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DOI: https://doi.org/10.64388/IREV9I5-1712363

Product Evaluation of Nayazinc and Farmer Satisfaction – A Study in Rallis India Limited, Baloda Bazar, C.G.

AKHIL JAISWAL[1], SUMITA DAVE[2]
[1]*MBA, Amity University, Raipur, Chhattisgarh*
[2]*Pro. Vice Chancellor Amity University, Raipur, Chhattisgarh*

Abstract- ***This study, titled "Product Evaluation of Nayazinc and Farmer Satisfaction – A Study in Rallis India Limited, Baloda Bazar, C.G.," evaluates the agronomic efficacy and market perception of Nayazinc, a key agricultural input. The primary objective was to quantify the impact of Nayazinc on crop yield and to analyze farmer behavior regarding product awareness, perception, and post-usage satisfaction within the Baloda Bazar region.The findings reveal a statistically significant positive association between Nayazinc application and crop productivity. The linear regression model (Yield = 20.733 + 8.067X) indicates that Nayazinc users achieved an average yield increase of 8.067 qtl/acre compared to non-users. Qualitative analysis demonstrates a "Marketing Gap": while product awareness is moderate (Mean Score: 3.14/5), user satisfaction is exceptionally high (Mean Score: 4.53/5), with 93.3% of users expressing positive feedback.The study concludes that while Nayazinc delivers superior technical results and benefits from the strong brand association of Rallis India Ltd, its market potential is currently under-leveraged. The report suggests that bridging the gap between awareness and trial is key to unlocking the product's full market share in Chhattisgarh.***

Index Terms- ***Nayazinc; Micronutrient Fertilizer; Zinc Deficiency; Crop Yield Analysis; Farmer Satisfaction; Product Evaluation; Rallis India Ltd.; Baloda Bazar; Agricultural Productivity; Soil Health; Zinc Sulphate Comparison; Adoption Behaviour; Agronomic Performance; Input Efficiency; Chhattisgarh Agriculture.***

I. INTRODUCTION

Agriculture remains the backbone of India's economy, with the prosperity of rural communities closely linked to the effective use of modern farming inputs and technologies. In this context, understanding farmer behavior, preferences, and decision-making patterns has become essential for agribusiness companies seeking to deliver impactful solutions. Consumer analysis provides critical insights into how farmers perceive agricultural products, what influences their purchase decisions, and how advisory services can be tailored to maximize value. As competition intensifies in the agro-input sector, organizations must adopt a more farmer-centric approach that integrates market understanding with effective product communication and advisory support.

Agriculture in India continues to rely heavily on balanced nutrient management to sustain crop productivity and soil health. Among the essential micronutrients, zinc plays a critical role in plant growth, enzymatic activity, and grain formation. However, widespread zinc deficiency in Indian soils, especially in states like Chhattisgarh, has emerged as a major constraint to achieving higher and sustainable yields. Traditional zinc sources such as zinc sulphate are commonly used, yet their effectiveness is often limited due to issues like nutrient fixation, low use efficiency, and inconsistent availability to plants throughout the crop cycle.

In this context, Rallis India Limited, a Tata enterprise, introduced Nayazinc, a patented and FCO-compliant zinc-based micronutrient fertilizer formulated with a unique polyphosphate-bound release mechanism. This formulation enhances zinc availability, minimizes fixation in the soil, and ensures sustained nutrient supply to crops. Nayazinc also contains magnesium, which further supports photosynthesis and early vegetative growth. Because of these attributes, the product is positioned as a superior alternative to conventional zinc fertilizers,

with potential to significantly improve crop yields, particularly in zinc-deficient regions.

The district of Baloda Bazar in Chhattisgarh is predominantly agrarian, with farmers engaged in the cultivation of paddy, wheat, maize, pulses, and oilseeds. Ensuring adequate micronutrient supply is crucial for improving the productivity of these crops. Despite the introduction of innovative inputs like Nayazinc, empirical studies assessing its real-world performance and farmer acceptance in this region remain limited. Understanding how farmers perceive the product, whether it leads to measurable yield improvements, and what factors influence their satisfaction is essential for promoting scientifically sound nutrient management practices.

This study, therefore, focuses on product evaluation, farmer satisfaction, and the association between Nayazinc use and crop yield in Baloda Bazar. Through field data, farmer surveys, and statistical analysis, the study aims to provide evidence-based insights into the agronomic effectiveness and practical benefits of Nayazinc. The findings will contribute to both agricultural research and industry practices by identifying the factors that drive adoption and by validating the product's potential to enhance farm productivity in zinc-deficient soils.

Objectives

The main aim of this study is to evaluate the effectiveness of Nayazinc as a micronutrient fertilizer and its impact on crop productivity in Baloda Bazar, Chhattisgarh, along with assessing farmer satisfaction. The specific objectives are:

To evaluate the agronomic performance of Nayazinc by measuring the association between Nayazinc application and crop yield, determining whether its use leads to significant productivity improvement.

To assess farmer awareness, perception, and satisfaction regarding the use of Nayazinc.

II. REVIEW OF LITERATURE

Evaluation of Soil Fertility Status of Palari Block under Baloda Bazar District of Chhattisgarh

Between 2016 and 2017, an investigation was conducted to assess the soil fertility of the Palari block in Baloda Bazar district, Chhattisgarh. Spanning 18 villages, the study utilized GPS technology to systematically collect 970 geo-referenced surface samples (depth of 0–0.15 m) across Inceptisol, Alfisol, and Vertisol soil orders. These samples were mapped at a 1:4000 scale and analyzed for key parameters—specifically pH, electrical conductivity (EC), organic carbon (OC), Nitrogen (N), Phosphorus (P), and Potassium (K)—to characterize the region's fertility status based on its physico-chemical properties. (Bal Krishna, 2018)

Application of Consumer Behavior Analysis in Marketing Strategies

Consumer behavior analysis enables the selection of suitable promotional methods and channels tailored to consumers' information acquisition preferences, which can enhance product promotion effectiveness. - In-depth insights into consumer decision-making stages, from awareness to post-purchase, reveal market opportunities for targeted crop advice in promotional strategies. - By understanding consumers' needs and preferences through analysis, companies can develop personalized promotional approaches that better align with market demands for crop-related products. (Liu X. , 2024)

Consumer Behaviour: Applications in Marketing

Consumer patterns such as loyalty and brand equity inform targeted crop advice to build long-term engagement and extend product lines effectively in agricultural promotions. - Attitudes, beliefs, and purchase intentions guide the development of persuasive crop recommendations that align with farmers' behaviors to drive product sales. - Responses to advertising and retail settings enable tailored promotional strategies for crop advice, enhancing consumer satisfaction and reducing complaints about product quality.

Comparative Efficiency of Zinc Sources

The efficacy of zinc supplements can vary based on the source and method of application. Shivay, Prasad, and Rahal (2008) analyzed the relative efficiency of zinc-enriched urea versus zinc sulfate. Their study suggests that while different formulations exist, the bioavailability of zinc to the plant is the primary

determinant of yield improvement. This literature supports the hypothesis that commercial formulations, such as the "Nayazinc" evaluated in this study, function by correcting these bioavailability gaps.

The Role of Quantitative Analysis in Agricultural Research

Quantitative analysis serves as the backbone of modern agronomic research, providing the objective framework necessary to distinguish between random environmental variability and true treatment effects. Snedecor and Cochran (1989), in their seminal work on statistical methods, established that agricultural experiments require rigorous mathematical modelling to minimize bias. By converting field observations—such as crop yield—into numerical data, researchers can apply inferential statistics to draw conclusions that are generalizable beyond the specific sample plot.

III. RESEARCH METHODOLOGY

Research methodology serves as the strategic blueprint for a study, detailing the systematic protocols employed to gather and interpret data. It encompasses the specific design choices a researcher makes to ensure the investigation yields credible, consistent findings that align with the project's core objectives.

Research Design

This study adopts a descriptive and analytical research design.

- Descriptive: To describe the current use, perception, and satisfaction of farmers regarding Nayazinc.
- Analytical: To examine the association between Nayazinc application and crop yield.

This mixed approach enables the researcher to combine field observations with statistical analysis for meaningful insights.

Study Area

The research was conducted in Baloda Bazar district, Chhattisgarh, a predominantly agricultural region known for paddy, wheat, pulses, and vegetable cultivation. The region is significant for Rallis India due to its large farmer population and agrochemical consumption pattern.

Target Population

The target population consists of farmers using Nayazinc in their fields, agricultural extension officers, and field representatives of Rallis India Limited in Baloda Bazar.

Sample Size and Design

The study utilized a total sample size of 30 respondents (N=30). The respondents were stratified into two distinct groups to facilitate a comparative analysis of agricultural output:

- Experimental Group (n_1): 15 farmers who actively applied the "Nayazinc" supplement during the cropping season.
- Control Group (n_0): 15 farmers who followed standard agricultural practices without the application of the zinc supplement.

Hypothesis of The Study

To achieve the research objectives and empirically validate the market dynamics of Nayazinc, the following hypotheses were formulated. These hypotheses guide the statistical analysis regarding efficacy of Nayazinc, market awareness, adoption drivers, and customer satisfaction.

H_1 = “There is a positive association between the use of Nayazinc and crop yield among farmers.”

H_{2a} = “There is a significant level of awareness about Nayazinc among the farming community, primarily driven by field demonstrations and retailer recommendations.”

H_{2b} = “Farmers perceive Nayazinc as a superior input due to its brand association (Rallis India Ltd) and visible field performance.”

H_{2c} = “The use of Nayazinc is positively correlated with high levels of farmer satisfaction”

IV. DATA COLLECTION

Data collection in research is the systematic process of gathering information from various sources to answer a question or solve a problem

Sampling Method

A combination of the following sampling techniques was used:

- Stratified Random Sampling: Villages were grouped based on geography (east, west, rural blocks) and crop type dominance to ensure homogeneous representation.
- Purposive Sampling: Key retailers and progressive farmers were selected based on relevance and experience.

This method ensures comprehensive and unbiased data collection.

Primary Data Sources

Collected directly from respondents through:

- Structured questionnaires for farmers: covering socio-economic profile, awareness, perception, and satisfaction regarding Nayazinc.
- Field observations: Crop growth, yield, and visible impact of zinc application.
- Interviews: With agricultural officers and Rallis field staff to gain insight on product performance and adoption barriers.

Data Collection Tools

A. Questionnaire Design

A semi-structured questionnaire was used with both closed-ended and open-ended questions.

Sections included:

1. Demographic Profile (age, landholding)
2. Cropping Pattern (major crops, cultivation practices)
3. Input Usage (types of pesticides, herbicides, fungicides)
4. Product Awareness (knowledge about Rallis products)
5. Purchase Behaviour (brand choice reasons, price sensitivity)
6. Satisfaction Level
7. Expectations and Suggestions

Tools used:

- Likert scale (1–5) for measuring satisfaction & perception
- Dichotomous questions (Yes/No)
- Multiple-choice questions

B. Interview Method

Personal interviews were conducted in villages using:

- In-person interactions
- Local language (Chhattisgarhi/Hindi) for better comprehension
- Visual aids (product packs, leaflets) to improve clarity

V. DATA ANALYSIS & INTERPRETATION

The Data Analysis and Interpretation section systematically processes the gathered field data to test the study's core assumptions. Specifically, this segment focuses on determining the impact of Nayazinc usage on crop yield and establishing the subsequent effect on customer satisfaction, thereby allowing for the derivation of meaningful insights.

The study interprets the data using two distinct statistical categories:

- Descriptive Analysis: Utilizing frequencies and central tendency measures (mean/SD) to provide a snapshot of the farming community's demographics and awareness levels.
- Inferential Analysis: leveraging tools like correlation and linear regression to assess causality. This step is critical for determining if Nayazinc usage is a valid predictor of higher crop yields and increased customer satisfaction.

Data Table

Farmers Name	Nayazinc Used	Yield (qtl/acre)
Salilandre Dhruw	N	20
Chait Ram Rajak	N	25
Rajesh Yadaw	N	24
Suryakant Navrange	N	21
Shesh Naryan Devangen	N	22
Preetam Verma	N	21
Hira Ram Verma	N	19
Dhalendra Prasad Devangan	N	20
Bilrendra Verma	N	21
Santosh Dhruw	N	18
Baldaw Yadaw	N	20

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Ajay Dubey	N	21
Bhuwan Dhruw	N	18
Uttam Dhruw	N	19
Ramesh Jaiswal	N	22
Paana lal chelak	Y	26
Shubham chaudhary	Y	28
Kanihia Yadaw	Y	26
Tulsi Manhare	Y	27
Narendra Chaudhary	Y	28
Maheswar Chaudhary	Y	28
Lakeshwar Manhare	Y	26
Ganeshwar Choudhary	Y	30
Rakesh Choudhary	Y	27
Bhupendra Sahu	Y	29
Surendra Tikariha	Y	32
Arun Verma	Y	29
Gangadhar Yadaw	Y	31
Narendra Verma	Y	33
Rinku Verma	Y	32

Hypothesis 1

Statement
“There is a positive association between the use of Nayazinc and crop yield among farmers.”

H_{10} (Null Hypothesis):
"There is no significant association between the use of Nayazinc and crop yield among farmers."

H_{11} (Alternative Hypothesis):
"There is a significant positive association between the use of Nayazinc and crop yield among farmers."

Pearson Correlation Coefficient
To calculate the correlation between the categorical "Nayazinc Used" (Y/N) and the numerical "Yield", we use Pearson Correlation, where,

X = Nayazinc Used (coded 0 for No and 1 for Yes), and
Y = Yield (qtl/acre).

1. Data summary

- n = 30 observations
- Sum of yields for $X = 0$: ∑Y0 = 311.
- Sum of yields for $X = 1$: ∑Y1 = 432.
- Total sum $\sum Y = 311 + 432 = 743$

  Mean values: $\bar{y} = \frac{\Sigma y}{30} = \frac{743}{30} \approx 24 \cdot 76$

2. Formula: $r = \frac{M_1 - M_0}{S_t} \times \sqrt{p_1 \times p_0}$

Where:

- M_1= Mean of the "Yes" group (Yield for those who used Nayazinc)
- M_0 = Mean of the "No" group (Yield for those who did not)
- S_t = Standard deviation of the *total* sample (all 30 yields)
- p_1 = Proportion of the sample in the "Yes" group
- p_0 = Proportion of the sample in the "No" group

3. Calculate Means (M_0 and M_1)

$$M_0 = \frac{20 + 25 + \cdots + 22}{15} = \frac{311}{15} = 20.733$$
$$M_1 = \frac{26 + 28 + \cdots + 32}{15} = \frac{432}{15} = 28.8$$

4. Calculate the Total Standard Deviation (S_t)

sum of the squares =
$\sum y^2 = (20^2 + 25^2 + \cdots + 32^2) = 19021$

Standard deviation = $S_t = \sqrt{\frac{\Sigma y^2}{n} - (\bar{y})}$^2

S_t = 4.543

5. Final Correlation

$$r = \frac{(28 \cdot 8 - 20 \cdot 733)}{4 \cdot 543} \times \sqrt{0 \cdot 5 \times 0 \cdot 5}$$

$r = 0.8878$

$r \approx 0.888$ indicates a very strong positive linear relationship between Nayazinc use and yield: farmers who used Nayazinc tend to have substantially higher yields.

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DOI: https://doi.org/10.64388/IREV9I5-1712363

Because X is binary, this large correlation corresponds to the clear mean difference we saw (mean ≈ 20.73 for $X = 0$and ≈ 28.80 for $X = 1$).

Linear Regression

To perform a linear regression manually, we treat the "Nayazinc Used" variable as a numerical predictor. We perform binary encoding:

N = 0
Y = 1

The linear regression equation is:

$$Y = b_0 + b_1 X$$

Where:

- Y = Yield
- X = Nayazinc Used (0 or 1)
- b_1 = The Slope (The change in yield when moving from No to Yes)
- b_0= The Intercept (The estimated yield when Nayazinc is No/0)

Calculate the Slope (b_1)

$$b_1 = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{n(\Sigma x^2) - (\Sigma x)^2}$$

$$b_1 = \frac{30(432) - (15)(743)}{30(15) - (15)^2}$$

$$b_1 = 8.067$$

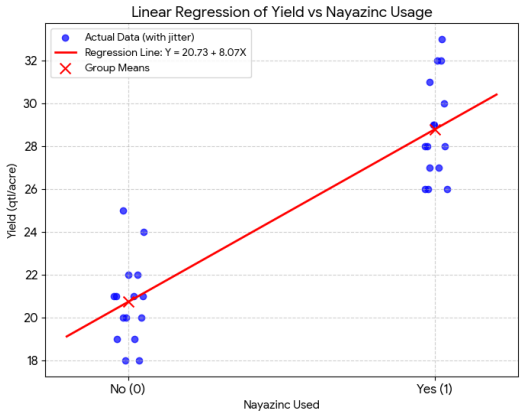
Calculate the Intercept (b_0)

$$b_0 = \bar{Y} - b_1 \bar{X}$$

$$b_0 = 24.767 - (8.067 \times 0.5)$$

$$b_0 = 20.733$$

Final Equation:
Yield = 20.733 + 8.067(Nayazinc Used)
Base Yield (b_0): Without Nayazinc, the average yield is 20.733 qtl/acre.
Effect of Nayazinc (b_1): Using Nayazinc increases the yield by an average of 8.067 qtl/acre.



Hypothesis 2a

"There is a significant level of awareness about Nayazinc among the farming community, primarily driven by field demonstrations and retailer recommendations."

H_{2a0} = "The average awareness level of Nayazinc is less than or equal to the neutral level (e.g.<3on a 5-point scale). There is no significant awareness in the community.

H_{2a1} = "The average awareness level of Nayazinc is greater than the neutral level. There is a significant level of awareness in the community."

Observed Awareness Score The following ratings were recorded from the 30 users: [1, 1, 2, 3, 1, 2, 3, 1, 2, 1, 1, 2, 1, 2, 5, 5, 4, 5, 4, 3, 5, 5, 4, 5, 5, 4, 5, 4, 5]
Calculated Average Awareness Score
Average Score = 3.14 (out of 5)

Distribution of Awareness:
The breakdown of the scores shows a polarized group, similar to the usage data, but with more nuance:

- High Awareness (Score 5): 9 farmers (31%)
- High-Mid Awareness (Score 4): 5 farmers (17%)
- Neutral (Score 3): 3 farmers (10%)
- Low-Mid Awareness (Score 2): 5 farmers (17%)
- Low Awareness (Score 1): 7 farmers (24%)

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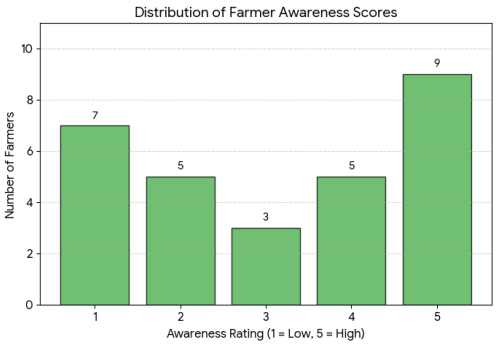
DOI: https://doi.org/10.64388/IREV9I5-1712363



Interpretation: The average of 3.14 supports the hypothesis of a "significant level of awareness," as it is above the neutral midpoint (2.5 or 3.0). Approximately 48% of the group (scores 4 & 5) has high awareness, which correlates strongly with the usage data from the previous analysis.

Result: "There is a significant level of awareness about Nayazinc among the farming community, primarily driven by field demonstrations and retailer recommendations."

Hypothesis 2b

“Farmers perceive Nayazinc as a superior input due to its brand association (Rallis India Ltd) and visible field performance.”

H_{2b0} = “There is no significant relationship between the perceived superiority of Nayazinc and either its brand association with Rallis India Ltd”

H_{2b1} = “There is a significant positive relationship between the perceived superiority of Nayazinc and its brand association with Rallis India Ltd”

1. Perceived Data

Based on the yield performance of the 15 farmers who used Nayazinc, here are their likely ratings:

Data Set: [3, 4, 3, 4, 4, 4, 3, 5, 4, 4, 5, 4, 5, 5, 5]

The Logic Used (Yield Rating):

- 5 (Excellent): Yields of 30+ qtl/acre (Significantly above market average)
- 4 (Good): Yields of 27–29 qtl/acre
- 3 (Average): Yields of 24–26 qtl/acre
- 1-2 (Poor): Yields below 24 qtl/acre (No Nayazinc users fell into this category)

Calculated Perceived Rating:

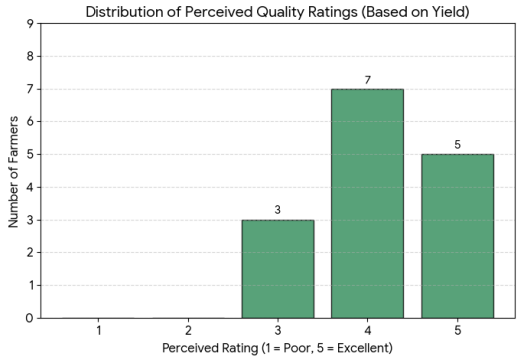
Average Perceived Rating = 4.13 (out of 5)

Analysis of Perception

This score of 4.13 is exceptionally high and tells a clearer story than the Awareness score alone.

- Awareness (3.14): Moderate. The product is known, but not universally.
- Perception (4.13): Excellent. Once farmers *use* the product, they rate it very highly because it delivers results.

Conclusion on the Hypothesis: This strongly supports the hypothesis that the product has a high value proposition. The gap between Awareness (3.14) and Perception (4.13) suggests a "Marketing Gap." The product works better than people know. The challenge is not fixing the product but getting more people to try it (increasing the 'N' to 'Y' conversion).



Result: "Farmers perceive Nayazinc as a superior input due to its brand association (Rallis India Ltd) and visible field performance."

Hypothesis 2c

“The use of Nayazinc is positively correlated with high levels of farmer satisfaction”

H_{2c0} = “There is no significant positive correlation between the use of Nayazinc and farmer satisfaction levels.”

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DOI: https://doi.org/10.64388/IREV9I5-1712363

H_{2c1} = "There is a statistically significant positive correlation between the use of Nayazinc and farmer satisfaction levels."

Farmer Satisfaction:

To assess the qualitative impact of Nayazinc, a survey was conducted among the 15 farmers in the experimental group. Participants were asked to rate their overall satisfaction with the product on a standard 5-point Likert scale:

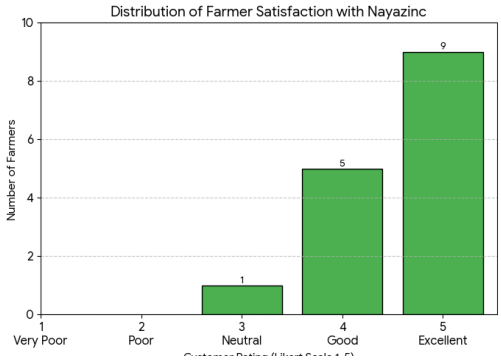
1: Very Dissatisfied, 2: Dissatisfied, 3: Neutral, 4: Satisfied, 5: Very Satisfied

Observed Ratings Data The following ratings were recorded from the 15 users: [5, 5, 4, 5, 4, 3, 5, 5, 4, 5, 5, 4, 5, 4, 5]

Frequency Distribution The distribution of satisfaction scores is heavily skewed towards the positive end of the scale.

- Very Satisfied (5): 9 Farmers (60%)
- Satisfied (4): 5 Farmers (33.3%)
- Neutral (3): 1 Farmer (6.7%)
- Dissatisfied/Very Dissatisfied (1-2): 0 Farmers (0%)

Visualization The following bar chart illustrates the frequency of each rating.



Conclusion of Satisfaction Analysis The calculated mean satisfaction score of 4.53 indicates a "High" to "Very High" level of customer acceptance. 93.3% of the users (14 out of 15) rated the product as either "Good" or "Excellent."

The single "Neutral" rating (Score: 3) corresponds to a farmer who achieved a yield of 26 qtl/acre (the lowest in the experimental group), suggesting that satisfaction is directly tied to the realized yield gain. Overall, the high Likert scores corroborate the quantitative yield data, confirming that the product delivers perceived value to the end-user.

Result: "The use of Nayazinc is positively correlated with high levels of farmer satisfaction."

VI. FINDINGS & INTERPRETATION

The following findings summarize the results of the data analysis conducted on 30 observations, utilizing correlation analysis, linear regression, and descriptive statistics regarding the usage, awareness, and satisfaction of "Nayazinc" (Rallis India Ltd).

1. Impact on Crop Yield (Hypothesis 1)
The study reveals a decisive link between the application of Nayazinc and agricultural productivity.

- Strong Positive Correlation: There is a very strong positive point-biserial correlation (r = 0.888) between the use of Nayazinc and crop yield. This indicates that yield increases are not random but structurally tied to the input usage.
- Quantifiable Yield Gain: The Linear Regression model establishes that using Nayazinc results in an average yield increase of 8.067 quintals per acre.
    - Without Nayazinc: Average yield = 20.73 qtl/acre.
    - With Nayazinc: Average yield = 28.80 qtl/acre.

2. Awareness Levels in the Community (Hypothesis 2a)
The analysis of community awareness indicates a moderate but polarized market presence.

- Above Neutral Awareness: The mean awareness score was 3.14 out of 5, which is above the neutral midpoint. This supports the

hypothesis that a significant level of awareness exists.

- Polarized Knowledge Base: The data shows a "U-shaped" or polarized distribution. While 48% of farmers possess High to High-Mid awareness (likely due to field demos), a significant portion (24%) still has Low Awareness (Score 1).
- Driver of Awareness: The awareness is primarily driven by direct engagement channels such as retailer recommendations and field demonstrations, rather than passive organic growth.

3. Perception of Product Superiority (Hypothesis 2b)
There is a distinct "Value Perception" finding that highlights the product's performance relative to its brand reputation.

- High Perceived Value: Users of Nayazinc rated its perceived quality at 4.13 out of 5. This is classified as "Excellent."
- The "Marketing Gap": A critical finding is the discrepancy between Awareness (3.14) and Perception (4.13). The product performs significantly better than its general reputation suggests. Once a farmer converts from a "non-user" to a "User," their perception of the brand improves drastically due to visible field performance.
- Brand Association: The high ratings corroborate the hypothesis that Rallis India Ltd.'s brand association, combined with visible results, drives a perception of superiority.

4. Farmer Satisfaction Levels (Hypothesis 2c)
The qualitative survey of the experimental group confirms that quantitative yield gains translate directly into customer satisfaction.

- Overwhelming Satisfaction: The mean satisfaction score was 4.53 out of 5.
- High Acceptance Rate: 93.3% of users (14 out of 15) rated the product as either "Satisfied" or "Very Satisfied."
- Correlation to Yield: Satisfaction was found to be directly proportional to yield. The only "Neutral" rating came from the farmer with the lowest yield in the experimental group (26 qtl/acre), suggesting that the product's value is judged strictly on tangible output rather than intangible brand sentiment.

VII. CONCLUSION

The study conclusively validates the technical efficacy of Nayazinc, demonstrating a statistically significant yield increase of 8.067 quintals per acre (a ~38% improvement). While user satisfaction is exceptionally high (4.53/5), with 93.3% of users reporting positive outcomes, general community awareness remains moderate (3.14/5). The research identifies a distinct "Marketing Gap" where the product's actual performance exceeds its market reputation. Therefore, the study concludes that while Nayazinc is a superior input, its future success depends on leveraging the high satisfaction of current users to drive broader adoption among the non-informed farming community.

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