

ORIGINAL ARTICLE

A Study on Market Potential of Micro Irrigation System and Consumer Awareness of Water-Soluble Fertilizers in Moradabad Division of Uttar Pradesh

Swarup Upadhyaya

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ABSTRACT

Purpose: This study evaluates the market potential of micro-irrigation systems and assesses consumer awareness of water-soluble fertilizers in the Moradabad division of Uttar Pradesh, India.

Approach: Primary data was collected through fieldwork. 85 farmers, 16 retailers/dealers, and 10 company representatives were interviewed. Purposive and snowball sampling techniques were used. Secondary data was gathered from government websites, news articles, and research papers. Market potential is calculated based on cultivated area, area under micro-irrigation, and unit price.

Findings: The study findings report a significant market potential of Rupees 10,657.161 crores for micro-irrigation systems in the region. Farmers are aware of water-soluble fertilizers, but they are primarily used as growth promoters, preferring conventional fertilizers as the primary source. Adoption of micro-irrigation systems is very low. The adoption is influenced by various factors such as economic constraints and impediments to perform farm operations.

Limitations: The sample size is representative of the studied areas and could limit the extent to which the findings can be generalized for the entire division.

Originality: This research offers a new perspective on farmers' utilization of water-soluble fertilizers, highlighting their predominant use as growth promoters. It also reports the complex interplay of factors affecting the adoption of micro-irrigation technologies in the specific context of the Moradabad division.

KEYWORDS

• Micro-irrigation systems • Water-soluble fertilizers • Market potential
• Consumer awareness • Moradabad Division-Uttar Pradesh

AUTHOR'S AFFILIATION:

Student, Division of Agribusiness Management, ICAR Indian Veterinary Research Institute, Bareilly, Uttar Pradesh, India.

CORRESPONDING AUTHOR:

Swarup Upadhyaya, Student, Division of Agribusiness Management, ICAR Indian Veterinary Research Institute, Bareilly, Uttar Pradesh, India.

E-mail: Swarup.mba.ivri@gmail.com

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INTRODUCTION

Water soluble fertilizers are chemical fertilizers, which are 100% soluble in water, having a low salt index (EC 0.9 to 1.2) and suitable for foliar application in case of plants with higher nutrient use efficiency. (Malhotra, 2016)

The Government of India, through the Fertilizer Control Order of 1985, has recognized the importance of water-soluble fertilizers by including them within its purview. This regulatory inclusion acknowledges their utility across various phases of crop development. Specifically, the order outlines the application of balanced NPK grades such as 19:19:19, 20:20:20, and 18:18:18 during the crucial early growth stages of plants. Similarly, nutrient-specific formulations like the nitrogen and potash-rich grade of 13:5:26 are recommended for supporting growth during the middle stages of the crop cycle. Furthermore, other specialized water-soluble fertilizer grades cater to distinct nutritional requirements at different growth phases. To date, the Indian government has officially approved a comprehensive list of 16 distinct grades of water-soluble fertilizers under the established framework of the Fertilizer Control Order, 1985.

Micro-irrigation system is a modern and efficient way to deliver water directly to the plant root zone using a network of pipes and emitters. This method significantly reduces water loss compared to traditional flood irrigation. Moreover, it also helps in reducing the risk of water borne diseases in the crops. In irrigation when water is delivered along with fertilizers its (it is) known as fertigation. Fertigation delivers precise and even nutrient application directly to the active root zone, allowing for tailored nutrient management throughout the crop's growth. This targeted approach makes fertigation more effective than traditional fertilization, potentially reducing fertilizer use by up to 50% while boosting crop yields by 20-30%. (TNAU, agritech portal)

Market potential refers to the maximum possible sales or revenue a product or service can generate within a specific market. It represents the total demand for a product or service, considering factors like market size, customer needs, and competitive landscape. Market potential analysis helps businesses understand their growth opportunities and

make informed decisions about product development, marketing strategies, and resource allocation.

Consumer awareness in the context of modern agriculture extends to farmers and other stakeholders developing a strong understanding of advanced irrigation and nutrient delivery systems, their attitudes towards these advancements and the willingness to adopt these technologies.

Uttar Pradesh is experiencing a significant decline in its water table, with reports indicating that a large portion of the state's groundwater is being over-extracted, leading to a critical depletion in many areas, particularly due to excessive agricultural pumping and increasing population demands. Therefore, it is of utmost importance to understand the efficient utilization which is possible through the Micro Irrigation System.

Moradabad division in Uttar Pradesh has significant potential for fertigation and drip irrigation. The region faces challenges like water scarcity and declining soil fertility, making efficient irrigation methods crucial. Fertigation, the simultaneous application of fertilizers with irrigation water, and drip irrigation, which delivers water directly to plant roots, can help address these issues by improving water use efficiency, reducing fertilizer losses, and enhancing crop yields. This paper aims to evaluate the market potential of micro-irrigation systems within the Moradabad division of Uttar Pradesh while simultaneously assessing the level of awareness among farmers and other stakeholders regarding the benefits and application of water-soluble fertilizers in this specific agricultural region. The findings of this study will provide valuable insights for stakeholders looking to promote and adopt these modern agricultural technologies in Moradabad, Uttar Pradesh. (Hashim, 2015).

REVIEW OF LITERATURE

Malhotra (2016) highlights the increasing importance of horticultural crops in ensuring nutritional security and reducing the pressure on production of cereal crops. However, the author identifies low fertilizer use, with only about 10% of total fertilizer consumption directed towards these crops, as a key constraint in enhancing their productivity.

In this context, the review emphasizes the potential of liquid fertilizers, particularly in protected cultivation, hydroponics, and open-field hydroponics for perennial fruit crops. The author further elucidates the characteristics of water-soluble fertilizers, such as their 100% solubility, low salt index to reduce the potential for burning of plant tissues, and suitability for foliar application and fertigation. The author also mentions that Belgium, Malaysia, UAE, Russia, Israel, China are some of the major fertilizer suppliers of India, and Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala and Gujrat are the major consumers and accounts for around 75% of total consumption of India. The review concludes by highlighting that the total consumption is lower than other countries, despite their potential to enhance crop yields and quality. Author also urges to include water soluble fertilizer in package of practices published by various scientific bodies like the ICAR and mentions that it will help in boosting productivity.

Suvarna & Singh (2021) discusses the evolution of water-soluble fertilizers (WSFs) in India and noted that WSFs were introduced in India in the late 1990s. The initial usage of WSFs was limited to Maharashtra until 2005. By 2011, their adoption has spread to other states, and since 2011, several North Indian states have also begun using WSFs. Initially promoted for horticultural crops, WSFs are now used across nearly all crop segments in India. The market size for WSFs has grown significantly, from approximately 10,000 tonnes in the early 2000s to around 300,000 tonnes in 2021. Key factors driving this growth include the expansion of drip irrigation, the need for improved nutrient delivery efficiency, lack of power and non-availability of labour in rural areas. The authors also highlight that the higher bioavailability of nutrients in WSFs supports plant physiological growth and meets crop nutritional needs during critical stages, contributing to their increased adoption. They suggest that as awareness of WSFs continues to grow, demand will likely increase, driving further innovation in this area.

Krishnamoorthy and Hanif (2014) investigates the impact of different fertilizer types on chilli crop productivity. The authors highlighted that the role of fertilizers is significant in influencing the production of chillies. This

study was conducted in the Pudukkottai district of Tamil Nadu, India, where conventional farming practices are common, and farmers face challenges due to the high cost of water-soluble fertilizers. The authors emphasize that the highest yield and benefit cost ratio were obtained when the recommended dosage of 120:20:80 kg/ha of N, P₂O₅, and K₂O was applied as a water-soluble fertilizer. In contrast to applying 50% and 25% of the appropriate nutrient dose as water soluble fertilizer, with the remaining 50% and 75% being traditional fertilizer. Therefore, it may be said that water-soluble fertilizers improve the efficiency of nutrient usage since they distribute fertilizer uniformly across the active root zone.

Nirocelle et al. (2019) reported a significant increase in the growth of yield and total dry matter were obtained at the 6-leaf growth stage and tasseling stage when a 100% recommended dose of water-soluble fertilizer spray was applied at 0.5% (19:19:19 NPK). The author further reports that the yields of stover, accumulation and maize kernels in comparison to other treatments that could be used in maize cultivation for higher kernel yield and financial returns, higher net returns (₹ 72500/ha-1) and a B: C ratio (2.8) was also observed with 100% of the recommended fertilizer dose followed by 0.5% foliar spray of water-soluble fertilizers at the 6-leaf growth stage and tasseling stage.

Madhavi (2009) Reports about an experiment conducted in the farm of Mahatma Phule Krishi Vidyapeeth, where the best results over all growth metrics were obtained when water soluble fertilizer were applied in 26 splits and in 100% of the recommended doses. Direct relation between water soluble fertilizer levels and cane output was found. The author further reports that drip irrigation techniques yielded higher cane yield (183.31 tonnes per hectare) as compared to the surface irrigation (155.46 tonnes per hectare). It was also mentioned that sugarcane absorbed more NPK from water soluble fertilizers than from traditional fertilizers.

Bajaj, Singh, and Nayak (2023) investigated farmers' willingness to pay for groundwater irrigation within informal groundwater markets in Western Uttar Pradesh, India. This study provides valuable insights into the economic factors influencing irrigation decisions, highlighting the importance of understanding the costs and benefits associated

with different irrigation methods, which is relevant to the adoption of water-soluble fertilizers and micro-irrigation systems.

Vahoniya and Rajwadi (2023) offer a conceptual exploration of markets and market potential, providing a theoretical foundation for understanding these key concepts. Their work likely examines the dimensions of market potential, which is crucial for evaluating the viability and scope of micro-irrigation systems and water-soluble fertilizers in specific agricultural contexts like the Moradabad division. The author defines market potential as the maximum sales available to all the firms in an industry during a given period, under a given level of industry marketing effort and environmental conditions. Further the author reports a common way to estimate total market potential is to multiply the potential number of buyers by the average quantity of each purchase and then by the price.

Hashim (2017) study appraised water resources and their agricultural use in Moradabad district (U.P.) using secondary data from 2001-02 and 2011-12. The findings indicated an uneven distribution of water availability, with some blocks having ample resources while irrigated land and crop production decreased overall during the decade. This highlights importance of water resource management for agriculture in the region.

METHODOLOGY

The author conducted extensive fieldwork throughout the Moradabad Administrative Division of Uttar Pradesh to gather primary data. This involved direct interaction with 85 farmers and 16 distinct retailers and dealers strategically located across the division. Furthermore, insights from the industry were captured through conversations with 10 company representatives actively engaged in the marketing and sales of water-soluble fertilizers for diverse companies operating within various sub-divisions.

The selection of retailers and dealers for these interactions followed a purposive sampling strategy, allowing the author to target key points of sale and distribution within the region. In the case of farmers, a snowball sampling technique was employed, leveraging the networks of retailers to identify and connect with progressive farmers who

were likely users or potential adopters of water-soluble fertilizers and micro-irrigation technologies. This approach facilitated access to farmers with relevant experience and knowledge. Interviews were unstructured and mostly in the farmers' fields.

Complementing the primary data collection, the research also incorporated secondary data sourced from credible platforms. These included official government websites, relevant news articles providing context on the agricultural sector, and existing research papers offering scholarly perspectives on related topics. The market potential was calculated by multiplying the potential number of buyers by the average quantity of each purchase and then by the price. Applying the formula potential number of buyers and average quantity of purchase was considered as one hectare of land and average quantity of purchase is the price of irrigation set per hectare.

RESULTS

The Market Potential

Market Potential = (Cultivated Area - Area under MIS) * Unit Cost of the Micro Irrigation system per hectare.

Number of Farmers in Moradabad Division (UP) are: 1179472

Number of Farmers Who has already installed MIS Systems are: 19629

Total Cultivated land area in Moradabad Division: 1195590 in hectares

Total Cultivated land area under MIS: 11461 in Hectares

Unit Price of installation of MIS per Hectare: 90,000 Rupees

Market Potential: Rupees 10,657.161 crores

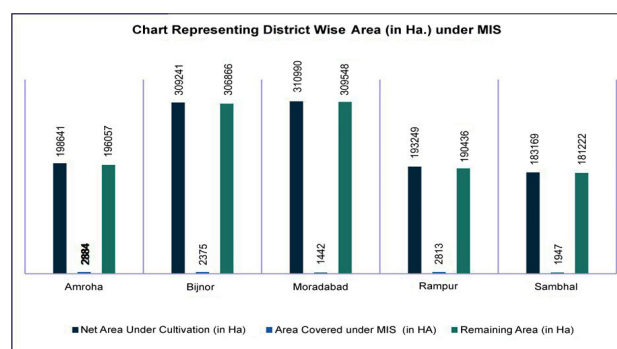


Figure 1: Chart representing district wise area under MIS (in Hectares)

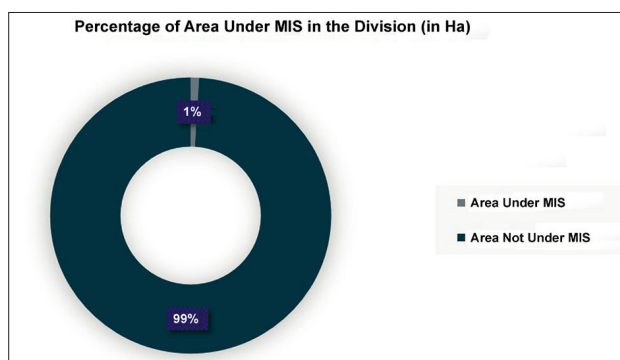


Figure 2: Percentage of Area under MIS in Moradabad Division

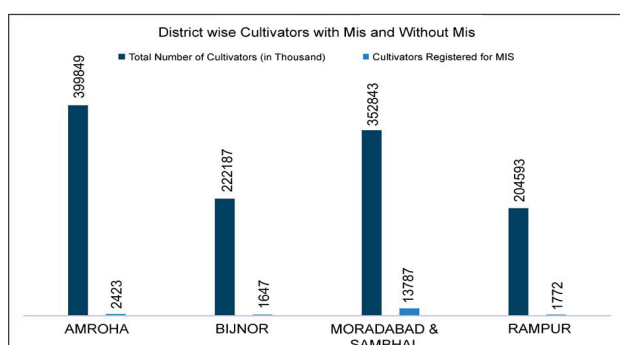


Figure 3: District wise cultivators with MIS and Without MIS



Figure 4: District wise Market Potential (In INR Thousand Crores)

Consumer Awareness

Total Number of Respondents Interacted: 101

Number of Farmers Interacted: 85

Number of Dealers and Retailers Interacted: 16

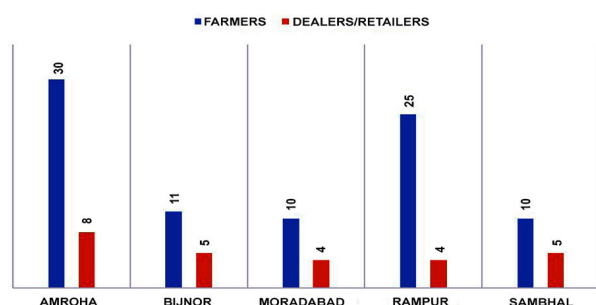


Figure 5: District wise Distribution of Respondents

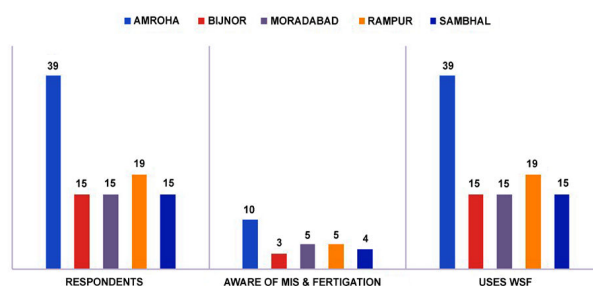


Figure 6: Chart Representing the response of respondents

DISCUSSION

Based on the data, Moradabad and Bijnor demonstrate the highest market potential for micro-irrigation. Amroha, Sambhal, and Rampur collectively present a potential of 2.5 thousand crores. Bilaspur stands out as an exception within Rampur, with larger landholdings and lower rainfall as compared to other parts of the district. Amroha, Moradabad, and Sambhal combined boast a higher population of farmers cultivating their own land, displaying greater awareness and understanding of irrigation needs and water-soluble fertilizers. Despite immense potential, only 1% of farmers have opted for micro irrigation systems or have registered for the UPMIP (Uttar Pradesh Micro Irrigation Project). However, farmers largely remain unaware of the pressing need for micro-irrigation. Despite acknowledging the availability of subsidies, farmers typically do not proactively seek them out.

Water-soluble fertilizers are well-recognized and understood by farmers and the author observed that they are primarily being used as growth promoters rather than primary source of fertilizers. But farmers lack awareness about fertigation and its potential benefits.

Many farmers reported that they encountered significant challenges in integrating the mini-sprinkler system with the existing agricultural practices. The presence of the irrigation setup obstructed the movement of farming equipment like tractor, hindering the operation in the field field operations. They firmly believed that existing irrigation infrastructure, comprising channels and a combination of flood and canal irrigation, was sufficient. Such farmers remained unconvinced of the superior efficiency and benefits offered by the micro irrigation systems. On the other hand, a farmer from Mandi Dhanaura, Amroha, was motivated to install an irrigation system in his mustard fields, and the decision was driven

by the complete failure of his mustard crop in the previous season. The crop succumbed to damping-off disease, a consequence of excessive moisture resulting from flood irrigation and inadequate drainage in his fields.

CONCLUSION

This study investigated the market potential of micro-irrigation systems and consumer awareness of water-soluble fertilizers in the Moradabad division of Uttar Pradesh. The findings reveal a significant market potential of Rupees 10,657.161 crores, indicating a substantial opportunity for the expansion of micro-irrigation technologies in the region. While farmers demonstrated a general awareness of water-soluble fertilizers, their adoption as a primary nutrient source is limited. The study offers a new perspective that water-soluble fertilizers are widely accepted by farmers but predominantly utilized as growth promoters, with conventional fertilizers still preferred for bulk nutrient application. This is further supported by the observation that companies often sell water-soluble fertilizers in combo pricing alongside conventional fertilizers. However, the adoption of micro-irrigation systems remains low due to factors such as perceived incompatibility with existing farming practices and economic constraints. The study also highlights that only 1% of farmers have installed the micro irrigation systems. These results emphasize the need for targeted interventions to promote both micro-irrigation and the optimal use of water-soluble fertilizers, including enhanced farmer education on integrated nutrient management, streamlined subsidy access, and marketing strategies that address farmers' specific concerns regarding both irrigation technology and fertilizer choices. Practically, this research suggests that irrigation and fertilizer companies should focus on demonstrating the ease of integration and cost-effectiveness of micro-irrigation systems and educating farmers on the benefits of water-soluble fertilizers as primary nutrient sources. Future studies could explore the long-term impacts of micro-irrigation and integrated nutrient management and investigate the role of extension services and farmer training in promoting the uptake of these technologies within the agricultural sector.

Conflict of Interests: The author declares no conflict of interests.

Ethics Statement: The authors have nothing to report

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