



Research Article

DISCRIMINANT ANALYSIS OF FACTORS ASSOCIATED WITH THE ADOPTION OF ORGANIC FERTILIZERS IN JUNAGADH DISTRICT

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Abstract: The study was carried out at Junagadh district of Gujarat state in the year 2018. Multi-stage random sampling was used to select the samples for the study. The data were collected by personal interview method, analyzed through various appropriate statistical tools. Discriminant function analysis was used to identify the factors discriminating users and non-users of organic fertilizers. From the study, it was concluded that the variables like age, level of education, irrigation facility, social participation and total cost of manures are the variables discriminate among users and non-users of organic fertilizers.

Keywords: Users, Non Users, Organic Fertilizers

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Introduction

In India, agriculture is the largest sector of economic activity. It provides food, raw materials and the employment to a very large proportion of the population. The national output depends on the output in agriculture, as it is one of the most dominating sectors in India. [1] India is one of the largest producers of oilseeds in the world and occupies an important position in the Indian agricultural economy. [2] In India groundnut is cultivated in all the three seasons: *kharif* (June to October), *rabi* (November to March) and summer (February to may). *Kharif* groundnut grown under rainfed conditions, low input use and high insect-pests, diseases and weeds hence, the productivity is low. In *rabi* season the crop is grown with protective irrigation or in river bed areas. Summer groundnut grown under assured irrigation, high input application and low insect-pests, diseases and weeds hence, the productivity is quite high. [3] In *kharif*-2017, the all India acreage was 41,51,500 hectares. Eight states viz., Gujarat, Andhra Pradesh, Rajasthan, Karnataka, Madhya Pradesh, Maharashtra, Uttar Pradesh and Tamil Nadu were identified to have acreages greater than one lakh hectares and these states jointly accounted for 95.50 percent of the national acreage. [4] Organic manure was originally for denoting materials like cattle manure and other bulky organic substances that were applied to land, with the object of increasing the production of crops. Therefore, manures are defined as the plant and animal wastes which are used as sources of plant nutrients. The role of organic fertilizer in agriculture is indirect. Organic fertilizer is an essential element for the growth of microorganisms in the soil, and is decomposed into inorganic fertilizer as the microorganisms grow. The rate of decomposition of organic fertilizer into inorganic fertilizer is strongly affected by the soil temperature, water content, and pH (degree of acidity) as well as the characteristics of the microorganism ecosystem. [5]

Objectives of The Study

To find out the factors discriminating users and non-users of organic fertilizers

Limitation of The Study

The study was limited to Junagadh district only.

The sample size for the survey was limited *i.e.*, 120 farmers which may not represent the whole district.

Results were derived from the base of the personal interview so there is a chance of inconsistency.

The study was conducted on the basis of knowledge and understanding of the researcher.

Methodology of the study

Selection of Sample

The data for the study were collected from primary sources. Multi-stage sampling procedure was followed in selecting the sample of groundnut farmers. Junagadh district of Gujarat state was selected purposively as it is one of the major pocket areas of groundnut crop. Four taluka's were selected randomly *i.e.*, Keshod, Mendarda, Vanthali, Visavadar. Three villages were selected randomly from each taluka. Five exclusive users of organic fertilizers and five exclusive users of chemical fertilizers were selected purposively from each village and hence, 120 groundnut growers were selected for the study purpose.

Discriminant Function Analysis

Discriminant function analysis was used to study the factors discriminating users and non-users of organic fertilizers [6-8].

The discriminant function of the following form was used:

$$Z = L_1 X_1 + L_2 X_2 + L_3 X_3 + L_4 X_4 + L_5 X_5 + L_6 X_6 + L_7 X_7 + L_8 X_8 + L_9 X_9$$

Where,

Z = Composite discriminant scores for the two groups.

X_i's = Variables selected to discriminate the groups.

L_i's = Discriminant coefficients

The variables which were selected to discriminate the users and non-users of organic fertilizers groups are as follows:

X₁ = Age (Years)

X₂ = Annual income (Rs.)

X₃ = Education (Years)

X₄ = Extension participation (0 - 9 score)

X₅ = Irrigation facility (Yes = 1, No = 0)

X₆ = Occupation (Agriculture = 1, Agriculture + Dairy = 2, Agriculture +

Other = 3)
 X₇ = Size of land holding (ha)
 X₈ = Social participation (0 - 3 score)
 X₉ = Total cost of manures and fertilizers (Rs./ha)
 SL = D

X₈ = Social participation (0 - 3 score)
 X₉ = Total cost of manures and fertilizers (Rs. / ha)

$$S = \begin{pmatrix} S_{11} & S_{12} & S_{1k} \\ S_{21} & S_{22} & S_{2k} \\ \vdots & \vdots & \vdots \\ S_{k1} & S_{k2} & S_{kk} \end{pmatrix} \quad L = \begin{pmatrix} L_1 \\ L_2 \\ \vdots \\ L_k \end{pmatrix} \quad \text{and} \quad D = \begin{pmatrix} D_1 \\ D_2 \\ \vdots \\ D_k \end{pmatrix}$$

Where,
 K = Number of variables
 L_k = Vector coefficient of the discriminant function
 S = Pooled dispersion matrix, and
 D = Vector of difference between the mean value of different characteristics for the two groups.

The discriminant function was tested for significance to examine whether the variables considered together are sufficiently discriminating the groups of users and non-users of organic fertilizers. The Mahalanobis D₂ test was used to measure the distance between the two groups. After transformation of the D₂ statistics, it becomes an F statistic, which was then used to test the significance of the group differ from each other. For this, Statistic 'F' was computed as follows:

$$F = \frac{N_a N_b (N_a + N_b - P - 1)}{P(N_a + N_b)(N_a + N_b - 2)} \times D^2$$

P is the number of variables considered in the function. The value of 'F' was tested for its significance at (P) and (N_a + N_b - P - 1) degrees of freedom.

Analysis and Interpretation

Factors Discriminating Users and Non-Users of Organic Fertilizers

The discriminant function analysis was carried out in order to examine the relative importance of different factors discriminating users and non-users of organic fertilizers. The coefficients of the discriminant function measure the net effect of an individual variable when all other variables were taken as constant.

Table-1 Summary of canonical discriminant function

Function	Eigen value	Percentage of variance	Cumulative percentage	Canonical correlation
1	0.886	100.000	100.000	0.685

An Eigen value (0.886) indicates the proportion of variance explained. A large Eigen value is associated with a strong function. The canonical relation is a correlation between the discriminant scores and the levels of the dependent variable. A high correlation (0.685) indicates a function discriminates well between users and non-users.

Table-2 Wilks' Lambda significance test

Test of Function	Wilks' Lambda	Chi-square	Df	Sig.
1	0.530	71.997	9	0.000

Wilks' Lambda is the ratio of within groups' sums of squares to the total sums of squares. This is the proportion of the total variance in the discriminant scores not explained by differences among groups. Here, the Lambda of 0.530 has a significant value (Sig. = 0.000), thus, the group means appear to differ which indicates that the model significantly differentiates scores among the groups.

The discriminant function for the data was estimated as:

$$Z = -0.161 X_1 - 0.196 X_2 - 0.192 X_3 - 0.203 X_4 - 0.11 X_5 - 0.122 X_6 + 0.393 X_7 - 0.255 X_8 + 1.080 X_9$$

Where,

- X₁ = Age (Years)
- X₂ = Annual income (Rs.)
- X₃ = Education (Years)
- X₄ = Extension participation (0 - 9 score)
- X₅ = Irrigation facility (Yes = 1, No = 0)
- X₆ = Occupation (Agriculture =1, Agriculture + Dairy = 2, Agriculture+ Other = 3)
- X₇ = Size of the land holding (ha)

Table-3 Tests of equality of group means

Variables	Wilks' Lambda	F	df ₁	df ₂	Sig.
Age (X ₁)	0.958*	4.437	1.000	118.000	0.033
Annual income (X ₂)	1.000	0.020	1.000	118.000	0.888
Education (X ₃)	0.941**	7.403	1.000	118.000	0.007
Extension participation (X ₄)	0.999	0.128	1.000	118.000	0.721
Irrigation facility (X ₅)	0.960*	4.940	1.000	118.000	0.028
Occupation (X ₆)	1.000	0.022	1.000	118.000	0.882
Size of the land holding (X ₇)	1.000	0.023	1.000	118.000	0.881
Social participation (X ₈)	0.901*	1.085	1.000	118.000	0.030
Total cost of manures and fertilizers (X ₉)	0.575**	87.203	1.000	118.000	0.000

* Significant at 5 % level of significance, ** Significant at 1 % level of significance

Results for the test of equality of group means are given in [Table-3]. It is seen from the table that only five variables viz., age, education, irrigation facility, social participation and total cost of manures and fertilizers showed the significant difference between the means of two groups which indicates that the only these variables are responsible in discriminating the users and non-users of organic fertilizers. The values of mean and the mean difference in characteristics are presented in [Table-4]. Relatively higher mean difference was observed in case of annual income.

Table-4 Different discriminant variables with mean values

Variables	Mean			Mean difference
	Organic fertilizer user	Chemical fertilizer user	Total (users and non-users of organic fertilizers)	
Age (X ₁)	48.600	46.617	47.608	1.983 *
Annual income (X ₂)	339479.167	335250.00	337364.583	4229.167
Education (X ₃)	5.750	7.717	6.733	-1.967 *
Extension participation (X ₄)	5.050	4.867	4.958	0.183
Irrigation facility (X ₅)	0.983	0.883	0.933	0.100 *
Occupation (X ₆)	1.300	1.283	1.292	0.017
Size of the land holding (X ₇)	1.820	1.844	1.832	-0.024
Social participation (X ₈)	1.550	1.350	1.450	0.200 *
Total cost of manures & fertilizers (X ₉)	1379.767	2100.283	1740.025	-720.517 *

* Significant variable

For the relative importance of the significant characteristics of organic fertilizers users and non-users, the function was re-estimated by taking only significant variables in the equation to see whether these characteristics alone could discriminate organic fertilizers users and non-users groups significantly. The new discriminating function taking only the significant factors was estimated as follows:

$$Z = -0.113 X_1 - 0.163 X_3 - 0.029 X_5 - 0.239 X_8 + 1.046 X_9$$

Where,

- X₁ = Age (Years)
- X₃ = Education (Years)
- X₅ = Irrigation facility (Yes = 1, No = 0)
- X₈ = Social participation (0 - 3 score)
- X₉ = Total cost of manures and fertilizers (Rs. / ha)

Again, the discriminant function was tested to examine whether these characteristics considered together could significantly discriminate between the organic fertilizers users and non-users groups. From the [Table-5], it is seen that the percentage of each variable into total contribution was obtained as 0.03, 0.04, 0.00, 0.01 and 99.92 percent.

Table-5 Relative importance of significant characteristics for organic fertilizers users and non-users

Discriminant variables	Coefficient (k)	Mean difference (Dk)	Contribution of variable (lk×Dk)	Factor contribution (%)
Age (X ₁)	-0.113	1.980	0.224	0.03
Education (X ₃)	-0.163	1.970	0.321	0.04
Irrigation facility (X ₅)	-0.029	0.100	0.003	0.00
Social participation (X ₈)	-0.239	0.200	0.048	0.01
Total cost of manures and fertilizers (X ₉)	1.046	-720.510	753.653	99.92
Total			754.249	100.00

From the [Table-6], it is seen that the discriminant function accurately (83.30 percent) classify the users while 83.30 percent of the non-users is classified correctly.

Table-6 Classification of results for the discriminant function

Category			Predicted group membership		Total
			0	1	
Original	Count	User	50	10	60
		Non-user	10	50	60
	%	User	83.30	16.70	100
		Non-user	16.70	83.30	100
Cross-validated	Count	User	49	11	60
		Non-user	10	50	60
	%	User	81.70	18.30	100
		Non-user	16.70	83.30	100

[Table-6] also shows the classification accuracy of discriminant analysis using the cross-validation with one random observation omitted at each time and it is seen that accuracy remains the same i.e., 81.70 percent for users and 83.30 percent for the non-users.

Conclusion

Out of the nine variables i.e., age, annual income, education, extension participation, irrigation facility, occupation, size of the land holding, social participation and total cost of manures and fertilizers used in stepwise linear discriminant analysis technique to find out the variables that discriminate the organic fertilizers users with non-users, five variables i.e., age, education, irrigation facility, social participation and total cost of manures and fertilizers were found significant. Hence it can be concluded that these five variables discriminate or separate users and non-users of organic fertilizers. The classification accuracy of discriminant analysis using the cross-validation with one random observation omitted at each time was 81.7 percent for the users and 83.3 percent for the non-users.

Suggestions

Farmers should provide awareness and knowledge about organic farming through extension activities. The identified variables which discriminate users and non-users of organic fertilizers i.e., total cost of manures and fertilizers need to be concentrate to overcome it. The identified variables which discriminate users and non-users of organic fertilizers i.e., age, level of education and social participation need to be concentrate to encourage it.

Application of research: The study will expose the various factors which determine the users of organic fertilizers.

Research Category: Organic Fertilizers

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