



Awareness and Usage Pattern of Water-Soluble Fertilizer in Himmatnagar Taluka, Gujarat, India

Asav D. Patel ^{a++} and Chetan R. Dudhagara ^{a#*}

^a International Agribusiness Management Institute, Anand Agricultural University, Anand, Gujarat, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Water-soluble fertilizers have become vital in modern agriculture due to their quick absorption and adaptability to crop needs. These fertilizers are especially significant in fruit and vegetable farming, offering enhanced nutrient delivery and improved crop growth. In India, the fertilizer industry has evolved substantially and is now largely self-reliant. The study was conducted to explore the farmers' awareness and usage pattern of water-soluble fertilizer with 200 samples by using purposive sampling techniques in the himmatnagar taluka of Gujarat. The study revealed that farmers are generally knowledgeable and view these fertilizers as effective and beneficial. Both dealers and farmers emphasized the need for improved pricing, high-quality packaging, and regular product demonstrations. Brand preferences differed depending on performance and availability,

⁺⁺PG Student;

[#]Assistant Professor;

^{*}Corresponding author: Email: drchetan32@gmail.com;

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with certain brands becoming popular due to their strong market presence. The findings also pointed to experienced and educated farmers being open to adopting new technologies. Overall, the study emphasized the growing role and potential of water-soluble fertilizers in Indian agriculture.

Keywords: Water-soluble fertilizers; nutrient delivery; brand preferences; crop growth.

1. INTRODUCTION

Understanding soil chemical properties is crucial as they influence nutrient availability for plants. These properties can often be improved using lime or fertilizers. For healthy growth and life cycle completion, plants require 18 essential nutrients. Soil amendments, such as lime and fertilizers, are used to enhance nutrient availability and improve soil chemistry for better plant nutrition. Advances in fertilizer formulations and application equipment have made soil modification more efficient and cost-effective. Fertilizers, derived from natural and synthetic sources, supply essential nutrients and are available in solid, liquid, and gaseous forms. According to fertilizer association of India, water-soluble fertilizers are particularly favoured in agriculture due to their high solubility, promoting quick nutrient uptake and reducing leaching losses. As a result, these fertilizers are more efficiently absorbed and utilized by plants. They can also be applied through irrigation, making them a highly effective option in modern farming. Additionally, their low seepage rate minimizes groundwater contamination, further contributing to their widespread use among farmers.

Water-soluble fertilizers contribute to both water conservation and reduced fertilizer application. Additionally, government regulations promoting eco-friendly fertilizers and the growing demand for fertigation as a means to optimize water use and enhance economic returns are expected to drive the global water-soluble fertilizers market in the coming years. These fertilizers are suitable for use in aromatic, medicinal, and plantation crops. Furthermore, the rise in crop diseases and declining soil fertility have increased the demand for highly efficient fertilizers worldwide. Water-soluble fertilizers not only enhance the quality and yield of agricultural crops but also help reduce environmental pollution.

The chemicals used in manufacturing soluble fertilizers for fertigation are essentially salts, meaning they dissolve readily in water, breaking down into charged ions. For instance, potassium nitrate (KNO_3) dissociates into two essential nutrient ions: potassium (K^+) and nitrate nitrogen

(NO_3^-). One key advantage of fertigation is that all nutrients are already in an ionic form when applied to crops, making them immediately available for plant uptake. In contrast, granular or controlled-release fertilizers must first dissolve in groundwater before plants can absorb the nutrients. According to Food and Agriculture Organization, the water-soluble fertilizers market is projected to grow at a compound annual growth rate (CAGR) of 7.4% during the forecast period. Numerous multinational companies are actively developing advanced formulations to meet growing demand. The favorable characteristics of water-soluble fertilizers are increasingly being applied in both horticulture and agriculture. Ongoing discoveries of new applications are expected to further accelerate market growth.

The study was conducted with the broad objectives to study awareness of water-soluble fertilizer among the farmers, to study usage pattern and benefits of water-soluble fertilizers among the farmers, to study expectations of farmers and dealers from the company.

2. METHODOLOGY

2.1 Research Methodology

The study on awareness and usage pattern of water-soluble fertilizer was carried out by using the multi stage sampling. Total 200 farmers were selected for the study. The sampling method for selection of the farmers was non-probability sampling under which the purposive sampling technique was used. Primary and secondary data were collected through semi structured schedule to fulfil objectives of the study.

2.2 Analytical Tools

Descriptive statistical tools and techniques like frequency distribution, Percentage and graphical representation were used to meet the stipulated objectives.

2.2.1 Weighted average mean

Weighted average is a type of average where some values in a dataset are given more

importance than others. This importance is reflected by assigning weights to each value, and these weights determine how much each value contributes to the overall average.

Weighted average mean was calculated using the following formula:

$$X = (F1X1 + F2X2 + F3X3 + F4X4 + F5X5) / X_t$$

Where,

F = Weight given to each response

X = Number of responses

X_t = Total number of responses

2.2.2 Garrett's ranking technique

Garrett's ranking technique was employed to analyze and rank the respondents' preferences across various factors. As per this method, respondents have been asked to assign the rank for all factors and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Percentage position} = (100 (R_{ij} - 0.5)) / N_j$$

Where

R_{ij} = Rank given for the ith variable by jth respondents

N_j = Number of variables ranked by jth respondents

3. RESULTS AND DISCUSSION

This section gives clear outline the main findings of the research. It presents the analysis of data in relation to the research objectives, emphasizing observed patterns, and trends. The results are examined in the context of the study's aims, offering valuable insights into the outcomes.

3.1 Socio-economic Profile

This section outlines the social and economic characteristics of the farmers, including key factors such as age, education level, gender, and others. These variables serve as vital resources and play a crucial role in shaping the study's outcomes. The socio-economic profile of the farmers is presented in Table 1.

Table 1 shows socio-economic profile data of 200 farmers which indicates majority farmers (83.50%) were aged between 31 to 50 years old. The majority of farmers with 55.00% had completed their higher secondary education

followed by graduate & above with 22.50%. Small group of farmers were illiterate that suggests a diverse educational background among farmers, with a significant portion having higher secondary or graduate level education. As per annual income 51.50% earn between 5 to 10 lakhs followed by 30.50% were earn between 3 to 5 lakhs annually which reflecting a lower-middle-income group. Farming experience of more than 20 years with 48.50% followed by 33.50% had farming experience between 11 to 20 years which shows that majority of the farmers have significant amount of farming experience.

3.2 Awareness of Water-soluble Fertilizer

The awareness level regarding water-soluble fertilizer among respondents varies significantly, reflecting differing degrees of knowledge and exposure. While some individuals are well-informed about the proper usage, benefits, application, price, doses of water-soluble fertilizers such as improved nutrient absorption and efficient application. The findings suggest a need for increased awareness initiatives to promote the effective and sustainable use of water-soluble fertilizers in agricultural practices. Table 2 represent the awareness about water-soluble fertilizer.

Awareness refers to the farmer's level of understanding and knowledge about water-soluble fertilizers, which plays a crucial role in their adoption and effective use. Table 2 presents an overview of farmers' awareness based on various criteria.

Among the surveyed farmers, 94.00% were knowledgeable about the correct use of water-soluble fertilizers (WSFs) for specific crops, and 90.00% were aware of the different application methods. Additionally, around 82.00% understood the nutrient composition of WSFs, particularly key elements such as nitrogen (N), phosphorus (P), potassium (K), and calcium. Moreover, 75.50% of farmers were aware of the appropriate timing for applying WSFs at different stages of crop growth to maximize productivity. In terms of market awareness, 81.50% farmers were aware about prices of WSFs, and 66.50% farmers were familiar with the available packaging sizes, including 1 kg, 5 kg, 10 kg, and 25 kg. Additionally, 74.50% of the farmers understand the recommended dosages for their respective crops and were aware about proper

Table 1. Socio-economic profile of farmers

Sr. No.	Particular	No. of Respondents	Percentage
1	Age		
	21 to 30 year	13	6.50
	31 to 40 year	57	28.50
	41 to 50 year	110	55.00
	Above 50 year	20	10.00
	Total	200	100.00
2	Education		
	Illiterate	17	8.50
	Up to SSC	28	14.00
	Up to HSC	110	55.00
	Graduate & above	45	22.50
	Total	200	100.00
3	Land-holding		
	< 1 ha	14	7.00
	1 to 2 ha	58	29.00
	2 to 4 ha	105	52.50
	4 to 10 ha	17	8.50
	> 10 ha	6	3.00
	Total	200	100.00
4	Annual Income		
	< 1 lakh	4	2.00
	1 to 2 lakh	13	6.50
	3 to 5 lakh	61	30.50
	5 to 10 lakh	103	51.50
	> 10 lakh	19	9.50
	Total	200	100.00
5	Farming Experience		
	< 6 year	17	8.50
	6 to 10 year	19	9.50
	11 to 20 year	67	33.50
	> 20 year	97	48.50
	Total	200	100.00

(Source: Field Survey, 2025)

stages for application, contributing to improved yields.

Regarding sources of awareness, the majority (67.50%) of farmers gain information from friends and dealers, indicating a strong reliance on personal networks and trusted sources. Around 17.00% of farmers become aware through exhibitions organized at different places, while 15.50% of farmers receive information via advertisements through different media. This suggests that farmers primarily trust dealers and peers, valuing their practical experience and product knowledge.

3.3 Usage Pattern of Water-soluble Fertilizers

The usage pattern of WSFs among farmers reveals a growing preference for these inputs due to their efficiency and effectiveness. The

adoption of WSFs reflects a shift toward more sustainable and scientifically informed farming practices.

Table 3 highlights the use of WSFs across various crops in Himmatnagar taluka of Sabarkantha district. The data shows that a majority of farmers—112 (56.00%) use WSFs for cultivating both vegetable and field crops. Another 57 (28.50%) farmers use them exclusively on vegetable crops, while the remaining 31 (15.50%) farmers apply WSFs to field crops alone.

Among the different types/grades of WSFs used, NPK (19:19:19) is the most commonly preferred due to its adaptability for application at any crop growth stage. Potassium sulphate (00:00:50) is also widely used, with 191 (95.50%) of farmers favouring it. Mono ammonium

Table 2. Awareness of water-soluble fertilizer

Sr. No.	Particular	No. of aware farmers (n=200)	Percentage
1	Awareness Regarding Biostimulants		
	Do you know about water-soluble fertilizer?	200	100.00
	Do you know that in which crop water-soluble fertilizer is used?	188	94.00
	Do you know the method of application of water-soluble fertilizer?	180	90.00
	Do you know about nutrient content of water-soluble fertilizer?	164	82.00
	Do you know the most suitable time for application of water-soluble fertilizer for the best result?	151	75.50
	Do you know about the price of water-soluble fertilizer?	163	81.50
	Do you know about size of packing available of water-soluble fertilizer?	133	66.50
	Do you know doses of different water-soluble fertilizers in major crops you grown?	149	74.50
2	Source of Awareness		
	Advertisement	31	15.50
	Exhibitions	34	17.00
	Through dealer	93	46.50
	Through friends	42	21.00
	Total	200	100.00

(Source: Field Survey, 2025)

Table 3. Usage of water-soluble fertilizers

Sr. No.	Particular	No. of Respondents	Percentage
1	Types of Crops		
	Field crops	31	15.50
	Vegetables	57	28.50
	Both	112	56.00
	Total	200	100.00
2	Different Grades		
	NPK (19:19:19)	194	97.00
	Mono-Ammonium Phosphate (12:61:00)	179	89.50
	Potassium Nitrate (13:00:45)	167	83.50
	Mono-Potassium Phosphate (00:52:34)	158	79.00
	Potassium Sulphate (00:00:50)	191	95.50
	Calcium Nitrate (15.5:00:00:18.8)	160	80.00
	Others	153	76.50

(Source: Field Survey, 2025)

phosphate (12:61:00) is another frequently chosen fertilizer, especially during the early growth and flowering stages of crops. Additionally, Mono potassium phosphate (00:52:34), potassium nitrate (13:00:45) and Calcium nitrate (15.5:00:18.8) are commonly used as basal applications, with mono potassium phosphate also being applied during the flowering phase.

3.4 Expectations of Farmers and Dealers from the Company

Understanding the expectations of both farmers and dealers is essential for fostering strong relationships, promoting product adoption, and improving customer satisfaction. Table 4 presents the expectations of farmers and dealers from the company.

The table presents the expectations of both farmers and dealers from the company, along with their respective mean scores and ranks.

Among farmers, the most important expectation is the availability of water-soluble fertilizers at a lower price, which received the highest mean score and top rank. This is followed by the demand for spot demonstrations and farmer meetings, which farmers view as essential for understanding product application. The third most important expectation is the assurance of good quality and proper packaging, while timely availability of fertilizers is ranked fourth. The introduction of new products is considered the least important expectation among the listed factors.

For dealers, the highest priority is also a lower product price along with increased profit margins, receiving the top mean score and rank. Promotional activities were the second most important expectation, reflecting the dealers' interest in marketing support to boost sales. The third rank is given to spot demonstrations and farmer meetings, highlighting their role in

Table 4. Farmers and dealers expectations from the company

Sr. No.	Particular	Mean Score	Rank
1	Farmers Expectation		
	Less Price	64.92	1
	Spot Demonstration and farmers Meetings	57.75	2
	Good Quality and Good Packaging	52.33	3
	Timely Availability	38.58	4
	New Product	36.42	5
2	Dealers Expectation		
	Less Price and Increasing Margin	69.33	1
	Promotional Activity	52.25	2
	Spot Demonstration and Farmers Meeting	46.58	3
	Good Quality and Good Packaging	43.75	4
	Timely Availability	38.08	5

(Source: Field Survey, 2025)

creating product awareness. Good quality and appealing packaging follow in fourth place. Timely availability of the fertilizers, although important, is ranked lowest among the expectations of dealers.

4. CONCLUSION

The study revealed that the majority of farmers 55.00% were aged between 41 to 50 years, and notably, all 200 respondents were male, indicating a complete lack of female representation in the sample. More than half of the farmers 55.00% had attained higher secondary education, and nearly half 48.50% had over two decades of farming experience, suggesting a knowledgeable and experienced group. Regarding landholding and income, 52.50% of the respondents managed farms ranging from 2 to 4 ha, while 51.50% reported annual earnings between ₹5 and ₹10 lakhs, pointing to moderate to high income levels. All participants were aware of WSFs, with the majority 67.50% obtaining information from friends and dealers. Farmers demonstrated a strong understanding of water-soluble fertilizers (WSFs), including their application methods, nutrient composition, and recommended dosages. Approximately 56.00% of respondents reported using WSFs on both vegetable and field crops. Among the various grades, NPK (19:19:19) and Potassium Sulphate (00:00:50) were the most widely adopted, recognized for their effectiveness and broad applicability. Regarding expectations, farmers emphasized the need for more affordable pricing, regular product demonstrations and meetings, and improved packaging. Dealers expressed similar concerns, prioritizing reduced product prices, higher profit margins, and increased promotional support.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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