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# An Empirical Analysis of the Adoption of HI-Tech Farming Techniques Among the Farmers of the Eastern Uttar Pradesh Belt

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**Abstract**

Like in every sector, the agriculture sector also shows numerous technological advancements every now and then and it is expected from farmers to incorporate the same and increase the crop yields and keep themselves up-to-date for meeting up any type of competitions & contingencies as well. A lot has been done in the agricultural sector to improve cultivation but Indian farmers still rely on the traditional practices. Farming is still not regarded as a secure source of income in India. For Indian agriculture to become more profitable and sustainable, smart farming is essential. The farmer breed will soon go extinct without getting into smart and high-tech farming. Though Agropreneurs have started taking baby steps in India with respect to smart farming, it is still a silent revolution in India as compared to other countries because of lack of awareness and confidence. In this paper a study has been conducted in order to identify the inclination of farmers towards new technologies when it comes to agriculture from the Eastern Uttar Pradesh belt. At the same time farmers have also been inquired about the limitations and the challenges faced by them in the traditional farming system. During the survey of this study farmers have also been made aware how innovative modern agricultural practices doubles the crop yield which is not only beneficial to meet the domestic needs but can also be exported worldwide adding to the GDP of the country which could be of economic importance to the nation.

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## Introduction

Farmers, who make up about 58%[1] of the India's population, are still unable to make a living due to unpredictable monsoons, poor infrastructure, the need for skilled labor, soil and seed quality, and low utilization of agricultural techniques. Their livelihoods depend solely on agriculture, and most of them still rely on traditional farming techniques.

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As per the report of the World Economic Forum,[2] the entire world population will be reaching almost 10 billion by 2050, obviously after which food needs will increase by 60% than today. However, looking at the pace of ecosystem degradation, there will not be enough arable land to meet such agricultural demands, which will lead to food crises and sustainability issues. So it's high time to think of the methods that maximize yield. Growers need to deploy new agricultural approaches and processes to grow more food in less space.

Country like India where 70% population directly or indirectly depends on farming, that feed the world needs to implement such innovations for the world as whole. Its a major concern that despite of all positive trajectories agricultural contribution to GDP is around 17% only. The major cause of this could be the thought process towards the agriculture as a career option, as many youngsters do not consider agriculture as settlement in life. We all know that earlier humans were hunters and gatherers and civilization started with the agriculture where Human civilization settled by doing agriculture but now the youth do not consider agriculture as a career option. India will become “Sone ki chidiya” only if the youth of our nation start considering agriculture as a prime career option. As agriculture sector will serve the backbone of Indian Economy.

With around 170 Mha of cropland, India was the largest country, followed by the US with 158 Mha, China with about 120 Mha. But after 1960’s green revolution, there has been massive growth in manufacturing and service sector which led agriculture as the last career option/sector for all. Despite of this,mere 17% contribution is giving us the biggest sense of security and that is food security.

Britishers promoted Indigo, tea, coffee, jute, sugarcane, oilseeds, opium, black pepper, silk, and other cash crops but did’nt took any measure for agriculture infrastructure which lead to droughts & famines. Because of lack of irrigation facilities the Indian Agriculture sector was dependent on monsoons. Absence of modern technology leads to food shortage.India is considered as the “Global Agriculture Powerhouse” being the world’s largest producer of milk,tea,spices and pulses, and second largest producer of fruits, sugarcane, cotton, wheat and rice. Despite of all such positive trajectories,agriculture is facing certain challenges such as

- Low land/arable lands
- Underdeveloped irrigation facilities
- Lack of mechanization
- Agriculture markets

Numerous research done by academicians & researchers are showing that innovations in agriculture can play a considerable role in uplifting the developing economies.

“Compendium of 75 Agri Entrepreneurs and Innovators” released by NITI Aayog in 2023 showcasing the top 75 technology-based Agriculture start-ups in India showcasing the success stories of innovators and entrepreneurs who are working in transforming the agriculture sector in modern and tech-enabled sector. The primary aim behind these researches and publications is to motivate the budding entrepreneurs/youth to adopt Hi-Tech farming techniques and begin with Agriculture start-ups to make judicious use of the land and many other resources available in rural areas which could enhance the agriculture productions. But still the country has taken only baby steps in order to adopt the same, because of various reasons.

In this paper, the attention has been given to identify the key issues and lacunae’s for the non-adoption of Hi-Tech farming methods/techniques, especially when it comes to the farmers across Eastern Uttar Pradesh in the Indian subcontinent.

A systematic and organized approach has been adopted to showcase the effectiveness of this study. This research paper has been demarcated into six sections, where section 1 draws the attentions towards the significance of agriculture sector and its contributions in the upliftment of the Indian economy. Also, an overall article’s gist has been showcased in the very first introduction chapter for better comprehension of the agropreneurs. Section 2 of the study ponders on some of the major challenges and limitations faced by the farmers across the Eastern Uttar Pradesh belt. On the basis of major highlighted issues and extensive literature review done , research gap for this study have been ascertained in Section 3. Section 4 elaborates the detailed research methodology adopted right from questionnaire

framing, study site and techniques incorporated for analyzing the responses collected from farmers. The 5th section showcases the evaluated results obtained under section 4 and its detailed discussion. Section 6 is the last and the concluding section of the work. Certain recommendations have been framed on the basis of feedback obtained from farmers under miscellaneous questions as their contingent experiences which can improve the current infrastructure of the agricultural sector and elevate the farmer's participation in adoption of Hi-Tech agricultural techniques within the belt of Eastern Uttar Pradesh.

**Issues & Challenges Related to Hi-Tech Farming**

Agriculture and its methods have been in doldrums since ages. There have been numerous attempts in recent years to revitalize it by experimenting and putting modern thoughts into usage, but they have not been particularly successful.

Modern tools have been regularly added to the agricultural sector throughout time in an attempt to address the food crisis. However, due to numerous reasons, it hasn't been able to take up the pace, and problems pertaining to agriculture have gotten worse with time.

**The Following Factors Contribute to Some of the Major Shortcomings**

**Seasonal Shower Inconsistency[3]**

About 80% of the nation's rainy season is brought by the south-west monsoon. Its importance may be shown in the fact that over 55% of Indian farmers rely on timely, sufficient, and evenly distributed rainfall from the southwest monsoon to raise healthy crops and provide cattle fodder. The monsoon is frequently cited as the engine of Indian agriculture since 60% of the country's agricultural output is rain-fed and 40% of its workforce is employed in the sector. It is realized that the monsoon rains' timely arrival, uniformity, and sufficiency are crucial. In this regard, it should be mentioned that although India receives more rainfall overall than many other nations, the distribution of the rain is erratic and unequal in terms of time and space.

Because of this, farmers, the general public, and animals suffer greatly from the unpredictable monsoon, which also has a negative effect on the economy. Without enough rain, the rivers have poor flows, the reservoirs are empty, the canals are dry, and farmers are unable to transplant crops.

**Climatic Changes**

India is quite concerned about the effects of climate change because 85% of farmers are not financially resilient. As a mitigation strategy,[4] even if greenhouse gas emissions are significantly reduced, the effects of climate change will not go away in the upcoming decades, making Hi-Tech farming techniques adaptation an important necessity. Farmers are the ultimate practitioners of adaptation measures to lessen the challenges on the agricultural system and are, in this sense, on the "front lines of climate change." It has long been understood that awareness of climate change is necessary before taking adaptive measures. Farmers are more inclined to support legislative efforts aimed at addressing climate change if they recognize its negative effects.

**Judicious Land use[5]**

The agricultural sector has significant challenges due to land degradation, with estimates indicating that 44% of India's land area is deteriorated. Land deterioration has many different and intricate causes. Vulnerability to natural disasters, excessive use of agrochemicals, incorrect crop rotations, and poor irrigation system management are some of the factors causing soil degradation. Furthermore, the practice of shifting agriculture, which is carried out in some regions of the nation, is responsible for deforestation and the conversion of agricultural fields into less productive lands.

Since district-level land use plans do not exist, industrialization- or urbanization-related regional development must be controlled in order to initiate land use planning for industrial, urban, or environmentally sensitive areas and ensure sustainable development.

Negative effects may result from the unanticipated development if prompt action is not done. Conflicts between land use and sensitive ecosystems, rural and agricultural areas, and locations with natural resources are some of these detrimental effects. Additionally, the risky effects will result in the loss of productive land and ecological services.

**Issues Related to Agricultural Workforce**

One of the biggest threats to India's agricultural sector is the increasing urbanization, rising literacy rates, and increased skill acquisition of rural youth. These factors raise the question of whether young people from farming families will choose to continue farming as their career or pursue more diverse careers due to opportunities in other fields. Diverse employment is being forced onto aspiring farmers, including the farmer's son. Do parents ever declare that their son or daughter will pursue an agricultural business? Parents view farming as an unprestigious, extremely hard, and round-the-clock job whose productivity depends mostly on environmental factors, governmental regulations, and human effort. It is important to understand how young people in Kushinagar, in particular, view farming as a career. Experiences alone never determine perception. It develops as a result of interactions with the whole world in which an individual lives and his or her visualization of a certain circumstance or occurrence.

**Water Supply from Tube Wells[6]**

Water tables are dropping as a result of the uncontrolled use of groundwater for irrigation, since the rate of extraction exceeds the rate of recharge. An organized groundwater irrigation market could be introduced because since very long period trading of informal groundwater has been common in Uttar Pradesh, India.

[7]All major freshwater resources, mainly surface water and groundwater, are used by irrigated agriculture worldwide (FAO, 2013). Specifically, almost 40% of irrigation relies on groundwater, which makes up 70% of all groundwater extractions. Furthermore, because groundwater is a more dependable and conveniently accessible source of irrigation than surface water, which is highly impacted by climate change, its share in irrigation has been rising quickly (OECD, 2016). Water sustainability through demand and supply management has been a hot topic of discussion at international fora since the early 1990s. One of the most important alternative ideas that have been studied and applied, especially in industrialized economies, is the idea of water as an economic good.

**Lack of Knowledge & Awareness[8]**

The majority of smallholder farming systems fall well short of their potential in terms of profitability and productivity. The incapacity to take on risks and the lack of access to capital and inputs are among the causes. The lack of knowledge and expertise that prevents or lessens the technical efficacy of existing technology and management techniques is another significant factor (World Bank, 2007). Farming is turning into a more information-intensive and time-sensitive industry. A system of agricultural decision-making based on information will be necessary to drive for increased output.

**Contaminated Water used for Irrigation**

Poverty is positively connected with the extensive use of contaminated water, especially wastewater, in agriculture. The main causes of the practice are the shortage of water in the face of rising demand, the contamination of conventional irrigation water sources and the absence of substitutes, the accessibility, affordability, and nutritional value of wastewater, as well as market incentives. Regretfully, pollutants are contaminating crops, water, and soils, and illnesses have been connected to these toxins through occupational and recreational activities as well as food. Industry, urbanization, and agriculture—activities driven by population growth—are the main sources of water pollution, with heavy metalloids being the main culprit.In most nations where untreated wastewater is regularly utilized in agriculture, the risks associated with it are little to unknown to farmers and consumers.

**Lack of Quality Seeds and Manure**

The goal of Hi-Tech farming, also known as Hi-Tech agriculture, is to act appropriately at the appropriate time, place, and manner. controlling the inputs used in crop production, such as water, seed, fertilizer, etc., in order to improve yield, profit, quality, and environmental friendliness while lowering waste. Hi-Tech farming aims to increase the accuracy of agricultural input and practice applications by matching them to crop and agroclimatic conditions. In order to practice Hi-Tech farming, one must effectively manage resources through site-specific high-tech interventions such as mulching for in-situ moisture conservation, drip irrigation, high density

planting micro-propagation, protected/greenhouse cultivation, fertigation, and fertilizer management based on soil and leaf nutrients.

**Yield Rate/Productivity**

To cultivate the crop, farmers in conventional farming utilize various agrochemicals, fertilizers, and high-quality seeds. In Hi-Tech Agriculture, farmers use a variety of cutting-edge technologies, such as climate-appropriate farming, hydroponics, aeroponics, aquaponics, vertical farming technologies, precision farming, GIS/GPS/DGPS based farming systems, and greenhouse and protected structure cultivation, to promote better plant growth and high productivity.

**Cost Efficiency**

The integration of new technologies into agricultural practices is the core of Hi-Tech farming. Drones, artificial intelligence, big data, the Internet of Things, satellites, and other technologies have made farming and agriculture "Hi-Tech," enabling producers to maximize productivity and achieve better quality growth. As a result, agribusiness becomes more cost-effective by decreasing the amount of human labor, lowering financial costs, and increasing the quantum of output.

**Why Hi-Tech Farming?**

**To give Edge over Farmers Income**

The Indian economy's greatest employer is the agriculture sector. India is considered as the second-largest farmer of the world. Moreover 50% of India's workforce is employed in this industry, which contributes 18% of the country's GDP. Nevertheless, farming is an unproductive endeavor. Large yield gaps and ineffective supply chain management are two of the industry's main problems. Adoption of smart farming techniques can give farmer’s an edge over.

**Managing any Climatic Implications**

Agriculture is not as internationally consolidated as other businesses and has complex objectives in addition to meeting climate standards, as noted by McKinsey. Concerns about food security, nutrition, biodiversity, and the continued existence of farming communities and farmers themselves are also present. The harsh truth is that agriculture needs to adapt in order to increase output and efficiency. Agriculture is being negatively impacted by climate change as well.[9] A study conducted by Cornell University's Applied School of Economics claims that during the 1960s, global warming has resulted in a 21% decline in agricultural productivity worldwide.

Optimizing agricultural operations, capturing carbon dioxide before it is discharged into the atmosphere, implementing a circular economy, and making the sector more sustainable with the possible use of cloud, artificial intelligence (AI), IoT, and analytics.

**Boosting food security[10]**

In order to guarantee food security, scientists are regularly creating new breeds or varieties of plants with novel, advantageous, and desirable traits through high-tech breeding and biotechnology procedures. Crops with high-quality produce can be cultivated all year round in autonomous greenhouses. [11]Applications of nanotechnology are also being developed to enhance crop nutrition balance and soil fertility, which favorably impact productivity and food production. In order to enhance livelihoods, increase food security, promote agricultural output, high-tech extension and advisory services are essential.

Many strategies, such as management of the competent workforce, the establishment of training facilities and trainers, a quick technology transfer system, initiatives to improve marketing support for farmers, timely delivery of high-quality inputs to farmers, etc., may be the most effective in promoting hi-tech agriculture. Thus, it is now need of time to implement a sustainable high-tech farming system to guarantee that everyone has access to cheap food.

**A Youth-Driven Agricultural Enterprise, Particularly In Rural Regions[12]**

Additionally significant and intricate are the effects of farmers' creative entrepreneurship on rural green development and sustainable agriculture. Creative entrepreneurship of farmers can result in the development of novel, sustainable agricultural techniques that help lessen the negative environmental effects of agriculture. Farmers that participate in creative entrepreneurship, for example, are more inclined to embrace sustainable agricultural methods.

**Literature Review**

Consumer's perceived worth beyond its usage as food, size, type, and price competition all have a significant impact on Urban Agriculture's economic performance. Despite its extremely high relative profitability, Urban Agric serves a variety of purposes for urban communities, ranging from large-scale commercial production facilities to subsistence-oriented goals.( Yuan GN, Marquez GPB, Deng H, Iu A, Fabella M, Salonga RB, Ashardiono F, Cartagena JA,2022)

[15]Climate change and its negative repercussions will have a significant impact on livelihoods, food security, and agriculture in the next decades. The Climate Smart Agriculture and sustainable agriculture are two very beneficial approaches. Three essential elements make up the CSA concept: productivity, mitigation, and adaptation. Food security is likely to be significantly impacted by sustainable agriculture. Thus, different crop kinds are impacted by climate change in different ways. Food security is likely to be significantly impacted by sustainable agriculture. Thus, different crop kinds are impacted by climate change in different ways. Climate harm can be avoided with the help of early warning systems and efficient weather forecasting systems. One significant aspect influencing the food and farming system was climate change. As there are so many pertinent opportunities, it is imperative to apply coordinated approaches to address food security and climate change. With agriculture CSA paths, sound agriculture policy will reduce poverty and food insecurity in the near term while also improving the environment over time. Horticultural items are in high demand and are predicted to continue to climb in demand due to rising per capita income and an increase in health-conscious population. This will necessitate more production. But manufacturing needs to be competitive, both in terms of cost and quality. As a result, one must take advantage of the opportunities that present itself and preserve earnings. development of enhanced cultivars possessing high yield, outstanding qualitative attributes, resilience to pests and diseases, and capacity to withstand abiotic stress. (Bano, Ambreen & Ali, Mariya & Gupta, Anmol & Pathak, Neelam & Hasan, Wajid. (2021).

[16]The study conducted by Biswas, Subhankar. (2022) shows that smart farming techniques has the potential to significantly alter agricultural operations in order to boost productivity and lessen the impact of pesticide waste on the environment. It outlines a path toward sustainable agriculture that involves networks including all parties involved in the agri-food industry, systems for producing crops and livestock, and technological diversity. The goal of encouraging and facilitating responsible ICT use cannot be met by a single legislative approach. The potential of the digital age could result in new forms of farm diversification in addition to enhancing existing forms through technical advancements.

[17]The current study demonstrated how crucial smart agriculture is to raising and enhancing agricultural yield in order to reduce the gap between supply and demand for food. Utilizing smart agricultural technology benefits developing nations. A few Egyptian initiatives serve as a starting point for the technology's dissemination and can aid in the growth of the agricultural industry and the achievement of farm sustainability in such nations. Lastly, as the goal of these smart technologies is to improve the efficient use of land and water resources and boost productivity, governments in third-world nations should promote them at the level of small farms. (Mohamed, E.s & Belal, Abdelaziz & Abd-Elmabod, Sameh Kotb & El-Shirbeny, Mohammed & Gad, Abd-Alla & Zahran, Mohamed. (2021)

[18]India's agricultural landscape might become more adaptable to climate change while also boosting food security and economic growth, thanks to more affordable digital technology, higher internet coverage in rural areas, and growing investor interest. A multi-stakeholder approach is necessary, with the government facilitating ecosystem participants. In order to achieve goals like Doubling Farmer Income and reaching the SDGs, it is crucial to take a comprehensive ecosystem approach to solving the many issues facing the agriculture sector.(Balkrishna, Acharya & Pathak, Rakshit & Kumar, Sandeep & Arya, Ved & Singh, Sumit. (2023))

[19]Another study conducted by Bazzana, Davide; Foltz, Jeremy D.; Zhang, Ying (2021), highlighted that Farmers who implement Climate Smart Agriculture do better than those who do not, according to climatic scenario models, even though Climate Smart Agriculture implementation does not entirely offset the extreme climate stresses. Additionally, because of greater price fluctuations, farmers with weaker linkages to food markets gain less from CSA. These findings urge policymakers to take a proactive approach in promoting CSA uptake and adaptation by expanding financial availability, enhancing food market integration, and fostering farmer-to-farmer information exchange.

[20]Another study by Pehin Dato Musa, Siti & Basir, Khairul. (2021) highlighted that a high degree of food safety and quality may be maintained while growing food output in a sustainable manner by using smart farming. By offering creative pathways into a more sustainable, resilient, and profitable agri-food system, smart farming provides a route towards accomplishing SDG 2. It is also discovered that because the governments depend on one another for the provision of food and agricultural goods, a regional approach to guaranteeing food security should be adopted in the South East Asia region. In order to equip the local workforce with STEM skills and enable smart farming to flourish in the area, a more robust government initiative is required.

[21]Creative irrigation techniques can reduce environmental impact while increasing water efficiency and giving farmers a financial edge. Reducing pesticide runoff and leaching issues could be achieved by integrating water and nutrient management through the use of water-efficient techniques and improved irrigation timing. Specialists have created a number of water efficiency and environmental benefit models to help realize this potential. However, these models are hardly ever employed for irrigation scheduling; at most, they are only useful for evaluating seasonal approaches in the past.(FAO,2012)

**Research Gap**

The overuse of synthetic pesticides, herbicides, and fertilizers is contaminating groundwater and deteriorating soil quality. Fertility of agriculture is consequently fast decreasing, and a large number of people are ill and undernourished. For this reason, Hi-Tech Farming techniques like hydroponics serve as a promising method for cultivating a large range of plants nowadays. Anyone may easily learn how to use these techniques. You can farm and use hydroponics to raise plants while gathering fresh foods. For those who are impoverished and landless, hydroponics can offer soilless production in a relatively small area with minimal work and quick turnaround times. Additionally, Hi-Tech farming practices can enhance people's lifestyles and accelerate economic growth of the nation. In totality in this study it has been tried to ascertain that shortage of water, expenditure on source of water, electricity & manpower, soil fertility, climatic conditions and irrelevant usage of pesticides, fertilizers does not play any significant role in the growth of the crops, if we adopt to Hi-Tech farming practices.

**Research Objectives**

Upon analyzing the main points and conducting a thorough review of the literature, it was found that a large volume of research studies have been carried out about the adoption of Hi-Tech farming techniques by farmers worldwide. But there is a lack of studies that reflects farmers' inclination towards various issues on the adoption of Hi-Tech farming practices, especially accepting the Hydroponics system among the farmers of Eastern Uttar Pradesh. As a result, a thorough literature review was conducted to ascertain the research objectives that can be used to determine the farmers' perceptions

i) Hi-Tech farming techniques are a sustainable solution for food requirements and healthy lifestyle.
ii) Hi-Tech farming techniques are a sustainable form of agricultural practices leading to higher productivity.
iii) Hi-Tech farming will give new avenues to the agriculture sector in India.

The population and sample methods used to carry out the current investigation and identify the underlying cause of the persistent problem are described in the next section.

**Research Hypothesis**

**H1**

There is a significant difference in factors/challenges responsible for farmers towards acceptance of Hi-Tech farming techniques.

**Research Methodology & Data Analysis**

**Study Region: Current Standing of Eastern Uttar Pradesh in Agricultural Domain**

One of the most important agricultural states in India's north-central area is Uttar Pradesh. Known as India's "Food Basket," Uttar Pradesh, state has a significant significance in Indian Agriculture as it produces roughly 20% food grains to the national food basket. Eastern Uttar Pradesh belt(highlighted green area in the map) especially from border area of UP & Bihar i.e., Kushinagar, Deoria, Siddharthanagar, Basti, Bahraich, Shravasti, Gonda, Gorakhpur, SantKabir Nagar, Maharajganj and some farmers of other state i.e. Bihar (border area of UP & Bihar) serves as the study's backbone.

Situated in the state of Uttar Pradesh (UP), Eastern Uttar Pradesh is situated between 23°51′ N to 28°30′ N and 81°31′ E to 84°39′ E. Divided into eighteen districts, the eastern UP shares boundaries with Nepal to the north, Bihar to the east, Chhattisgarh and Madhya Pradesh to the south, and numerous other UP districts to the west. UP has a humid subtropical climate with a dry winter, while certain areas in the east have a semi-arid climate. The agriculture of the eastern United Pradesh is mostly rainfed, with small and marginal land holdings and a high susceptibility to soil salinity, frequent flooding, and droughts. The predominant farming system is rice-wheat. The farmers plant rice, pigeon peas, mung beans, and maize during the wet season, which runs from July to October. The crops that farmers plant in the winter (November to February) include wheat, barley, mustard, rapeseed, peas, and chickpeas.

Globally, the agricultural sector has advanced significantly throughout time in areas such as food security, agricultural techniques, and other delicate subjects. The Indian central government has been focusing on some common goals, such as increasing farm yield through maximum campaigning, workshops and awareness programs for farmers, in order to keep up the pace. concepts.

**Research Methodology & Statistical Tools Adopted for Analysis of Responses Given by Farmers**

To get into the root cause of the and identify the correct issues, the author has drafted a questionnaire,


**Map 1: Map of Uttar Pradesh: Study Area- the entire Green Area**

containing 11 questions which could be the possible issues that act as a hurdle in the adoption of Hi-Tech agricultural techniques. The target audience of this study's field survey are the farmers from the different zones of Eastern Uttar Pradesh belt especially from border area of UP & Bihar i.e., Kushinagar, Deoria, Siddharthanagar, Basti, SantKabirNagar, Maharaj Ganj and some farmers of other state i.e. Bihar (border area of UP & Bihar). The farmer's responses have been demarcated on Likert scale into four different categories, i.e., Never, Sometimes, Often and Always. Feedbacks from respondents were given a specific value based on responses on a 1-4 Likert Scale.

This research paper is a descriptive study. It has been conducted on a sample of 214 farmers from Eastern Uttar Pradesh. Eleven items were included in the questionnaire, and each response was given a 4-point Likert scale with the options Always, Often, Sometimes, Never. To ensure that respondents could grasp the breadth of the questions, the questionnaire was written in both Hindi and English.

The feedback was evaluated and examined using Statistical Packages for Social Science (SPSS) Version 22 based on the responses. To find out if there are any statistically significant differences between the means of two or more independent (unrelated) groups, a one-way ANOVA was used. Variance reflects the measures of dispersion, which shows how far the data is scattered from the mean.

In addition, an Independent-sample T-test was run on the replies to assess the farmers' role as a percentage in implementing smart agricultural ideas. Purposive sampling is the sample strategy used in this investigation. To gauge farmers' perceptions of the use of Hi-Tech agricultural practices, a survey instrument was created.

Interviews with farmers in Eastern Uttar Pradesh were used to gather responses on a range of topics, including the farmers' inclination for the adoption of Hi-Tech Farming techniques. The study has also included the performance and presentation of descriptive responses.

**Data Analysis**

To obtain a thorough understanding of the state's farmers' thinking, the questionnaire was designed to focus on the fundamental challenges that farmers have when implementing H-tech farming technology. Six categories served as the foundation for the questionnaire's question structure.

By carrying out the three operations listed below, the evaluation and influence of each segment on the propensity to adopt Hi-Tech farming practices have been determined.

i. Descriptive Analysis
ii. Independent sample T-test
iii.One-way ANOVA

**Water Crisis during Farming Process**

Table 1 shows the mean and S.D result calculated on responses collected from farmers .Results shows the mean score 2.93, w.r.t S.D .977 which shows more than 70% sample i.e. farmers facing the shortage of water during farming process in the Eastern Uttar Pradesh of this particular study area.

**Table 1: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Do you face shortage of water during farming process | 223 | 2.93 | .065 | .977 |
| Valid N (listwise) | 223 | | | |

**Expenditure on Electricity & Manpower**

Table 2 shows the mean and S.D result calculated on responses collected from farmers. Results shows the mean score 1.91,w.r.t S.D 1.187 which shows around 47.75% sample i.e. farmers facing expenditure on source of water i.e. pumping set/ electric pump, diesel electricity and manpower between 0 to 50,000 rupees for one crop for one season.

**Table 2: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Expenditure on Water, electricity, manpower for one crop in one season | 223 | 1.91 | 0.080 | 1.187 |
| Valid N (listwise) | 223 | | | |

**Effect of Light & Humidity**

Table 3 shows the mean and S.D scores calculated on acquired responses from farmers. Results shows the mean score 2.93,w.r.t S.D 1.029 which shows more than 70% sample i.e. farmers agree that sunlight and humidity plays an instrumental role in the development of crop and they also support the statement that yes they do face the challenge in maintaining the same.

**Table 3: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Sunlight and humidity plays instrumental role for crop. | 223 | 2.93 | .069 | 1.029 |
| Valid N (listwise) | 223 | | | |

**Soil Fertility**

Table 4 shows the mean and S.D scores calculated on collected responses from farmers .Results shows the mean score 3.68 ,w.r.t S.D .667 which portrays that more than 92% sample i.e. farmers agree to the fact that soil fertility plays an instrumental role in agriculture which makes it very clear that soil is an essential ingredient for plant to grow.

**Table 4: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Soil fertility plays an an instrumental role in agriculture | 223 | 3.68 | .045 | .667 |
| Valid N (listwise) | 223 | | | |

**Climate & Crop Yield**

Table 5 shows the mean and S.D result calculated on acquired responses from farmers. Results shows the mean score 3.22, w.r.t S.D .910 which shows that more than 80.5% sample i.e. farmers agree to the fact that climate change has a huge impact on the productivity/crop yield.

**Table 5: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| Climate change affects the crop yield | 223 | 3.22 | .061 | .910 |
| Valid N (listwise) | 223 | | | |

**Disease Free Crop**

Table 6 shows the mean and S.D result calculated on collected responses from farmers. Results shows the mean score 3.05 ,w.r.t S.D .868 which shows that around 76.25% sample i.e. farmers say that frequency of the usage of pesticides, fertilizers and manures in their crops is from often to always which reflects that these are kind of major supportive ingredient for agriculture process.

**Table 6: Descriptive Statistics**

| | N | Mean | | Std. Deviation |
|---|---|---|---|---|
| | Statistic | Statistic | Std. Error | Statistic |
| How frequently Pesticides, fertilizers, manures used for crop | 223 | 3.05 | .058 | .868 |
| Valid N (listwise) | 223 | | | |

**Hypothesis Testing & Finding**

**H1**

There is a significant difference in factors/challenges responsible for farmers towards acceptance of Hi-Tech farming techniques.

**Result**

- An independent sample t-test was administered to compare the factors variables/challenges responsible for farmers towards Non-Acceptance or Acceptance of Hi-Tech Farming techniques. Results depicted in Table 8 shows that there was no significant differences (t(221)= -1.254,p=.211) in the scores with the mean score for Acceptors (M=2.9675,SD=.47693) was higher/lower than and Non-Acceptors (M=2.8452,SD=.52102 in )Table 7. The magnitude of the differences in the means (mean difference=-.12,95%,CI= -.31 to .06) was not significant. H1 was rejected.
- One-way ANOVA was administered to compare the factors variables/challenges responsible for farmers towards Non-Acceptance or Acceptance of Hi-Tech Farming techniques. The ANOVA results depicted in Table 9 suggest that there was no significant difference as p-value .048 is less than .05,($F_{14,208}$=1.749,p<0.05). Hence,H1 was rejected.

**Inference**

There is no significant difference in factors/challenges responsible for farmers towards adoption of Hi-Tech Farming.It means all factors/challenges uniformly support towards the acceptance of Hi-Tech Farming techniques/practices in that region.

**Table 7: Group Statistics**

| Farmer's Inclination Towards Adoption of Hi-Tech Farming | | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Overallmean | Non-Acceptors | 28 | 2.8452 | 0.52102 | 0.09846 |
| | Acceptors | 195 | 2.9675 | 0.47693 | 0.03415 |

**Table : 8 Independent Samples Test**

| | | Levene's Test For Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | Df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| OVERALL MEAN | Equal Variances Assumed | .000 | .990 | -1.254 | 221 | .211 | -.12228 | .09752 | -.31447 | .0699 |
| | Equal Variances not Assumed | | | -1.173 | 33.82 | .249 | -.12228 | .10422 | -.33412 | .08955 |

**Table 9: ANOVA**

| Farmer's Inclination Towards Adoption of Hi-Tech Farming | | | | | |
|---|---|---|---|---|---|
| | Sum of Squares | Df | Mean Square | F | Sig. |
| Between Groups | 2.579 | 14 | 0.184 | 1.749 | 0.048 |
| Within Groups | 21.906 | 208 | 0.105 | | |
| Total | 24.484 | 222 | | | |

**Findings**

i) Hi-Tech farming techniques are a sustainable solution for food requirements and healthy lifestyle.

ii) Hi-Tech farming techniques are a sustainable form of agricultural practices leading to higher productivity.

iii) Hi-Tech farming will give new avenues to the agriculture sector in India.

- Descriptive statistics shows that farmers in the study area faces troubles when it comes to water,electricity,manpower and expenditure related to the same.Also,descriptive study shows that sunlight,humidity and soil fertility are some of the essential ingredients for the agricultural processes.Also,in order to increase the crop yield lots of pesticides,fertilizers are used which surely impacts the crops and will

never lead to disease free crop.

Now,where food requirements has no end,such constraints are hindrance towards the sustainable solution for the food requirements.So,adapting to Hi-Tech farming practices gives an edge over these problems mentioned by farmers and such practices serves as sustainable solution for the food requirements and since Hi-Tech farming practices do not use any fertilizers and pesticides it can also be considered as permanent solution for healthy lifestyle. And such descriptive study and Independent T-test supports the first objective of the study i.e.Hi-Tech farming techniques are a sustainable solution for food requirements and healthy lifestyle.

- 100% germination is being claimed by Hi-Tech farming practices like hydroponics etc which also claims for 90% less requirement of water without any usage of fertilizers and pesticides and such practices can be performed in less space even in vertical layers which justifies the very second aim of this study i.e. Hi-Tech farming techniques are a sustainable form of agricultural practices leading to higher productivity.
- During the survey of this study farmers have also been made aware adoption of innovative modern agricultural practices doubles the crop yield which is not only beneficial to meet the domestic needs but can also be exported worldwide adding to the GDP of the country which could be of economic importance to the nation.And this is how third objective of the study has been tried to achieve i.e. Hi-Tech farming will give new avenues to the agriculture sector in India.

**Limitations**

According to World Bank estimates, the share of agricultural workers in the entire labor workforce would decrease to 25.7% by 2050 from 58.2 percent in 2001. As a result, the nation needs to increase the quantum of farm mechanization and adopt the Hi-Tech Agriculture practices. (The Economic Times, 2018).

It is necessary to draw attention to the following limitations faced by the study area while adoption of Hi-Tech farming techniques.

i) There are large number of infrastructure impediments in the region of study area. They also rely on others for technical assistance such as threshing, irrigation, and land preparation. Finding a trustworthy source of seeds and varietal substitution to increase output, productivity, and ultimately the cost-benefit ratio (CBR) is another difficulty faced by farmers.

ii) The last 20 years have seen a trend in the agriculture sector of ever-lower "return on investment" from agricultural operations because of rising input costs (especially those of labor, irrigation, fertilizer, and mechanization) and stagnating output values for Uttar Pradesh farmers. Small and marginal farmers also have significant challenges with marketing, transportation, and timely access of chemical fertilizer, which lowers productivity and production.

iii) This region's agriculture is also extremely susceptible to nature's whims, such as floods. In the District of Shrawasti, about 48% of farmers deal with flooding or water logging during the rainy season each year. Because of the Rapti River's flood-prone lowlands, the soil is less fertile here.In addition to harming the local crops during the monsoon season (Kharif), floods can destroy up to 30–40% of agricultural land, making it susceptible to waterlogging for three to four months. This has an impact on productivity and cropping during the Rabi season.

iv) Agriculture research and extension facilities in the study region is developing at a very slow pace and has remained laggard in introducing Hi-Tech farming practices to bring-up the agriculture sector. Agriculture sector can be visioned and observed as a new competitive edge in the light of a new liberal economic scenario.

**Conclusion**

Hi-Tech farming is beneficial not only for consumers who can eat pesticide-free and fresh produce, but especially for farmers who will no more remain dependent on unstable weather, natural water levels and soil contamination.

This form of sustainable agricultural practices can make a remarkable difference in a country's agricultural sector.

Saying No to pesticides, herbicides and other chemicals will lead to environment friendly agriculture while doubling the crop yield will have better Return on Investments which will also cater to the food crises of developing countries like India and worldwide.

**Recommendations**

Certain policies should be formulated which can pave new direction to the trade practices of certain crops in terms of their yield contributing to the economy and meeting any kind of food crises not only at the National level but internationally also.

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**Conflict of Interest**

The authors do not have any conflict of interest.

**Data availability**

Data will be made available on request.

**Ethics Statement**

The present study doesn't involve an experiment on humans and animals.

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