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Socio-Economic and Buying Behavior of Groundnut Growers towards Micronutrient Fertilizer in Sabarkantha District of Gujarat, India

P. G. Chauhan [a++*], R. M. Jadeja [b#], L. K. Saini [a++] and A. P. KHANT [a++]

[a] Collage of Agribusiness Management, SDAU, Sardarkrushinagr, Gujarat, India.
[b] Regional Research Station, SDAU, Bhachau, Gujrat, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study aims to analyze the impact of socio-economic, knowledge level and buying behavior of groundnut growers towards micronutrient in Sabarkantha district. This study employed a multistage sampling technique in the Sabarkantha district of north Gujarat, known for its high groundnut productivity. The focus was on three talukas-Himmatnagar, Idar and Talod-chosen for their extensive groundnut cultivation areas in 2024. From each taluka, five villages were randomly selected and eight growers from each village, totaling 120 growers, were selected. The study aimed

[++]Post-Graduate Student;
[#]Assistant Research Scientist;
**Corresponding author: E-mail: pruthvirajsinh774@gmail.com;*

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to explore the socio-economic profiles of groundnut growers, assess their knowledge of micronutrient fertilizers, analyze their buying behavior. The majority of growers (55.83%) were between 36 and 50 years old, with more than 15 years of farming experience. Most belonged to nuclear families and had completed higher secondary education. Borewells and open wells were the main irrigation sources, with 57.50% also involved in animal husbandry. Annual incomes ranged between ₹1,44,901 and ₹6,72,800. Additionally, 73.33% between ₹3,38,501 and ₹8,26,500 from both farming and other sources. Groundnut growers demonstrated high awareness of the importance, access and benefits of micronutrients, though only 19.17% had soil health cards. Agro-input dealers (54.16%) were the primary information source and mixed micronutrients (49.16%) were most preferred. The study found a strong relationship between socio-economic variables and buying behavior, with 96.20% of the variation explained. Positive influences on purchasing included the price of micronutrients, growers' income, farming experience and larger landholdings, while older growers and those with higher knowledge were less likely to purchase micronutrients. Most growers (75.00%) purchased from agro-service centers or dealers. This comprehensive analysis provides valuable insights into the socio-economic profiles, knowledge and buying behavior of groundnut growers in the Sabarkantha district.

Keywords: Groundnut; micronutrient; fertilizer; socio-economic; buying behavior; knowledge.

1. INTRODUCTION

Fertilizers, essential for soil fertility and crop yields, include organic (e.g., manure) and inorganic types (e.g., potassium chloride). Russia leads global fertilizer exports, followed by Canada and China. India's fertilizer market is projected to grow at 4.7% CAGR to reach $1160.18 billion by 2028 [1]. Micronutrient fertilizers, crucial for plant health, come in inorganic salts (e.g., sulphates) and chelates (e.g., EDTA). Groundnut, or peanut (*Arachis hypogaea* L.), a significant oilseed, is widely used for cooking and is rich in vitamin E, fatty acids and carbohydrates. It is widely cultivated in tropical and subtropical regions worldwide, including Sabarkantha district in Gujarat, India. During the 2020-21 Kharif season, Sabarkantha district saw extensive groundnut cultivation, with Himmatnagar leading in cultivated area. The district achieved high productivity with an average yield of 3,057.24 kg/ha in 2021-2022, showcasing efficient agricultural practices and favorable growing conditions in Gujarat [2].

2. METHODOLOGY

The multistage sampling technique was adopted as per the objective of the study. In the first stage, Sabarkantha district was selected purposively because the productivity of groundnut in north Gujarat is high in 2024. In the second stage, three talukas from Sabarkantha district were selected purposively i.e., Himmatnagar, Idar, Talod, because these talukas possess highest area under cultivation. In the third stage, from each taluka five villages were selected randomly and from each village eight farmers were selected randomly. In this way total 120 farmers were selected from Sabarkantha district.

To study the socio-economic characteristic and knowledge of micronutrient fertilizers among groundnut growers in Sabarkantha district, a simple tabular analysis method was used, surveys and interviews were conducted. The data regarding the annual income and annual income +other source of the groundnut growers was analyzed by the mean and standard deviation method and divided into three categories according to Mean - S.D., Mean ± S.D., and Mean + S.D.

Mean ($\overline{X}$): Mean is the average of the numbers or a calculated 'central' value of a set of numbers. This technique was used for classification of the respondents into different categories. This was obtained by total score divided by the numbers of the respondents.

$$\overline{X} = \frac{\sum X_i}{n}$$

Standard deviation (S.D.): Standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values. Standard deviation was calculated by taking the difference of each item (X_i) in the sample from their arithmetic mean ($\overline{X}$), squaring this difference $(X_i - \overline{X})2$, summing all the squares differences $\sum (X_i - \overline{X})2$, dividing by the number of items minus one (n - 1) and then extracting the square root. Standard deviation was calculated by using following formula:

$$S.D. = \sqrt{\frac{\sum(X_i - \bar{X})^2}{n-1}}$$

Multiple Regression Method: To study the factors influencing the buying behavior of growers for purchasing of micronutrient fertilizer for groundnut crop, multiple regression method was used in Microsoft Excel. The model is given as:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n + u$$

Where,

y = Expenditure on micronutrient (Rs/ha)	x_5 = Land holding (ha)
b_0 = Intercept	x_6 = Education of farmer (Illiterate-1, Primary level-2, Secondary level-3, Higher secondary-4, Graduation / post-graduation-5)
x_1 = Price of the product (Rs)	x_7 = Frequency of application
x_2 = Farmer income (Rs)	x_8 = Knowledge score
x_3 = Farming experience	u = Error term
x_4 = Age	

Objective:

1. Socio-economic characteristic of groundnut grower
2. Knowledge level of micronutrient fertilizers among the groundnut growers
3. Buying behavior of the groundnut growers with respect to micronutrient fertilizers

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristic of Groundnut Grower

3.1.1 Age

The results indicate that 55.83% of groundnut growers belong to the middle age group (36 to 50 years) followed by the old age group (above 50 years) at 30.00% and only 14.17% of groundnut growers belong to the young age group (18 to 35 years). Similar findings were reported by Choudhary et al. [3] and Gayathri and Sahana [4] in Banaskantha district. The result revealed that more than half of the respondents belonged to middle age category.

3.1.2 Farming experience

The results showed that the agricultural experience of the sample respondents, who were groundnut growers divided into four groups according to their growing experience. The majority (60.83%) of groundnut growers had at least 15 years of experience followed by 17.50% with 6 to 10 years of experience and 16.67% with 11 to 15 years of experience%). This pattern of farming experience indicated that the majority of groundnut growers had more than 15 years of farming experience. Similar findings were reported in Hadiya and Deshmukh [5].

3.1.3 Family type

The results were displayed in Table 1, It was observed that the majority of groundnut growers (60.83%) belonged to the nuclear family, while a comparatively lesser percentage (39.17%) belonged to the joint family.

3.1.4 Educational

It was observed that 30.00% of groundnut growers have studied up to higher secondary level. Among these groundnut growers, 26.67% have attained graduation or post-graduation level followed by 20.00% who have studied up to the secondary level. Additionally, 17.50% of groundnut growers have studied up to the primary level and 05.83% of groundnut growers were reported as illiterate [6].

3.1.5 Size of land holding

The groundnut growers were categorized into five groups based on their land holdings. The highest percentage (44.17%) of groundnut growers belonged to the medium size land holding category followed by the semi-medium land holding category (28.34%). Additionally, 13.33% of the growers fell into the small land holding category, 08.33% in the marginal land holding category and only 05.83% belonged to the large land holding category. This pattern of

land-holding distribution showed that most groundnut growers belonged to the medium and semi-medium land-holding categories. Similar findings were reported by Hadiya and Deshmukh [5] Kharif groundnut growers in the Saurashtra zone of Gujarat which study concluded that majority of respondents belonged to medium size of land holding (65.83%).

3.1.6 Sources of irrigation

The results showed that the main source of irrigation water for groundnut growers was a combination of borewells and open wells, accounting for 44.16%. Borewell was also a significant irrigation source utilized by 14.17% of groundnut growers. Additionally, open wells were another important irrigation source utilized by 41.67% of groundnut growers.

3.1.7 Occupation

The results revealed that the majority (57.50%) of the growers were engaged in farming alongside animal husbandry, with another significant portion (12.50%) involved in farming alongside business. Furthermore, 10.84% were engaged in farming along with animal husbandry and business, while 10.00% were involved in farming alongside services. A smaller percentage of growers were engaged solely in farming (5.83%) or in combinations such as farming with animal husbandry and service (3.33%) or farming with animal husbandry, business, and service (1.67%). Similar findings were reported by Chaudhary et al. [3]. In Banaskantha district, study concluded majority of respondents depended on agriculture + animal husbandry.

3.1.8 Annual income

The results revealed that 71.66% of the groundnut growers have an annual income in the range of ₹1,44,901 to ₹6,72,800(1USD≈₹84.00). Meanwhile, 16.67% of the growers have an annual income of more than or equal to ₹6,72,801, and 11.67% have an annual income of less than or equal to ₹1,44,900. This pattern indicated that the majority of groundnut growers have a moderate level of annual income. Similar findings were reported in Patel et al. [7] and Gajera et al. [8].

3.1.9 Annual income from farming and other source

The results revealed that 73.33% of the groundnut growers have an annual income in the range of ₹3,38,501 to ₹8,26,500. Meanwhile, 17.50% of the growers have an annual income of more than or equal to ₹8,26,501, and 9.17% have an annual income of less than or equal to ₹3,38,500.

Table 1. Categorization of groundnut growers according to their socio-economic characteristic (n=120)

Variables	Category	Frequency (n)	Percentage (%)
Age	Young age (18 to 35 years)	17	14.17
	Middle age (36 to 50 years)	67	55.83
	Old age (above 50 years)	36	30.00
Farming experience	Up to 5 Years	06	05.00
	6 to 10 Years	21	17.50
	11 to 15 Years	20	16.67
	More than 15 Years	73	60.83
Type of family	Joint	47	39.17
	Nuclear	73	60.83
Education	Illiterate	7	05.83
	Primary (1 to 8 std.)	21	17.50
	Secondary (9 or 10 std.)	24	20.00
	Higher secondary (11 or 12 std.)	36	30.00
	Graduation /post-graduation	32	26.67
Size of land handling	Marginal (Up to 1.0 ha)	10	08.33
	Small (1.01 to 2.0 ha)	16	13.33
	Semi medium (2.01 to 4.0 ha)	34	28.34
	Medium (4.01 to 10.0 ha)	53	44.17
	Large (more than 10.0 ha)	07	05.83
Source of irrigation	Borewell	17	14.17
	Open well	50	41.67
	Borewell + Open well	53	44.16

Variables	Category	Frequency (n)	Percentage (%)
Occupation	Farming	07	05.83
	Farming+ Animal husbandry	69	57.50
	Farming+ Animal husbandry + Business	13	10.84
	Farming+ Animal husbandry + Service	04	03.33
	Farming+ Business	15	12.50
	Farming+ Service	12	10.00
Annual income	Low (≤ ₹1,44,9000	14	11.67
	Medium (₹ 1,44,901- 6,72,800)	86	71.66
	High (≥ ₹6,72,801)	20	16.67
	Mean- 408800	S.D.- 2640000	
Annual income + Other source	Low (≤ ₹3,38,500)	11	09.17
	Medium (₹3,38,501- 8,26,500)	88	73.33
	High (≥ ₹8,26,5010)	21	17.50
	Mean- 582500	S.D.- 244000	

3.2 Knowledge Level of Micronutrient Fertilizers among the Groundnut Growers

3.2.1 Knowledge level of micronutrient fertilizers among the groundnut growers

The results indicated that 100.00% of the groundnut growers were aware of the importance of micronutrients for groundnut cultivation and applied micronutrients to their crops. Additionally, 100.00% of the growers were satisfied with the availability of micronutrient fertilizers in their area. A significant majority (93.33%) knew about the specific micronutrients recommended for groundnut cultivation, and 87.50% were familiar with the symptoms of micronutrient deficiencies. Based on their experience, 84.17% noticed improvements in groundnut yield or quality after using micronutrient fertilizers. Furthermore, 67.50% were familiar with the recommended dosage of micronutrients for groundnut cultivation, while 41.67% consulted agricultural experts or extension services for advice on micronutrient management. However, only 34.17% thought micronutrient deficiencies were more common in their soil types or regions. In terms of formal education, 20.00% had received training regarding micronutrient management in agriculture. Partially similar result found in Patel et al. [9], Magarvadiya [10] and Chaturvedi et al. [11].

3.2.2 Sources groundnut growers used for information on micronutrient application and deficiency management in groundnut crops

The majority of growers (54.16%) relied on agro-input dealers for information. This was followed by 20.83% of growers who received information from the local co-operative society and 19.16% who got information from friends or relatives. Social media or online platforms were a source for 18.33% of the growers. Farmers meetings were attended by 11.66% of the growers for this information, while 2.50% relied on Self-assess. Similar findings were reported in Vithani and Pundir [12].

3.2.3 Micronutrient fertilizer preference in groundnut crop

A majority of the growers (49.17%) preferred using mixed micronutrients for their groundnut crops. This was closely followed by 47.50% of the growers who preferred using both single and mixed micronutrients. Only a small fraction (3.34%) of the growers preferred using single micronutrients.

3.3 Buying Behavior of the Groundnut Growers with Respect to Micronutrient Fertilizers

3.3.1 Factors influencing the buying behavior of groundnut growers with respect to micronutrient fertilizers

The results showed that the coefficient of multiple determination (R2) is 0.962, indicating that the explanatory variables included in the model explain over 96.2% of the variation in the purchasing behavior of groundnut growers for micronutrient fertilizers.

The coefficient for the price of the product was 6.26, which was positive and highly significant ($p<0.001$). This suggests that as the price of the micronutrient fertilizer increases, the buying behavior of groundnut growers was positively influenced. The coefficient for farmer income was 0.001, which was positive and significant ($p<0.001$). This implies that an increase

Table 2. Knowledge level of micronutrient fertilizers among the groundnut grower (n=120)

Sr. No.	Particular	Frequency (n)	Percentage (%)
1.	Are you aware of the importance of micronutrients for groundnut cultivation?	120	100.00
2.	Do you apply micronutrients to your groundnut crops?	120	100.00
3.	Are you satisfied with the availability of micronutrient fertilizers in your area?	120	100.00
4.	Do you know any micronutrients applied or recommended for groundnut cultivation?	112	93.33
5.	Are you familiar with the symptoms of micronutrient deficiencies in groundnut crops?	105	87.50
6.	Based on your experience, have you noticed any improvements in groundnut yield or quality after using micronutrient fertilizers?	101	84.17
7.	Are you familiar with the recommended dosage of micronutrients for groundnut cultivation?	81	67.50
8.	Do you consult agricultural experts or extension services for advice on micronutrient management?	50	41.67
9.	Do you think micronutrient deficiencies are more common in your soil types or regions?	41	34.17
10.	Have you received any formal training or education regarding micronutrient management in agriculture?	24	20.00
11.	Do you have soil health card?	23	19.17

Table 3. Sources use for information on micronutrient application and deficiency management in groundnut crops (n=120)

Sr. No.	Sources	Frequency (n)	Percentage (%)
1.	Agro input dealers	65	54.16
2.	Local co-operative society	25	20.83
3.	Friends/ Relatives	23	19.16
4.	Social media/ Online platform	22	18.33
5.	Farmers meeting	14	11.66
6.	Self-assess	03	02.50

Table 4. Distribution of micronutrient fertilizer preference in groundnut crop (n=120)

Sr. No.	Micronutrient	Frequency (n)	Percentage (%)
1.	Mix micronutrient	59	49.16
2.	Both	57	47.50
3.	Single micronutrient	4	03.34
Total		120	100.00

Table 5. Factors influencing the buying behavior of groundnut growers regarding micronutrient fertilizers (n=120)

Sr. No.	Factors	Coefficients	P-value
1.	Intercept	2592.08	0.000
2.	Price of the product	6.26**	0.001
3.	Farmer income	0.001**	0.001
4.	Farming experience	32.44**	0.014
5.	Age	-50.75*	0.001
6.	Land holding	69.98*	0.043
7.	Education of farmer	-48.81 ^{NS}	0.406
8.	Frequency of application	149.84^{NS}	0.077
9.	Knowledge score	-83.07**	0.004
R^2		0.962	

*(*Significance at 0.05 level, **Significance at 0.01 level, NS- Non significance)*

Table 6. Distribution of growers according to their place of buying (n=120)

Sr. No.	Place of buying	Frequency (n)	Percentage (%)
1.	Agro service center/Dealer	90	75.00
2.	Co-operative& Mandli	19	15.84
3.	Online	11	09.16
Total		120	100

in farmer income has a positive impact on the buying behavior, although the effect size was very small. The coefficient for farming experience was 32.44, which was positive and significant (p=0.014). This indicates that growers with more farming experience were more likely to purchase micronutrient fertilizers. The coefficient for age was -50.75, which was negative and significant (p<0.001). This suggests that older growers were less likely to purchase micronutrient fertilizers [13].

The coefficient for land holding was 69.98, which was positive and significant (p=0.043). This indicates that farmers with larger fields were more likely to buy micronutrient fertilizers because they needed more of these inputs to cover their extensive land. The coefficient for the education of the farmer was -48.81, which was negative but not significant (p=0.406). This suggests that the education level of the farmer does not significantly influence the purchasing behavior for micronutrient fertilizers [14-18]. The coefficient for the frequency of application was 149.84, which was positive but not significant (p=0.077). This implies that while frequent application might influence buying behavior, the effect was not statistically significant. The

coefficient for the knowledge score was -83.07, which was negative and significant (p=0.004) [19-22]. This could be because more knowledgeable farmers are better informed about the appropriate doses and effective use of fertilizers, reducing the need to purchase excessive quantities.

3.3.2 Place of buying groundnut growers for micronutrient

The majority of the growers (75%) bought their micronutrients from agro-service centers or dealers. This was followed by 15.84% of the growers who purchased from co-operative societies, or mandlis. A smaller percentage (9.16%) of the growers bought their micronutrients online. Similar findings were reported by Amaliyar and Singh [23].

4. CONCLUSION

The majority of groundnut growers (55.83%) were between the ages of 36 and 50 years. Most (60.83%) of the groundnut growers had more than 15 years of farming experience. Results revealed that 60.83% of the growers belonged to nuclear families. In terms of educational level, most respondents had completed higher secondary education (30.00%), followed by graduation (26.67%). Most growers (44.17%) belonged to the medium-size landholding category. Additionally, 57.50% of groundnut growers were involved in farming and animal husbandry. The distribution of groundnut growers by yearly income from farming revealed that 71.66% of growers fell within the range of ₹1,44,901 to ₹6,72,800; while annual income from farming plus other sources showed that 73.33% of groundnut growers were in the range of ₹3,38,501 to ₹8,26,500.

Groundnut growers demonstrated high awareness of micronutrient importance, access and benefits, but only 19.17% had soil health cards. Agro-input dealers were the dominant source of information (54.16%) for groundnut growers regarding micronutrients, with mixed micronutrients being the most preferred type (49.16%) in Sabarkantha district. The price of micronutrient fertilizers and farmer income positively and significantly influenced the purchasing behavior of groundnut growers. Farming experience and larger landholdings significantly increased the likelihood of purchasing micronutrient fertilizers. Conversely, older farmers were significantly less likely to purchase micronutrient fertilizers. Higher knowledge scores also significantly reduced the purchasing of micronutrient fertilizers, possibly due to better-informed nutrient management practices. The majority of groundnut growers (75.00%) purchased their micronutrients from agro-service centers or dealers.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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