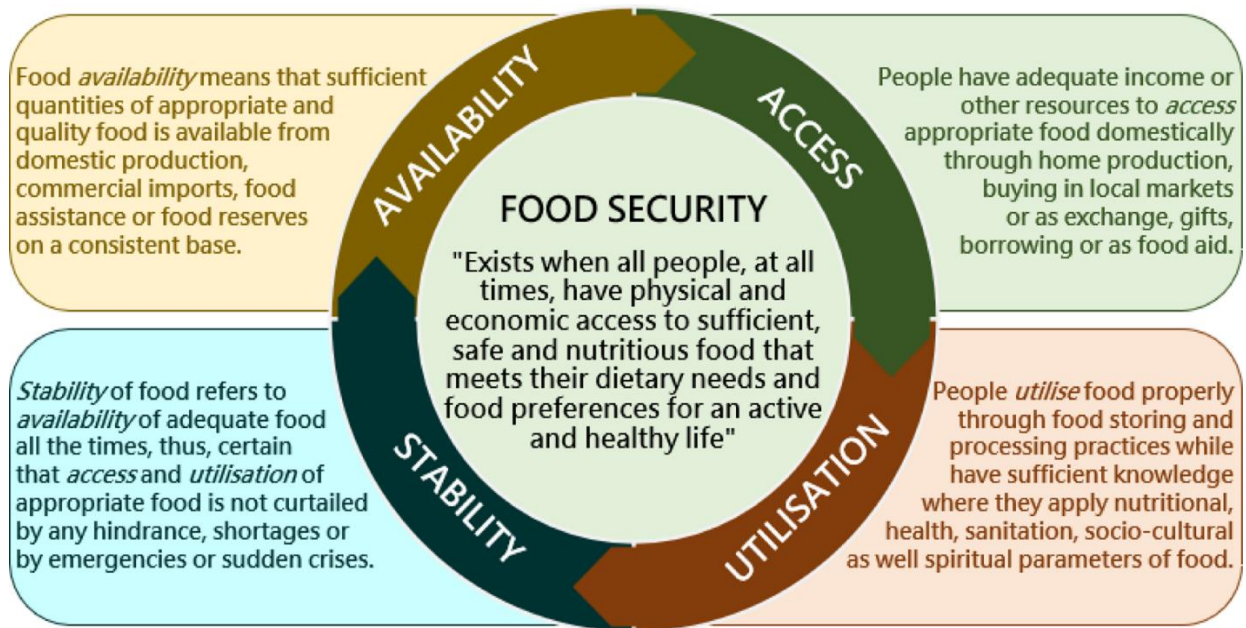
floods that destroy crops, infrastructure, and displace communities (Pakistan Today, 2023).

- **Water Scarcity:** Glacial melting because of rising temperatures contributes to short-term water abundance during floods, but also depletes long-term water reserves in rivers and aquifers. This creates water scarcity for irrigation, impacting agricultural productivity (South Asian Voices, 2023).



FOOD SECURITY FRAMEWORK

Food security rests on four pillars: availability, accessibility, utilization, and stability of food supplies (Committee on World Food Security, 2012). Climate change disrupts all these pillars:



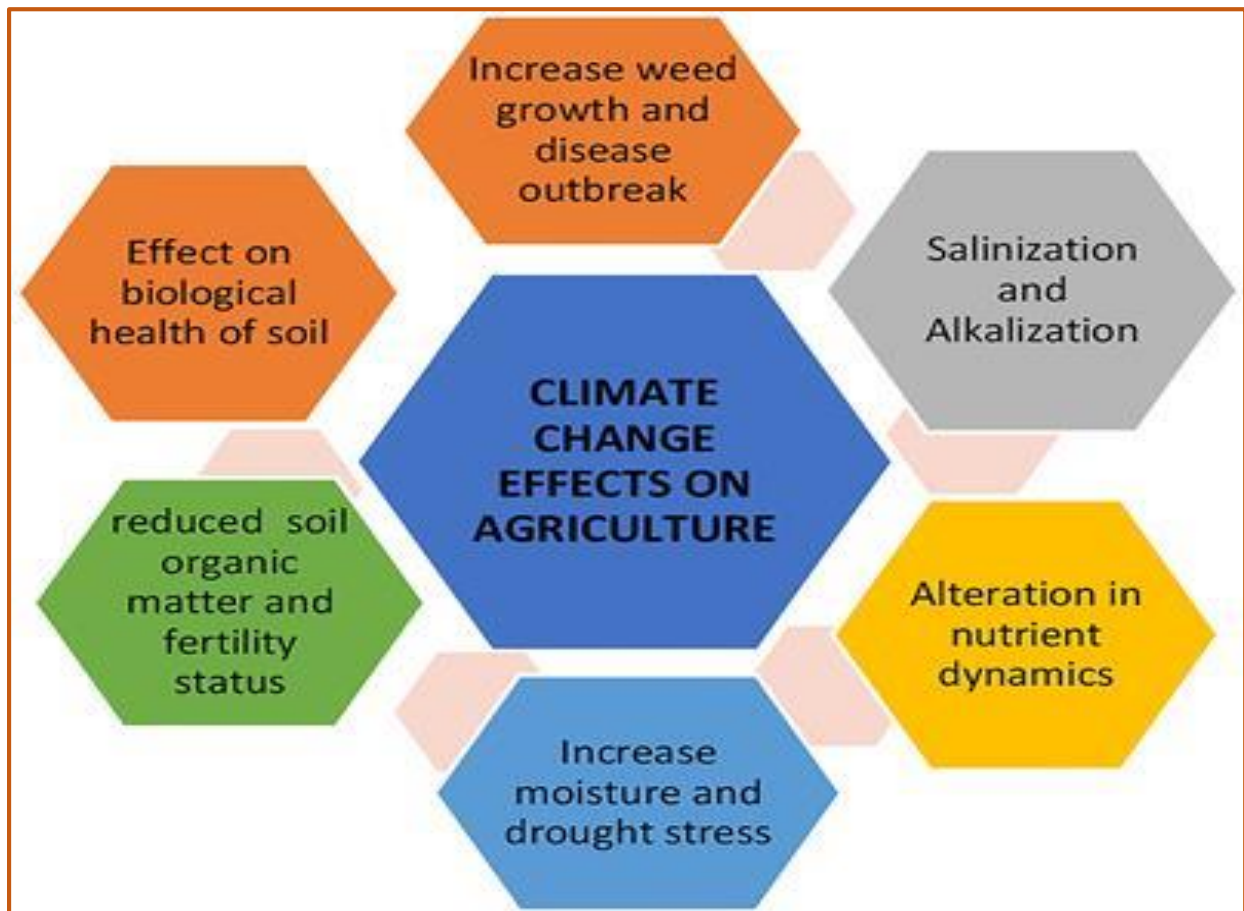
- **Availability:** Reduced crop yields due to extreme weather events threaten food availability (Impact of Climate Change on Food Security in Chicago, 2016).
- **Accessibility:** Droughts and floods damage infrastructure, hindering food transportation and distribution, particularly in remote areas (Food security in the context of climate change in Pakistan, 2012).
- **Utilization:** Malnutrition persists in Pakistan, and climate change can worsen this by reducing the diversity and nutritional content of available food (World Bank, 2021).
- **Stability:** Erratic weather patterns and extreme events make food production and prices highly volatile, impacting the stability of food supplies (Climate Change and Food Insecurity in Pakistan, 2023).

IMPACT OF CLIMATE CHANGE ON CROPS

The specific impacts of climate change vary across crops and regions. Here's a breakdown of some key challenges:

- **Wheat:** Pakistan's staple crop is highly sensitive to heat stress. Rising temperatures reduce yields and grain quality. Erratic rainfall patterns can disrupt the crucial planting and harvesting seasons (Janjua et al., 2010). Climate change has accelerated pests and diseases in wheat crop.

- **Rice:** Floods can devastate rice paddies, while droughts in key rice-growing regions threaten production. Increased salinity due to sea-level rise can affect coastal rice cultivation (Impact of Climate Change on Food Security in developing countries, 2016).
- **Cotton:** Pakistan's major cash crop is vulnerable to heat stress and erratic rainfall. Additionally, rising pest pressure due to changing climatic conditions threatens cotton production.
- **Fruits and Vegetables:** Heatwaves and water scarcity can significantly impact the production of fruits and vegetables, leading to shortages and price hikes (Climate Change and Food Insecurity in Pakistan, 2023).



REGIONAL VARIATIONS AND VULNERABILITY ASSESSMENTS

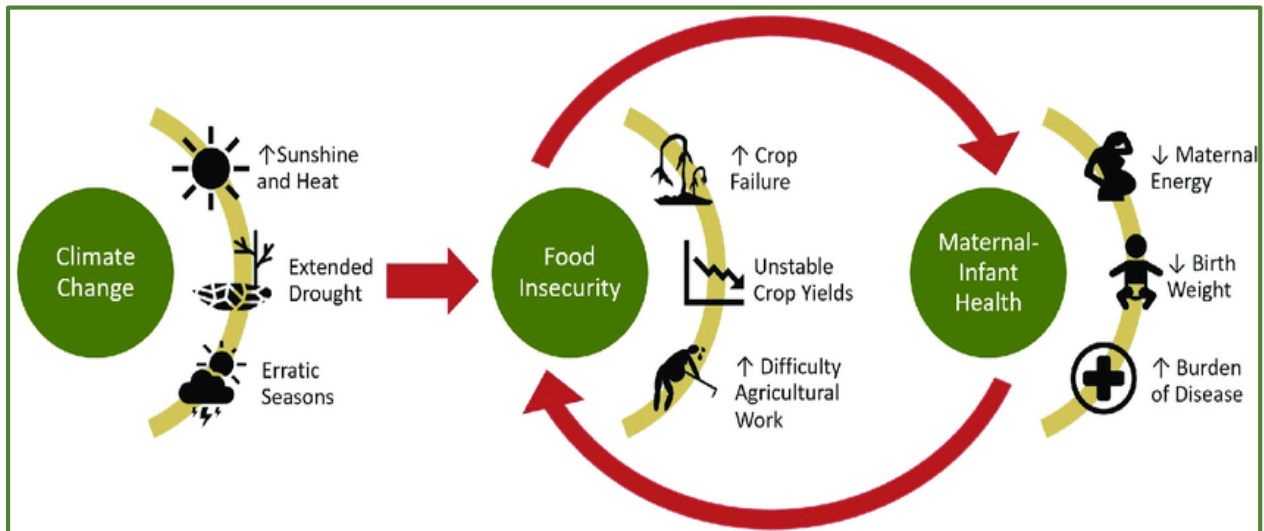
Climate change impacts are not uniform across Pakistan. Different regions experience varying degrees of temperature rise, changes in precipitation patterns, and water availability. Understanding these regional variations is crucial for developing targeted adaptation strategies (South Asian Voices, 2023).

- **Arid and Semi-Arid Regions:** These regions, encompassing Balochistan, Sindh, and parts of Punjab, are already water-scarce. Rising temperatures and erratic rainfall further worsen water stress, crippling rain-fed agriculture, a mainstay for many communities (South Asian Voices, 2023).
- **Khyber Pakhtunkhwa and Gilgit-Baltistan:** These mountainous regions are more prone to glacial melt. While short-term meltwater can cause floods, the long-term depletion of glacial reserves threatens river flows and irrigation systems, impacting downstream agriculture (Intergovernmental Panel on Climate Change (IPCC), 2022).
- **Irrigated Indus Basin:** This fertile region is the backbone of Pakistan's agriculture. However, over-reliance on Indus River water and inefficient irrigation practices are major concerns. Climate change, with increased evaporation and potential changes in monsoon patterns, threatens the sustainability of this system (World Bank, 2021).

SOCIOECONOMIC CONSEQUENCES OF FOOD INSECURITY

Food insecurity caused by climate change has far-reaching socioeconomic consequences:

- **Increased Poverty and Malnutrition:** Reduced food production and rising food prices disproportionately affect the poor, pushing them further into poverty and access to nutritious food. Children and pregnant women are particularly vulnerable to malnutrition (World Bank, 2021).



- **Social Unrest and Displacement:** Food security can lead to social unrest and conflict, especially in competition for scarce resources. Extreme weather events can displace communities, disrupting livelihoods and increasing social tensions (Pakistan Today, 2023).

- **Impact on Rural Livelihoods:** A large portion of Pakistan's population relies on agriculture for their livelihoods. Climate change threatens their incomes and way of life, potentially leading to rural-urban migration and further straining urban infrastructure (Climate Change and Food Insecurity in Pakistan, 2023).

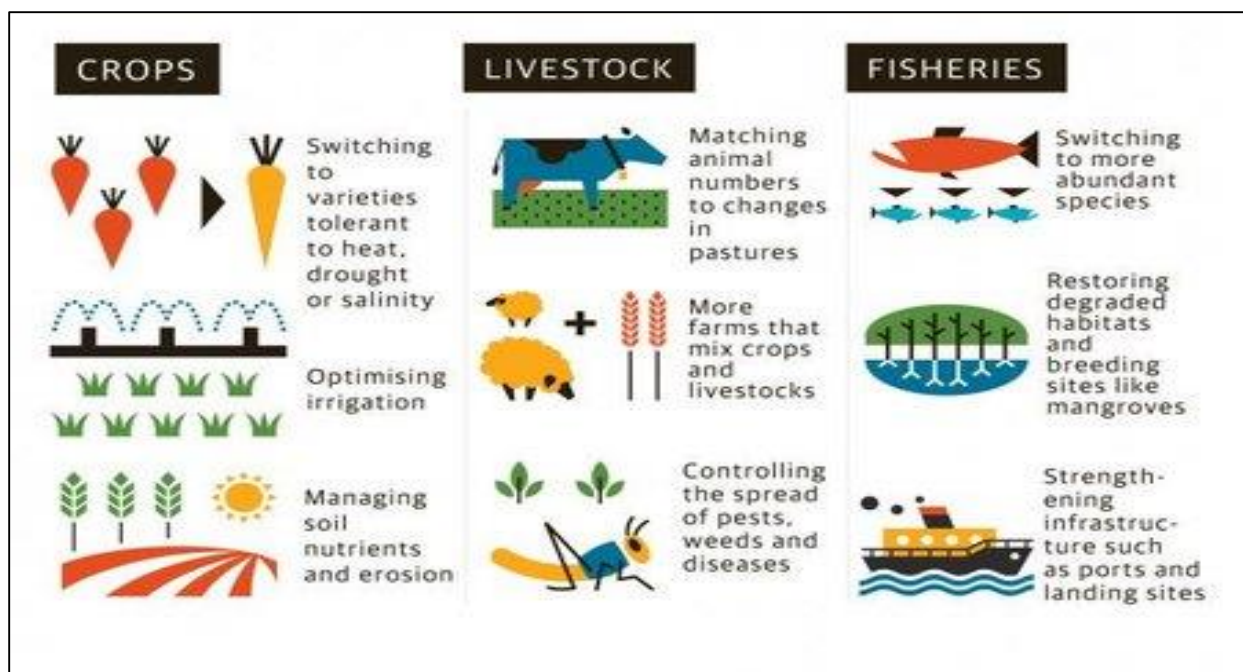
Gender and Equity Considerations

The impact of climate change on food security is not gender-neutral. Women often play a crucial role in food production and household food security. However, they often have limited access to resources like land, water, and credit. Climate change can exacerbate these inequalities, disproportionately impacting women's livelihoods and food security (FAO, 2021).

STRATEGIES TO MITIGATE FOOD INSECURITY IN PAKISTAN

Addressing the challenge of climate change requires a multi-pronged approach:

- **Adaptation Strategies in Agriculture:** Promoting drought-resistant crop varieties, improving water management through drip irrigation and rainwater harvesting, and enhancing soil health are crucial (World Bank, 2021).
- **Technological Advancements and Innovation:** Investing in climate-smart agriculture technologies like precision farming can improve resilience (FAO, 2023).
- **Policy and Infrastructure Development:** Government policies promoting sustainable agriculture, early warning systems for extreme weather events, and improved rural infrastructure are essential (Climate Change and Food Insecurity in Pakistan, 2023).
- **Role of International Cooperation:** Sharing knowledge, technology transfer, and financial support from developed nations are crucial to address climate change and its impact on food security (South Asian Voices, 2023).



- **Financial Inclusion:** Banks and financial institutions can play a critical role by providing financing for Climate Smart Agricultural (CSA) technologies for small-scale farmers, and post-harvest infrastructure development. Additionally, gender-sensitive financing programs are essential to empower women farmers and promote equity in climate-resilient agriculture.

ROLE OF ZTBL IN MITIGATING FOOD INSECURITY IN PAKISTAN

The agriculture sector in Pakistan faces major challenges, including, lack of technological innovation, Climate Change, Water Scarcity, Saline and Sodic Soils, Land degradation and Energy crisis. All these challenges ultimately lead towards the issue of food security in the country. Zarai Taraqiati Bank Limited (ZTBL) former Agricultural Development Bank of Pakistan (ADBP) is the premier financial institution geared towards the development of agriculture sector through provision of financial services and technical know-how. ZTBL is now addressing the major challenges climate challenges through its “Green Financial services/Green Business Products/Green Banking Products”. These products include:

1. CLIMATE SMART AGRICULTURAL MACHINERY

a) Raised bed planter

Raised Bed Planter is Climate Smart Agriculture (CSA) technology/machinery that helps in conservation of water resources and prevents the crop from harsh weather/climate effects such as wind lodging, and helpful in increasing the crops and vegetables. With raised bed planters:

- Bed and furrows sizes can be adjusted for individual crop.
- Seed and fertilizer rates can be adjusted as per requirement.
- Bed planter can be operated by a common tractor operator.

b) Direct Seeding of Rice (DSR)

“Direct seeding of Rice” (DSR) technology refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. DSR is effective as:

- Labour required for nursery raising, uprooting and transplanting of seedlings are saved to the extent of about 40 %.
- Saving of water (up to 50%) as nursery raising and puddling are eliminated.
- Early maturity (7-10 days) helps in timely sowing of next crop.
- Energy saving (up to 60% of diesel) because of elimination of field preparation for nursery raising, puddling and reduced water application for irrigation.
- Reduction in Green House Gases emissions.

c) Pak Seeder/Happy Seeder

Happy Seeder is a tractor-mounted machine that cuts and lifts rice straw, sows wheat into the soil, and deposits the straw over the sown area as mulch. Happy Seeder/Pak seeder machines can reduce air pollution, smog and greenhouse gas emissions.

2. RENEWABLE APPLIED AND NEW ENERGY RESOURCES IN AGRICULTURE

It is a dire need to shift the energy systems away from fossil fuels that produce Green House Gases and towards Renewable applied and new energy Resources. ZTBL is also financing on Renewable Applied and New Energy Resources in Agriculture through “Financing Scheme for Agriculture Land Development through Alternate/Renewable Energy”. Solar Energy System, Bio Gas Plant and Solar Dryer for agricultural products are the alternate energy products of ZTBL.

a) Solar Dryer for Agriculture Products

Solar energy can be utilized very effectively in drying agriculture commodities using solar dryers. Good quality products can be obtained at much less cost due to savings in cost of electricity or other heating fuels that would have been used otherwise for the same purpose. Solar dryer helps in reduction of carbon emissions. Solar Drying didn’t affect the main nutritional value of fruits. and have a longer shelf-life under proper storage conditions.

b) Solar Energy System/Solar pump

Solar powered tube well is proposed as a green banking product because it mitigates the greenhouse gases emission from the burning of fossil fuels for electricity generation. Renewable energy such as solar is a viable and alternate energy source. Solar energy, coupled with suitable pumps i.e. submersible pumps, could help to meet the irrigation requirements. Further,

- There is no CO₂ emissions and greenhouse gas emissions in solar coupled system.
- No Recurring Cost.
- Less pollution resulting from inadequate fuel handling (diesel pumps).
- Continuous Power Supply as compared to load shedding from Power supply company
- Reliable for the farmers who are troubled by ever increasing prices of electricity and diesel oil.
- At farm level, solar tube well is a reliable source of energy for pumping of irrigation water in remote areas, particularly in areas that are not connected to the electricity grid or where regular supply of liquid fuels and maintenance services is not guaranteed.

c) Bio Gas Plant

Biogas during its production uses the animal dung or agricultural waste which is daily obtained in large amount contrast to the natural Sui gas which is a non-renewable source and is depleting day by day. Although burning of biogas also produces CO₂, its residue if applied to the soil recycles the carbon back into the system.

3. FINANCING ON EFFECTIVE IRRIGATION TECHNOLOGIES:

Pakistan is facing water scarcity issues and 93% of the water resources available in the country are used for irrigation/Agricultural purposes so there is dire need to conserve water and finance on water conservation practices in the country. Keeping in view the water scarcity issues in the country ZTBL is financing on solar powered Drip irrigation system under Green Banking Products.

a) Drip Irrigation powered by Solar Panel

Solar powered drip irrigation system is found suitable for point to point application of irrigation for orchards and high-value crops.

Salient Features of Solar Powered Drip Irrigation System:

- **Water Efficiency:** A drip irrigation system will provide water with less runoff or evaporation.
- **Root Zone:** Plants need water at their roots, and drip irrigation enables to provide water at the root zone.
- **Conserves Earth's Resources:** Drip irrigation system powered with solar panel helps in conservation of natural resources such as "Soil" from Soil Erosion and save water up-to 80-90%.
- **Reduction of Pests & Weeds:** A drip irrigation system directs the water at the root zone of plants and effectively reduces insect pests, weeds and harmful fungal growth.

- Reduction in Carbon Emissions: Solar Powered Drip Irrigation System reduced input cost, and reduced energy requirements and cut down the carbon emissions.

Further, in addition to it, another product “Financing for High efficiency irrigation System” has also been launched across the country keeping in view the added requirements and features to overcome water scarcity and huge fuel/power charges on irrigation.

4. PRODUCTS FOR LAND DEGRADATION/ SODIC AND SALINE SOILS

a) Sesbania (Jantar Crop)

Jantar crop is a Green Baking Product as it is used as a green manure crop restores soil fertility, fixing nitrogen in the soil and improves soil organic matter. Researchers recommending Jantar crop in all climates sensitive areas of the country. It helps reclaim degraded land and make it productive again. It not only improves physical properties but also helps in meeting nitrogen requirement of succeeding crop. Jantar crop is also a drought tolerant crop and can be suggested in the countries like Pakistan facing water scarcity issues.

b) Soybean Crop

Soybean is also a drought tolerant crop. The cultivation of soya bean after exhaustive crops (wheat, rice and cotton) also helps restore the soil fertility and health for the next exhaustive crop, because soya bean captures nitrogen from air and stores it in the soil as it is a leguminous crop. Soybean is a short duration crop, maturing in 90 to 120 days depending on the seed variety and weather. It also fits well in our existing cropping system without clashing with major crops. Therefore, farmers could utilize rice, cotton, and rain-fed fallow areas for soya bean cultivation. The respective patterns for soya bean cultivation in rain-fed, rice and cotton areas are wheat-soya bean-wheat, rice-soya bean-rice, and cotton-soya bean-cotton.

5. GENDER-SENSITIVE FINANCING

One of the major components of food security is affordability of nutritional food. Women play a crucial role in Pakistan's agricultural sector, but often face challenges accessing financial resources. In order to promote gender equity in climate-resilient agriculture, ZTBL has designed loan programs specifically tailored for women farmers, addressing their specific needs. ZTBL Khwateen Rozgar Scheme and financing scheme for “Women Empowerment in Garments Sector” are two exclusive products for women. Further, bank has also nominated “Women Champions” at head office/branch level for financial inclusion of women.

CONCLUSION

The challenge of climate change and its impact on food security requires a collaborative and multi-pronged approach. By understanding the regional variations, addressing the social and economic consequences, and fostering collaboration among stakeholders, Pakistan can build resilience and ensure long-term food security for its population. Climate change presents a significant threat to food security in Pakistan, but it is not an impossible challenge. By taking decisive action, prioritizing adaptation strategies, and fostering collaboration across all sectors, Pakistan can build a more resilient and food-secure future for its citizens.

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