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Research Article

Food Security in Hyderabad: Water Governance, Climate-Smart Farming, and Sustainable Agriculture

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ABSTRACT

This paper investigates the critical paradigms of food security in the Hyderabad division, focusing on the intertwined issues of water governance, climate-smart farming practices, and sustainable agriculture. This research has used mixed-methods approach, combining quantitative and qualitative tools, to capture detailed insights into the region's agricultural and water management challenges. Data was gathered using a blend of surveys, interviews, and Focus Group Discussions (FGDs). Surveys, composed of close-ended questions, provided structured data, while interviews were conducted, and open-ended questions were used to obtain in-depth responses. The study's sample population was drawn from four districts within the Hyderabad division—Badin, Thatta, Dadu, and Matiari—ensuring diversity in terms of gender and age demographics. The research found that climate change is impacting the overall agricultural system. The study identifies food insecurity as a critical issue in Hyderabad Division, where inadequate agricultural productivity is due to the lack of water governance. Water scarcity emerges as the primary driver of crop failures, financial distress, and demotivation among small farmers. The findings affirm that food security cannot be achieved without securing the availability of water resources for cultivation. Thus, efficient water governance and food waste reduction and adoption of smart farming technology can significantly contribute to higher productivity.

Key Words: Climate change, Food Security, Water Governance, Smart Farming, Sustainable Agriculture.

INTRODUCTION

Pakistan is facing a huge challenge of food insecurity. The food situation in our country is going from bad to worse because of climatic apocalypse. Pakistan ranks among the top ten countries most vulnerable to climate stress, according to Global Climate Risk Index 2021. (S. Ahmed, 2022). Food production in Pakistan is facing huge threats due to climate events, water scarcity, lack of agricultural improvement and economic situation disrupted by disasters in Sindh. These problems have contributed to growing hunger in Pakistan and Sindh. Thus, ensuring that people have access to healthy food is an enormous challenge. There is growing food insecurity in the world. It is estimated that “41 million people are on the verge of famine (Maxwell, D., Howe, P., & Fitzpatrick, M., 2023) and “Pakistan ranks 92 among 116 nations worldwide in the Global Hunger Index (Javed, M. D. M. A. 2023).” Pakistan is one of the most populous countries in the world. Feeding Pakistan's growing population is formidable challenge. According to WFP “approximately 43% of Pakistanis are food insecure and 18% of those are facing acute food shortage.” Additionally, most people are unable to get a nutritionally



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balanced diet. In Pakistan, agriculture is the major contributor to food needs of country and rural employment. However, its performance remains dependent on climatic conditions. Variation in climate affects the agricultural productivity which results in increasing food insecurity. Farmers in Pakistan are facing huge problems, including water shortage, soil erosion and nutrition-deficient land and they are unable to access major farm inputs including good quality seeds, suitable fertilizer, irrigation, and mechanization (S. Ahmed, 2024)

This research paper is based on the data collected under the research project “Food security paradigms: water governance issues, climate smart farming and sustainable agriculture in Hyderabad Division 2023-2024”. Thus, the major objective of this article is to explore the major causes of food insecurity and to find out the solutions to the problem keeping in view sustainable growth of food supply. Further, it explores the possibilities for removing barriers in implementing food security plans and to find out the ways to ensure the economic and efficient use of water resources for the purpose of agriculture.

This study explores various ways and techniques for saving water through its commercial and domestic uses. It aims to investigate the possibilities for introducing new climate friendly varieties for increased productivity. Further research on factors of artificial inflation was conducted to recommend solutions for containing inflationary pressure. Study recommends that existing market practices and market mechanisms must be reformed to develop a system of checks and balances through monitoring the food supply and suggests that the gaps between producers and consumers must be reduced to eliminate the middleman practices. This research has also analyzed the role of agricultural improvement through the use of modern techniques in mechanization, irrigation patterns and crop inputs. The study reveals that food diversification, climate-smart farming, water saving and efficient use of water in above activities are key to the improvement of food supply and sustainable farming in Hyderabad division.

METHODOLOGY

This project-based study was focused on the Hyderabad division which is one of most important divisions of Sindh. It is comprised of nine districts such including District Hyderabad, Tando Mohammad Khan, Matiari, Tando Allahyar, Badin, Dadu, Jamshoro, Thatta and District Sajawal. Hyderabad hosts 22.12% of the entire province's total population. This study has collected data from four districts of Hyderabad: Badin, Thatta, Dadu and Matiari.

The study has used mix methods. A survey method was used to collect the data from landowners, farmers, consumers, irrigation and water experts, economists, and agriculture experts who were selected through a sampling method. A total 172 questionnaires were administered for this project, of which 103 survey forms were completed in the first phase and 69 later in the second phase from the targeted districts of Hyderabad division.

In addition to the collection of quantitative data, in-depth interviews were conducted to supplement the data that was not available through other sources of data. Interviews from landlords, farmers, civil society members and environment experts enabled the project research team to deeply investigate the issues related to water governance, food security and agricultural productivity. Thus, 15 in-depth interviews were conducted for this project in the four districts of Hyderabad division. Focus Group Discussions (FGDs) were also conducted with cultivators to understand the situation of water shortage and to explore the issues associated with various farm inputs of farming. A total of four Focus Group Discussions (FGDs) were conducted in four districts of Hyderabad division; one in each district.

LITERATURE REVIEW

For reviewing literature, the focus remained primarily on the official reports released by institutions including ICCI, IPC, Government of Sindh, and World Food Program while our theoretical knowledge of the subject is based on scientific literature by various researchers.

Agriculture is backbone of Pakistan's economy which predominantly depends on its major crops. According to Government of Sindh's report:

Sindh is the second largest economy of Pakistan. Its GDP per capita in 2010 was \$1,400, 50 percent higher than the rest of the country or 35 percent higher than the national average. Historically, Sindh's contribution to Pakistan's GDP has ranged from 30% to 32.7%. Its share in the service sector ranges from 21% to 27.8% and in the agricultural sector from 21.4% to 27.7%.” Agriculture has played a vital role in Pakistan's economy but unfortunately, due to increasing population and water scarcity, the crops are facing huge losses (Talpur, et al. 2022). According to Sheikh, F. et al. (2021):

“Pakistan's agriculture is most affected by water scarcity and due this reason productivity of different crops is affected. In Pakistan, major cash crops are sugarcane, cotton and important food crops are wheat and rice for the

whole population.” The rice crop among these crops is water intensive. It needs sufficient water for higher productivity. Sugarcane also requires a large amount of water compared to cotton and wheat.”

Islamabad Chamber of Commerce and Industry’s (ICCI) former President Muzzamil Hussain Sabri (2014) stated that: “Water scarcity is emerging as a serious issue for Pakistan, which could badly affect its economy. The government should focus on developing a National Water Strategy to cope with this issue of national importance.”

Scarcity of water negatively impacts on agricultural sector in Pakistan. Due to this problem, agricultural productivity is declining at an alarming rate. However, its performance depends on weather conditions. Climate change has affected agricultural production resulting in increased food insecurity. In addition, most people in Sindh are unable to obtain a nutritionally balanced diet.

According to IPC report 2023-2024 “For years, Sindh has been experiencing a high prevalence of food insecurity, malnutrition, poverty, and other natural shocks.” About “a 2.01 million or 62 percent of people are facing high levels of acute food shortage in nine districts namely Badin, Mirpur Khas, Sanghar, Sujawal, Tharparakar, Thatta, Umerkot, Dadu and Jamshoro.”

The relationship between agricultural production and food insecurity is not limited to the realm of scientific publications but has now become positively affirmed and acknowledged by Integrated Food Security Phase Classification report, “About 5.75 million people (30 percent of the 19.3 million rural population analyzed) are experiencing acute food insecurity between April and October 2023 in 16 districts of Sindh.”

Pakistan is facing water scarcity problem in which agriculture sector is the most affected. Chairman of Coordination of the Federation Pakistan Chambers of Commerce and Industry (FPCCI) Malik Sohail Hussain 2018 said that “water has become an issue of survival for people, but it has yet to catch the attention of the leaders. He further said that water availability has dropped from 9000 cubic feet to 900 cubic feet in the last seventy years which is set to transform Pakistan into a desert (The Nation 2018).” Water underpins every aspect of development in our society, and it underpins almost every Sustainable Development Goal (Ait-Kadi, M. 2016). It is a necessary and fundamental requirement for economic development, healthy ecosystems, and life itself.

There are many reasons behind this scarcity like overpopulation, water pollution, climate change, natural disasters, wastage of water, and improper management, etc. and this scarcity of water adversely affects the agriculture of Pakistan. Ramay (2016) argues that “water availability is a major problem in Pakistan, and it will become more complicated in the future due to factors including climate change, population growth, weak infrastructure etc.” According to FAO synthesis report (2021), “The global water budget is under pressure. Internal renewable water resources (IRWRs) from rivers and aquifers amount to 44 000 km³/year, and withdrawals (all sectors) exceed 4 000 km³/year, almost 10 percent of IRWRs. The local impacts of physical water scarcity and freshwater pollution are spreading and accelerating. In many cases, the first sign of scarcity from increased withdrawals is falling groundwater levels.”

Agriculture plays a very important role in the economy of the country. But day by day the agriculture is declining due to shortage of water. “Agriculture is both a cause and effect of water scarcity. An adequate amount of water is essential for crops, livestock and fisheries, as well as for the processing and production of these foods and products. Water is the lifeblood of ecosystems, including forests, lakes and wetlands, on which food and nutrition security for current and future generations depend (Dankova, R., 2016).”

For many years, Pakistan has faced many natural and man-made crises including the devastating earthquake in 2005, floods in 2010 and most recently the 2022 flood that has claimed many human and animal lives. Thousands of people have become homeless, deprived of agricultural land, and have become victims of food insecurity. People in Pakistan are suffering from food insecurity, but children are the most vulnerable among them. “In Pakistan, four out of ten children under five years of age are stunted while 17.7% suffer from wasting. The double burden of malnutrition is becoming increasingly apparent, with almost one in three children underweight (28.9%) alongside a high prevalence of overweight (9.5%) in the same age group. The prevalence of overweight among children under five has almost doubled over seven years, increasing from 5% in 2011 to 9.5% in 2018 (NNS 2018).” In Sindh, children as well as adults suffer from malnutrition. Women among adults and girls among children are more likely to be malnourished. “There is clear evidence that the major damage caused by malnutrition takes place in the womb and during the first 2 years of life. This damage is irreversible and is linked to lower intelligence and reduced physical capacity, which in turn diminishes productivity, slows economic growth, and perpetuates poverty. Moreover, malnutrition passes from generation to generation because stunted mothers are more likely to have underweight children (Atinmo. T., Mirmiran. P., 2009).

RESULTS

Exploring the issue of food insecurity in Badin, Dadu, Matiari and Thatta, survey results found that 82% percentage of the total respondents believed that food insecurity in their area is of significant issue. They believed that there is a direct relationship between agricultural productivity and food security. According to them, water, good infrastructure, and timely awareness can bring good results. These initiatives can bring positive economic change in the lives of farmers as well as general population. There was only a small number of respondents 9.9 percent who believed that there are other reasons for food insecurity. Food wastage at various places causes the issue of food insecurity.

Do you think there is food insecurity in your area?

172 responses

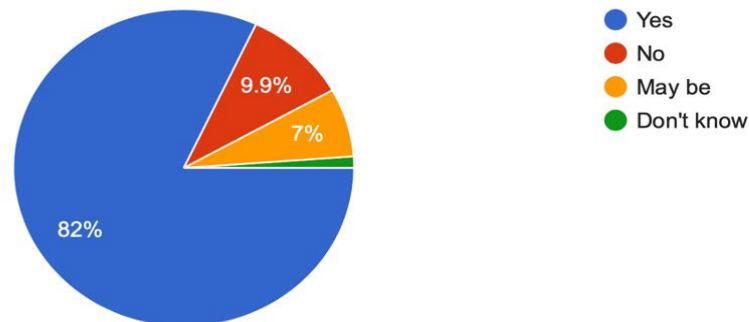


Chart # 01.

Water is a very important source for farming. Without a sufficient supply of water on time causes a lot of economic losses to landlords and small farmers. To understand the issue of water shortage, the survey found that there is serious water shortage in the targeted areas. The majority of the respondents 81.4 percent said that they were facing water shortage, whereas only 11.6 percentage of the respondents were satisfied with the availability of water and believed they did not face any water shortage. 7 percentage of the respondents believed that water shortage may be an issue.

Do you think there is water shortage in your area for farming?

172 responses

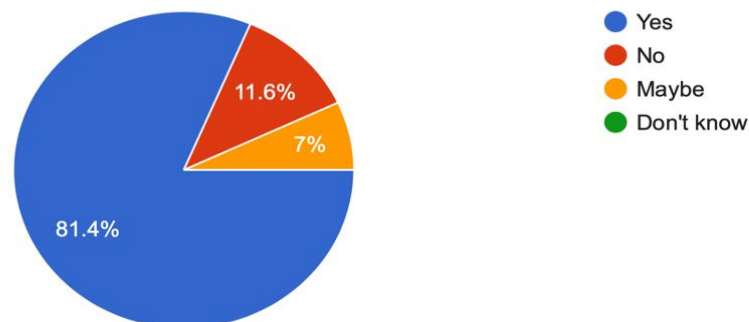


Chart # 02.

Study reveals that management of water was big issue. They agreed that there were irregularities, negligence, and the use of power by the large land holders who use excessive water. The data collected through the survey suggests that 46.2 percent of the respondents believed that there was a government system to manage the water share, whereas 41.5 percent opposed the idea that there was no effective way of managing the system. Only 12.3 percent of the respondents were unsure and replied that there may be a water management system in their area. Chart # 3 highlights the details about the water management issue.

Do you think there is water management system in your area for farming?

171 responses

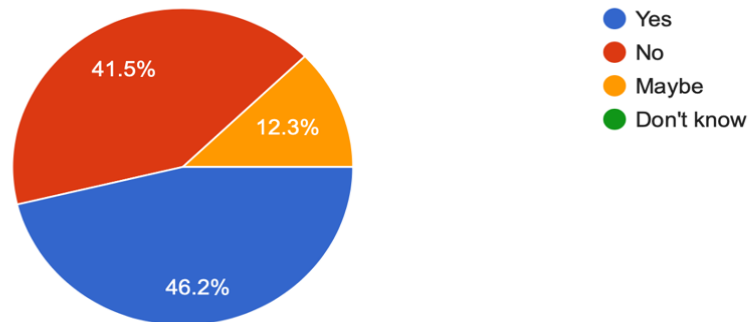


Chart # 03.

During the survey, most respondents, consisting of 29.1 percent consider food insecurity is primarily due to water scarcity. Respondents expressed the belief that addressing water scarcity and implementing effective governance policies could solve many challenges. Another 26.2 percent indicated that economic disruptions were the primary causes of food insecurity. Respondents voiced concerns, highlighting the lack of employment opportunities as a primary factor contributing to economic challenges. Additionally, they said that the slow decline in agricultural productivity is another significant issue. They emphasized that if their crops could be sold at favorable prices in the market, food insecurity in the region could be alleviated. Climate-related events, such as floods and droughts, were cited as major concerns by 21.5 percent of respondents. Additionally, 18.6 percent of respondents identified the lack of agricultural advancements as a key factor in food insecurity. They noted that many farmers continue to rely on traditional farming methods and have yet to use new methods and new technologies in agriculture.

What are the primary causes of food insecurity in your area?

172 responses

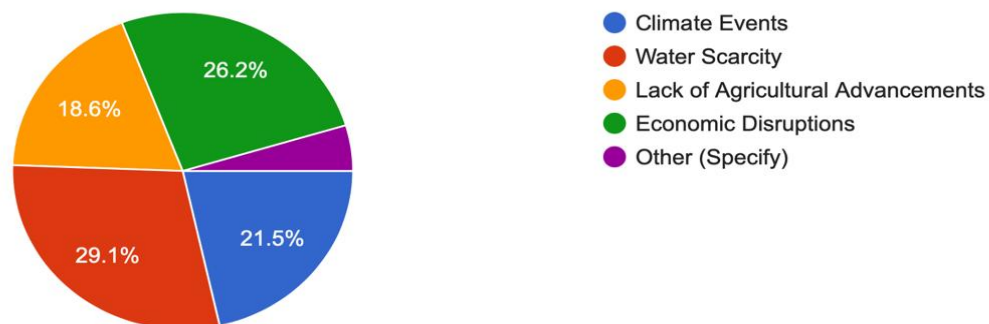


Chart # 04.

To get an indigenous perspective on food insecurity, we asked, How would you define food insecurity in the context of your area? Most respondents in the survey defined food insecurity as the lack of access to nutritious food. Specifically, 34.3 percent of respondents expressed their inability to procure an adequate quantity of food. Low agricultural productivity and limited access to livelihoods were cited as the primary reasons for this lack of access to nutritious food. Additionally, 20.7 percent of respondents attributed food insecurity to economic disruptions, particularly highlighting the challenges posed by the rise in inflation rates. The continual rise in prices has exacerbated difficulties in meeting proper dietary needs. Approximately 18.3 percent of respondents identified insufficient food production from their lands as a significant issue contributing to food insecurity. Another 19.5 percent of respondents attributed food insufficiency to climate-related factors, noting the adverse impact of climate change affecting agricultural lands and crop yields.

How would you define food insecurity in the context of your area?

169 responses

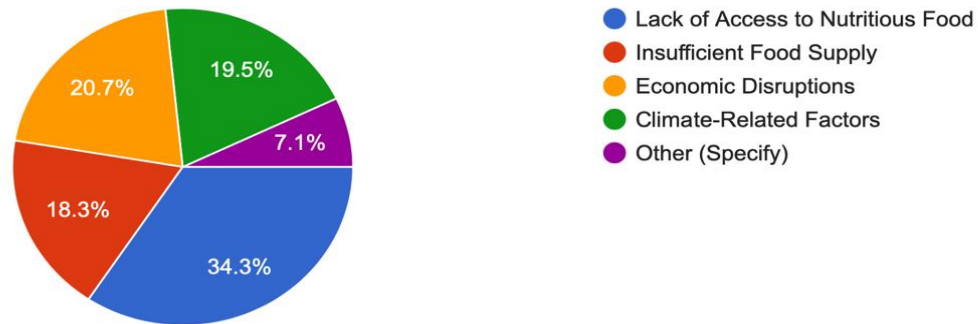


Chart # 05.

Throughout our survey, various responses were documented regarding how to reduce the role of intermediaries. The necessity of establishing farmers markets was one of the significant responses dominating all other factors, making a strong case that farmers' markets should be established. 61.8 percent of the total respondents expressed the view that the government should take initiative in creating such farmer markets. In contrast, 14.1% of respondents favored direct-to-consumer platforms, where they could engage in the direct buying and selling of crops with one another. A smaller percentage, 12.4, suggested adopting the Cooperative Farming model and 9.4% of respondents indicated a preference for E-commerce platforms. Please see chart # 06.

How to reduce intermediaries to create a direct link between consumers and farmers?

170 responses

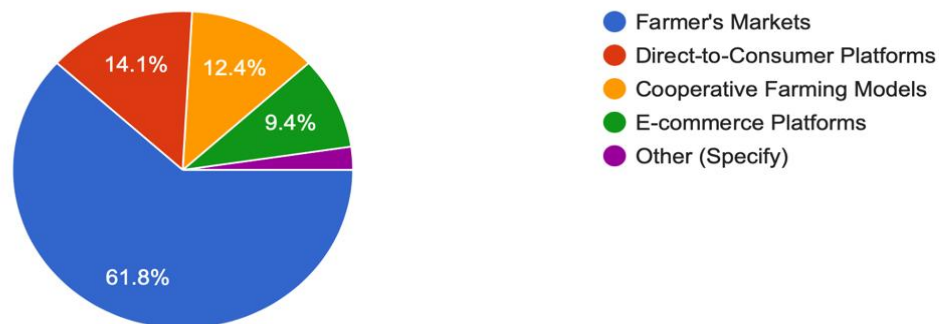


Chart # 06.

According to respondents, the current market mechanism presents challenges primarily in the form of frequent changes in prices, as suggested by 43.6 percent of respondents. They emphasized that these fluctuations create ongoing difficulties, preventing them from selling their crops at unfavorable prices. Moreover, respondents highlighted the issue of the high cost of pesticides, with rates being particularly unbearable. Additionally, 19.8 percent of respondents expressed concern over intermediaries' practices, noting that they often retain a significant portion of profits, providing farmers with only a fraction of the actual crop value. Limited market access was cited as a major concern by 21.5 percent of respondents, who stated that they were unable to reach the primary market due to these constraints. Furthermore, respondents were not happy with the market mechanism, which lacked transparency. Intermediaries exploit their position to set prices for crops. This lack of price consistency further complicates the selling process for farmers, who feel compelled to accept these terms due to their limited market access. 12.2 percent of farmers complain that the market, government institutions and the intermediaries do not offer transparency in agricultural farming and production.

What are the key challenges in current market mechanisms related to agriculture?

172 responses

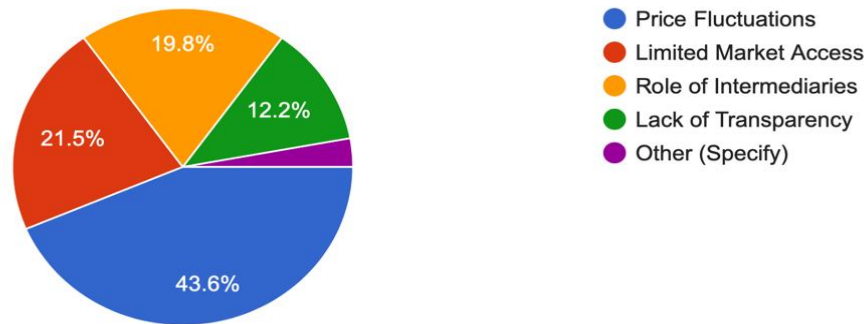


Chart # 07

In response to the question about encouraging sustainable agriculture practices among farmers, 19.4 percent of the total respondents emphasized the importance of promoting sustainable agriculture among farmers by suggesting that the government should provide incentives to encourage new trends and ways to renew their agricultural practices. They emphasized the need for governmental and non-governmental organisations that could offer incentives to farmers for their capacity-building for crop quality. Additionally, 36.6 percent of respondents voiced for the provision of training programs by the government to equip farmers with the necessary skills for improved agriculture. Similarly, 35.5 percent of respondents stressed the importance of initiating awareness campaigns. They emphasized that raising awareness and providing training opportunities would enable farmers to adopt modern farming practices, resulting in enhanced agricultural productivity. To achieve better crop production and overall agricultural improvement, it is significant for the government, non-governmental organizations, and private sectors to implement both awareness and training initiatives among farmers. Please see chart # 08 for more details.

What are encouraging sustainable agriculture practices among farmers?

172 responses



Chart # 08.

When asked a question about what the specific challenges related to water scarcity are impacting agriculture and food security? The respondents mentioned various factors. They believed that water scarcity significantly impacts agriculture and food security. Specifically, 43.3 percent of respondents highlighted the specific challenge of ineffective water management policy, which they identified as a major factor affecting agriculture and food security. Following this, 24 percent of respondents pointed out that inefficient water distribution in agriculture is a fundamental issue. Additionally, 17.5 percent of respondents elaborated on the problem of inadequate water supply, which adversely affected agriculture. Please see chart # 09 for more details.

What are the specific challenges related to water scarcity impacting agriculture and food security?

171 responses

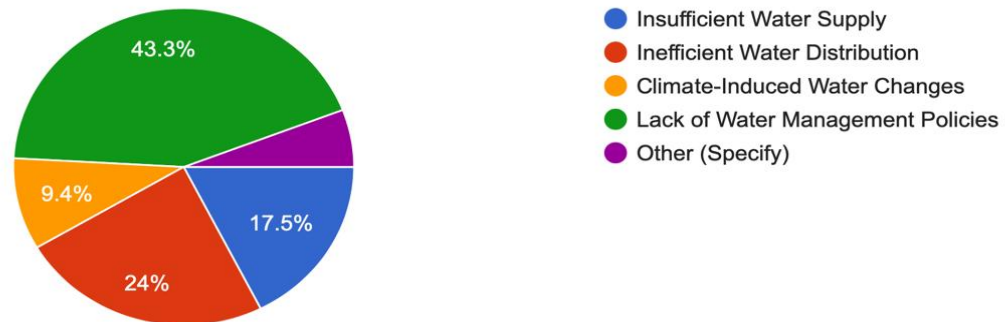


Chart # 09.

Our project survey included a question asking whether you think that there is a smart agricultural farming system in your area. Approximately 50.6 percent of respondents indicated that there is a lack of awareness about the concept of smart agricultural farming systems in their area. A significant 28.5 percent reported its presence, noting that some farmers nearby have adopted new agricultural technology. 17.4 percent expressed uncertainty or lack of knowledge about smart agricultural farming systems. Please see chart # 10 for more details.

Do you think that there is smart agricultural farming system in your area?

172 responses

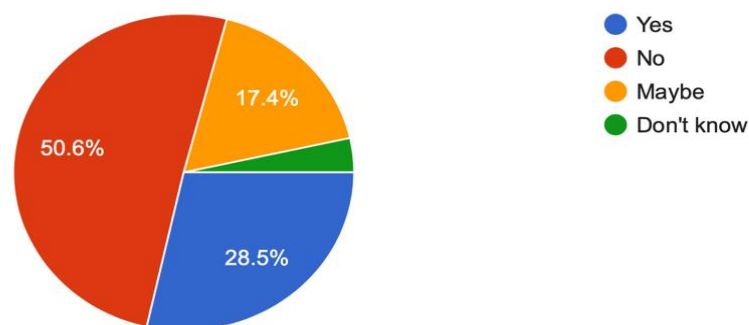


Chart # 10.

One of the critical questions we asked the respondent was "What does 'climate-smart farming' mean, and how can it contribute to sustainable agriculture?" The following chart # 11, highlights the priorities and understanding of the surveyed population regarding climate-smart farming. The majority of the respondents focused on "Water Management" (39.2%), emphasizing the critical importance of water-related practices in the context of climate change and sustainable agriculture for this region. This suggests that respondents perceive efficient water usage, conservation, and adaptation to water scarcity as core components of climate-smart approaches.

The combined theme of "Climate Resilience/Adaptation/Crop Management/Diversification" (35.7%) closely follows, reinforcing the understanding that adapting farming practices to changing climatic conditions and diversifying crops are vital for long-term agricultural sustainability. This includes strategies like using drought-resistant varieties or implementing agroforestry.

The third dominant reply we received was about "Technological Advancement" as a prerequisite tool to address the project themes. Around 11.7% believed in adopting technological advancement, which indicates an awareness that modern tools and methods, such as precision farming, are seen as contributors to both climate resilience and sustainable practices. The presence of "Crop Management/Diversification" as a separate, albeit smaller, category (8.8%) further emphasizes specific aspects of adapting agricultural production.

Overall, the percentage breakdown confirms a strong and practical understanding of climate-smart farming, primarily focused on water management and climate adaptation strategies. These insights are invaluable for tailoring agricultural development programs and educational initiatives to effectively address the challenges faced by farming communities in the region. Chart # 11 further shows the details of the respondents.

What does "climate-smart farming" mean, and how can it contribute to sustainable agriculture?

171 responses

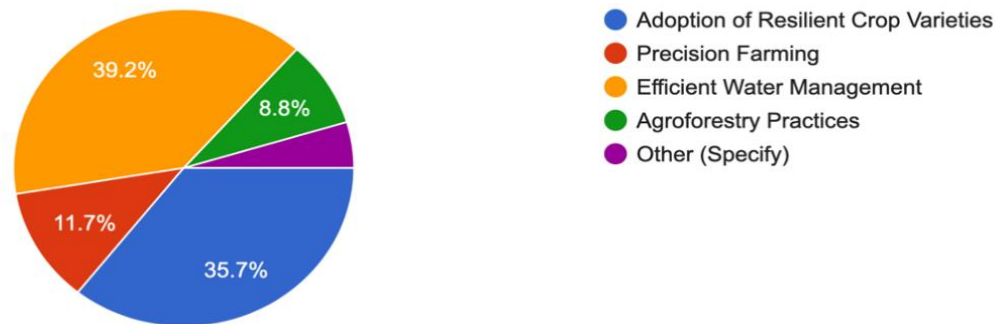


Chart # 11.

Similar to the above question, we asked the question "What are the barriers faced by farmers in adopting climate-smart and sustainable farming practices?" The most striking finding from this survey is the overwhelming factor of "Lack of Awareness/Knowledge." 64.3% of respondents believed it was the primary barrier. This suggests that a significant majority of farmers may not fully understand what climate-smart and sustainable farming practices entail, their benefits, or how to implement them effectively. This highlights a critical need for extensive outreach, education, and training programs to disseminate knowledge and build capacity among farmers in the region.

"Financial Constraints" emerged as the second most significant barrier, as 20.5% respondents replied. This is a common challenge in agricultural development, as adopting new practices often requires initial investments in new technologies, inputs, or changes in farming methods. Even with awareness, farmers may be unable to implement these practices without adequate financial resources, access to credit, or subsidies.

To accelerate the adoption of climate-smart and sustainable farming practices, interventions should primarily focus on increasing farmers' knowledge and awareness, coupled with providing accessible financial support or incentives. Addressing these two major barriers would likely yield the most significant impact on promoting sustainable agriculture in the region. The following bar chart # 12 shows the details of the responses.

To understand the impact of water shortage on farming, the majority of the respondents vividly demonstrate that "Reduced Crop Yield" is by far the most prominent impact of water shortage on farming activities. This is an intuitive and direct consequence, as insufficient water directly hinders crop growth and productivity. The sheer dominance of this factor (nearly 70%) underscores the immediate and critical threat water scarcity poses to agricultural output.

"Livelihood Challenges" emerge as the second most significant impact. This is a broader category that likely encompasses financial difficulties, reduced income, and overall hardship for farming communities due to the loss of crops or reduced productivity. This highlights the socio-economic implications beyond just agricultural output. "Changes in Cropping Patterns" being mentioned by nearly 10% of farmers suggests that some are adapting by shifting to less water-intensive crops or altering their planting schedules. This indicates a reactive coping mechanism in response to water stress.

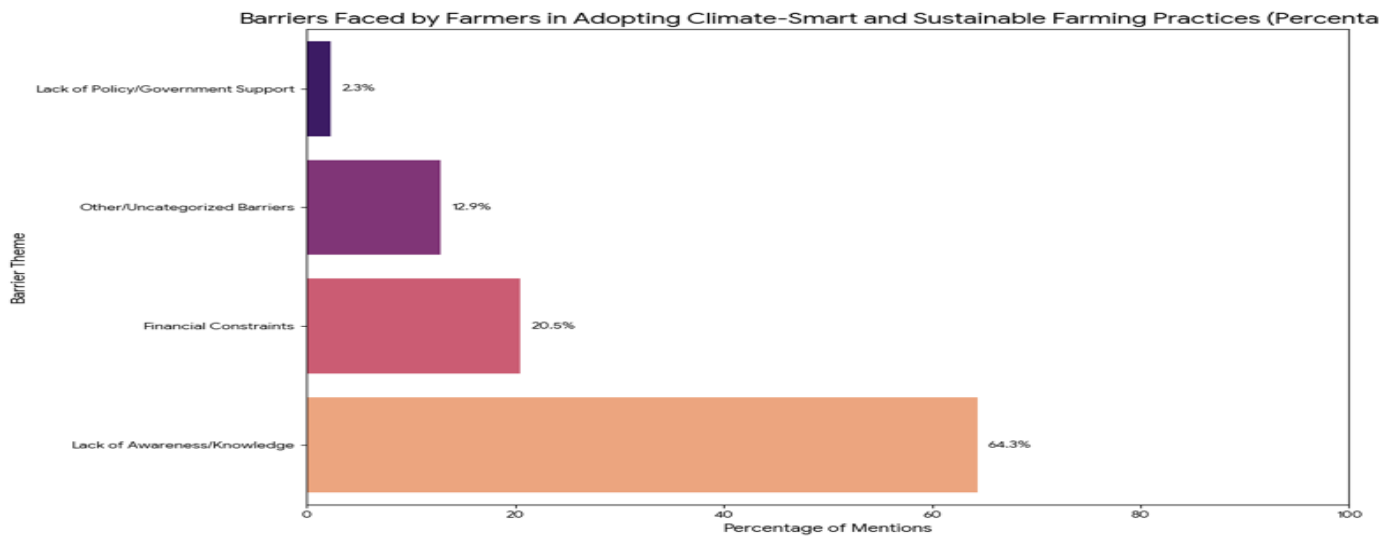


Chart # 12.

The "Increased Water Costs" (7.6%) points to the economic burden faced by farmers who might have to purchase water or invest in more expensive irrigation methods due to scarcity. The "Other Impacts" category is very small, indicating that the defined categories largely covered the most common responses.

Chart # 13 clearly shows that the primary concern for farmers regarding water shortage is the direct loss of crop yield, which then cascades into broader livelihood challenges.

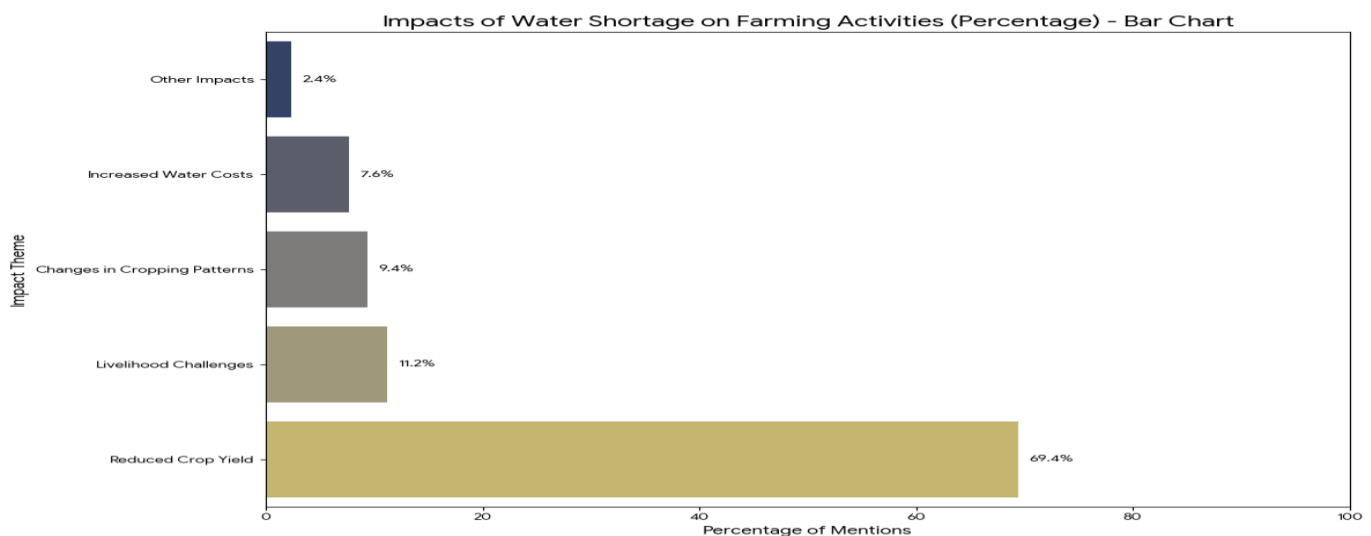


Chart # 13.

The survey included a question that “what factors to consider when selecting less water-intensive varieties?” The respondents believed that there is a considerable and widespread belief in the potential for introducing less water-intensive food varieties in the Hyderabad division, with very little outright disagreement or uncertainty. The distribution of opinions emphasizes the dominant "Yes" and "Maybe" categories. The "Yes" slice clearly occupies half of the circle can be seen in chart # 14, showcasing a strong belief in the potential for less water-intensive varieties. The "Maybe" slice, though slightly smaller, also takes up a substantial portion, highlighting a significant proportion of respondents who are considering this possibility. The very small segments for "No" and "Don't Know" are almost negligible in the overall circle, confirming that there is little opposition or uncertainty on this matter.

The survey included an opinion seeking poll to understand the “Effectiveness of current water supply systems and what they think of the best way to deal with water management”. The respondents highlighted that "Equity in Distribution" is the most significant factor contributing to the effectiveness of current water supply systems, being cited by over 40% of respondents. This indicates that fair and widespread access to water, ensuring that all segments of the community receive their share, is paramount in defining the system's success from the perspective of the respondents.

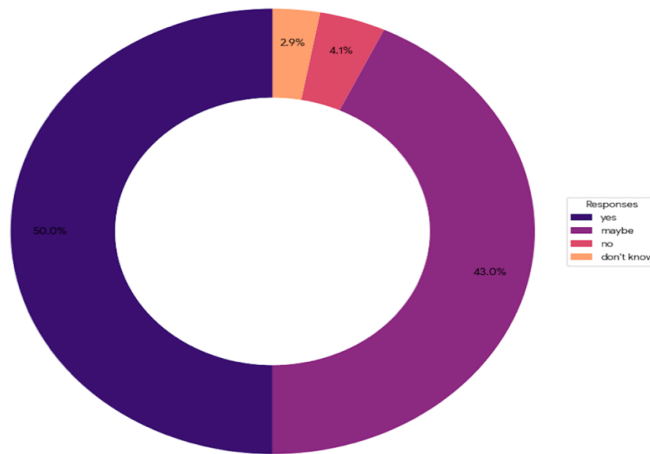


Chart # 14.

"Infrastructure Condition" and "Accessibility" are also identified as major contributors, together accounting for nearly 50% of the responses. This suggests that the physical state of the water supply infrastructure (pipes, pumps, treatment plants) and the ease with which people can access water (proximity, connections) are crucial for the system's perceived effectiveness. Good infrastructure ensures water delivery, while accessibility ensures it reaches the users.

"Reliability" is mentioned by a smaller but still notable percentage (7.0%), indicating that consistent and uninterrupted water supply is also a factor, though less dominant than equitable distribution or physical access. The "Other Factors" category is minimal, suggesting that the primary drivers of effectiveness are well-captured by the main categories.

Chart # 15 offers an insight and emphasizes that for water supply systems to be deemed effective, the key elements are equitable access, robust infrastructure and ease of reach for the population.

Effectiveness of current water supply systems is because of:

172 responses

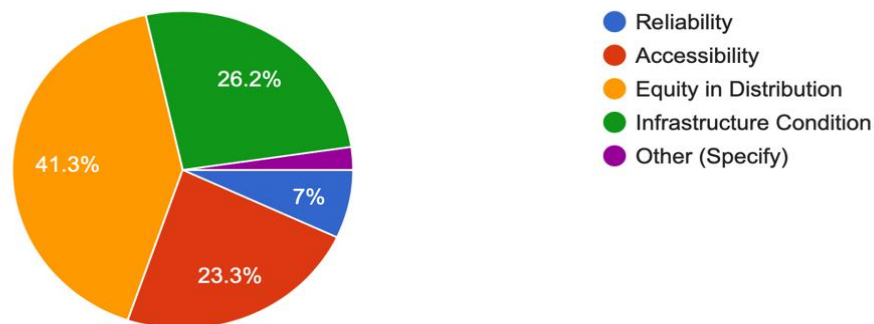


Chart # 15.

Collaboration among key stakeholders is vital when it comes to food security, water governance and smart farming under the threat of climate change. We sought opinion through this survey by asking the question "What collaboration between the local community and relevant authorities would be beneficial for food security and water governance?" The data reveals a strong and almost equal emphasis on two key areas: "Policy Forums" (33.9%) and "Community Workshops" (33.3%). This suggests a dual approach is desired, where both top-down policy discussions and grassroots community-level engagement are seen as crucial for effective food security and water governance. Policy forums indicate a desire for community input into formal decision-making processes, while workshops highlight the need for direct knowledge sharing, capacity building, and practical problem-solving at the local level.

"Joint Projects" also emerge as a significant area of collaboration, accounting for nearly one-fifth of the suggestions. This points to a desire for tangible, shared initiatives where both authorities and the community work together on specific programs. This could involve infrastructure development, water management projects, or sustainable farming initiatives. "Stakeholder Meetings" are also considered important, though less so than the top three, suggesting a need for regular dialogues and coordination among various actors. The very small "Other Collaboration" category indicates that the identified themes largely cover the main types of collaboration desired by respondents. See chart # 16 for more details.

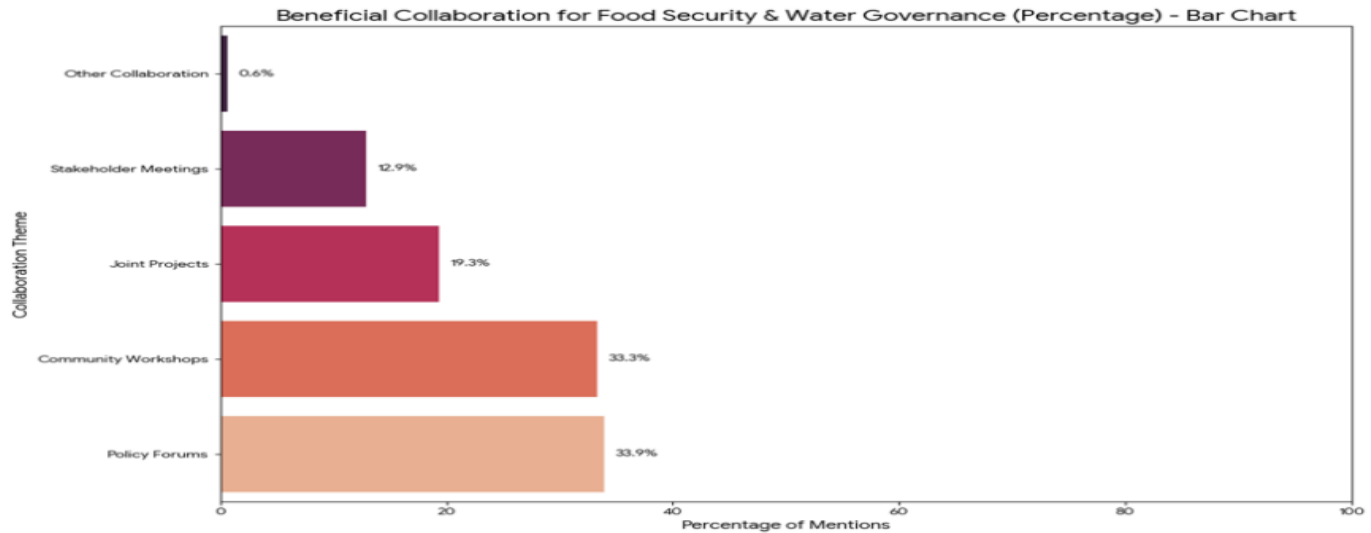


Chart # 16.

DISCUSSION

The study reveals that food insecurity is a major issue in the targeted areas of Hyderabad Division. Food security is directly linked to improved agricultural productivity. Further, the policy must be made to stop the wastage of food at various places. Crop failures due to scarcity of water cause frustration among the farmers. Small farmers face a lot of financial difficulties and this situation causes demotivation among farmers. The majority of respondents were of the view that there was an acute shortage of water in their areas. They considered water insecurity as a major cause of low productivity. This study indicates that without ensuring the availability of water as a key input, the conditions of farmers cannot be improved. Most of the cultivators considered the water shortage a serious issue. However, the inefficient use of available water resources is also negatively affecting food security. Ineffective water management policies also negatively contribute to agricultural improvement. Thus, the transparent system of water distribution emerged as one of the key solutions to food insecurity and low agricultural productivity. This can also save a lot of water used by powerful rural elites for non-productive purposes.

During our discussions with the farmers and landlords, it was clear that there is a government system to manage the water, but there is corruption, irregularities, local big landlords' influences and misuse of water management. Some people also opposed the idea that there is any water management system. However, the water management is not effective, and the supply of water is not enough for the cultivation of various crops.

It has been found that the majority of the stakeholders, including farmers, landlords, civil society members and local village inhabitants, prioritized economic disruptions as the primary cause of food insecurity. They believed that the lack of opportunities is the major factor for food insecurity, exacerbated by low agricultural productivity. It was also observed that low price for food crops in the market causes demotivation among farmers to produce food crops. There was also a strong voice that respondents who argued that the root cause of food insecurity in the Hyderabad division is due to a shortage of irrigation water. They stressed the need to improve water governance and ensure the required availability of water to resolve the issue.

The establishment of farmers' markets was a significant suggestion that came from the respondents of the study. The Overwhelming majority of respondents supported this idea. These markets must be engaged in direct selling and buying activities between farmers and traders. This is how the role of the middleman will be reduced. The biggest challenge faced by farmers is that they are compelled to sell their produce at the lowest rates offered in traditional markets. These markets do not serve the interests of farmers. The lack of a protection mechanism against

fluctuations in prices creates hurdles for farmers. This study reveals that farmers have serious concerns about the role of intermediaries' practices. Elimination of these practices will significantly contribute to agricultural productivity and improvement in food security.

The positive trend observed during the research was the openness of farmers in accepting the new trends, methods, and technologies for the maximum output of their crops. However, Farmers have suggested that the Government should incentivize the use of new techniques for increasing productivity. They also believed that awareness programs can greatly improve the situation. Further, the capacity building of cultivators through training cannot be overemphasized. It was further believed that non-governmental organizations can greatly contribute to capacity building for farmers.

This study also indicates the lack of awareness and misinformation about climate smart agriculture. The majority of respondents have no idea about climate smart agriculture. They argue that there is no climate smart agriculture in their areas. The study findings underscore the importance of a multi-faceted collaborative framework that integrates policy-level dialogue with practical community-based interventions and shared project implementation to address the issues of agriculture, water governance and food shortage.

The project results and findings highlight the need for greater awareness and education campaigns to shed light on the multifaceted contributions of women across the entire food security value chain. Understanding these perceptions is crucial for designing effective interventions that aim to empower women and leverage their potential to achieve comprehensive food security within the region.

CONCLUSION

The research study based on project titled Food Security Paradigms: Water Governance Issues, Climate Smart Farming and Sustainable Agriculture in Hyderabad division explored the major causes of food insecurity and offered an insight into understanding the sustainable growth of food supply. The project's research team used mixed methods – qualitative as well as quantitative techniques – and collected the data and analyzed that data from the sampled districts of Hyderabad, including Badin, Thatta, Dadu and Matiari. The study suggested that there are multifaceted issues that cause food insecurity. Due to drastic climate change, economic unsustainability and water scarcity have increased the water insecurity in the Hyderabad division. Due to water shortage, farmers are unable to achieve sustainable food productivity, food security and overall agricultural growth in the Hyderabad division. Apart from the climate change and unsustainable economic situation, the government's response towards addressing the food insecurity, access to water, adopting smart farming and awareness through capacity-building remained a serious concern for the small farmers and landlords. The government can play a vital role in managing the water resources through equitable water distribution and robust water governance. Water shortage and limited access to water have a direct relationship with agricultural growth, economic sustainability, and food security. Without the strong monitoring and water governance system, the Hyderabad division will remain vulnerable, especially for small farm holders who experience multiple challenges to yield their crops. In conclusion, it is high time for the government, civil society and NGO's working on food security, water governance and smart farming to develop a comprehensive farmers driven multi-dimensional approach to address the issues and challenges affecting the people in the Hyderabad division.

RECOMMENDATION

- Local political interference in the distribution of water resources negatively contributes to the mismanagement of water. The government should develop a strong mechanism of supervision and monitoring to control the theft and loss of water.
- The government needs to make a comprehensive strategy to ensure the availability of water for agriculture in the Hyderabad division.
- A strong management system should be established for the equitable distribution of water to deal with the issue of scarcity.
- In addition to water scarcity, the poor infrastructure of water management exacerbates the issue. Water cannot reach the land within the time, causing huge losses and stress to the small landlords and farmers. The government urgently needs to improve the infrastructure of small water bodies.

- The government should establish farmers' markets and eliminate the role of middlemen. These markets must offer reasonable prices to farmers. The agricultural shops should be set up in rural areas where the farmers can buy pesticides and seeds at subsidized prices. They should be allowed to sell their crops at a good price.
- It is very important for the farmers and landlords to know about the types of crops that should not be water intensive. Farmers should be encouraged to cultivate climate smart crops. The government needs to facilitate the farming community by conducting soil tests to ensure its suitability for crops.
- New methods of intensified farming adaptable to local conditions should be encouraged to reduce food insecurity.
- Higher productivity-based farming should be encouraged to cater to the needs of a growing population.
- Production of staple as well as cash crops by using improved methods of irrigation is an important factor in food security.
- Focus on comprehensive reforms and investments aimed at improving the equity of water distribution across the Hyderabad division. This includes upgrading and maintaining existing water infrastructure, expanding access to underserved areas, and implementing transparent distribution mechanisms. Addressing these core issues will directly enhance the perceived effectiveness and actual functionality of water supply systems, which is foundational for sustainable agriculture and food security.
- Develop and implement targeted programs to actively promote the research, development, and adoption of less water-intensive food varieties suitable for Hyderabad's climate. This should include providing farmers with access to drought-resistant seeds, offering training on water-efficient irrigation techniques, and providing financial incentives or subsidies for transitioning to these varieties.
- There is a need to create awareness campaigns and training sessions for farmers on climate smart farming. There should be programs on radio channels, TV channels, and social media platforms. Information should also be disseminated through newspapers about modern methods of cultivation. Further workshops, seminars, and training events should be organized in rural areas to inform the farmers about the latest technology and how they can benefit from this technology to grow more with the help of smart farming. There should be inclusion of agriculture related lessons in the school and college curriculum, which may be taught in school textbooks, so that children can learn about the organic farming system.

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