RESEARCH ARTICLE

Factors Influencing the Usage of Biofertilizers in Hill Vegetable Cultivation

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ABSTRACT

Indian agriculture has undergone enormous change since the Green Revolution in order to meet the demands of the country's constantly expanding population. Utilizing chemical fertilizers excessively to protect plants is one such change. Concerns about these chemical fertilizers' detrimental impacts on human and soil health have recently risen. Alternative approaches, such as eco-friendly bio fertilizers, are being used to counteract these negative impacts of conventional fertilizers. Consequently, a deeper comprehension of farmers' preferences for bio fertilizers is required especially in hill vegetable cultivation. This study focuses on the several variables that significantly influence the farmers' decisions to use bio-fertilizers. An exploratory factor analysis was conducted, and the findings revealed that experience, effectiveness, product quality, brand loyalty, advertising, and dealers' influence were some of the key factors that drove farmers to use bio-fertilizers.

INTRODUCTION

Organic farming is relatively new in India. Over 2.30 million hectares of cropland were being farmed organically as of March 2019. This is equivalent to 2 per cent of the 140.1 million acres of net sown land in the country. India is the second-most populous nation, but farming lands, however, are decreasing day by day. It is necessary to increase agricultural production and soil health to meet the demand for food, fodder, fuel, fiber, and other demands sustainably. Using organic fertilizers from plants and animals, farming has always been done without chemicals. Beginning in the middle of the 19th century, farmers began employing synthetic or inorganic fertilizers. However, people started to move towards organic farming for almost two decades as they became aware of the negative effects that chemical fertilizers have ill effect on human health. One of the keys in achieving sustainable agriculture is organic farming. Growing vegetables organically instead of using fertilizers or chemicals may be healthier and satisfying.

As long as agricultural practises involve the widespread application of artificial fertilisers, it is evident that sustainability will never be attained. As a result, bio-fertilizers have enormous promise for increasing soil fertility as well as for making efficient use of a variety of resources to boost crop yield on a long-term basis. Bio-fertilizer is a unique class of substances that include microorganisms that enable the soil to hold some crucial components required for plant nourishment. Since "bio" is short for "living thing," bio-fertilizers are naturally live microbial inoculants that are introduced to the soil. In addition to producing organic nutrients for the soil, they also greatly improve its fertility and combat disease. Biofertilizers aid in the mobilisation of naturally occurring nutrients during harvesting **(Venkatashwarlu, 2008).** Further, bio-fertilizer does not contain chemicals that harm productive soil. The usage of bio-fertilizer is becoming more and more important globally in terms of the environment. The organisms known as biofertilizers improve soil quality without causing any negative side effects. Blue-green algae, fungus, bacteria, and other microbes are the main sources of biofertilizers. Biofertilizers assist in balancing many of the negative consequences of chemical-based technologies by making nutrients that are naturally abundant in the soil or environment usable by plants **(Ghosh, 2004).**

Importance of biofertilizers

Reduce the excessive reliance on chemical pesticides and fertilisers that has hampered agriculture **(Chaturvhedi, 2006).** Natural pesticides are used in bio-fertilizer farming, maintaining the nutritional value of the produce. The bio-fertilizer applied product has much higher nutritional quality **(Pascale and Barberi, 1995).** Bio-fertilizers act as stimulators of vegetative and yield growth. It always

has a positive impact on things like ecological health and soil fertility. Beneficial for agriculture that is sustainable.

REVIEW OF LITERATURE:

Lin and Ming (2020) investigated the elements affecting farmers' decisions to purchase organic fertilisers. According to the research, the amount of the farmer's land holding, their degree of education, and their gender were the main factors influencing their purchases of organic fertiliser. Among the 20 factors impacting farmers' purchases of organic fertiliser, 12 indicators were found to be crucial. The twelve factors included the farmers' gender, educational background, family size, overall income, farmland quality, depth of knowledge regarding organic fertiliser, ease of application, price predictability, understanding of national policy regarding organic fertiliser.

Sushil Kumar and Jabir Ali (2011) conducted a study on Analysing the Factors Affecting Consumer Awareness on Organic Foods in India. To systematise the theoretical foundation for analysing the determinants impacting consumer purchasing behaviour of domestic confectionary items in Hanoi, this study reviews theory and earlier research. According to research, there are five elements that influence consumer purchasing decisions for domestic confectionery products: packaging, pricing, customer service, product quality, and location. The place of purchase element has the least impact on purchasing decisions, whereas the package factor has the most.

A study on the variables influencing the use of bio-inputs for sugarcane was undertaken by **Banumathy and Thennarasu (2008)**. Both bio-input adopters and non-adopters participated in the study. The results of the cost of production for both categories showed that the cost of production of bio-input non-adopters was (2.35 per cent) higher than that of adopters. All of the calculated coefficients were discovered to be very positive. The age of the respondent and the farmer's handling experience played secondary roles.

A study on the Correlation and path coefficient analysis for yield and quality traits under organic fertilizer management in rice (Oryza sativa L.) was undertaken by **Dhurai and Mohan Reddy (2014)**. In order to determine the relationships between the fourteen contributing variables for yield and quality as well as their direct and indirect effects on grain production under organic fertiliser management, research including 32 genotypes of rice was conducted. According to the correlation study, there was a substantial relationship between grain yield and harvest index, number of grains per panicle,

and days to maturity. The genotypic correlation coefficient was also greater than the phenotypic correlation coefficient. The results of path coefficient analysis showed that the following factors positively correlated with grain yield: days to maturity, harvest index, panicle length, plant height, kernel elongation ratio, kernel length, kernel L/B ratio, and kernel width.

OBJECTIVE OF THE STUDY:

To find out the factors influencing the farmers towards the usage of biofertilizer products in hill vegetables cultivation.

MATERIAL AND METHODS

This study employed a descriptive research methodology to identify the characteristics that affect farmers in the Nilgiris district to use biofertilizer products. Purposive sampling was employed as a technique. Farmers in the Nilgiris district who had previously employed bio-fertilizers were included in the study. A total of 90 farmers were chosen for the study. Data was acquired through well-structured interview schedule. A 5-point Likert scale was used to record the farmers' responses to the factors influencing their usage of biofertilizer products. (5=Strongly Agree), (1=Strongly Disagree), (2=Disagree), (3=Neutral), and (4=Agree). Exploratory factor analysis (EFA) was utilised to achieve the goal while taking into account of the following variables.

Table 1. Variables

List of variables
Quality of biofertilizers
Effectiveness in crop performance
Own interest
Subsidies given by government
Availability of biofertilizers
Influence of advertisement
Brand loyalty
Environmental benefit
Dealers influence
Experience in using biofertilizer
Low price of biofertilizers
Chemical free production
Fellow farmers influence
Higher price for the produce
Extension officers influence

The factors influencing farmers towards the usage of biofertilizers was analysed using exploratory factor analysis. In order to determine whether the data can be used for factor analysis, two tests were performed, namely Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity. These tests were applied to see whether there was a significant relationship among the variables and to test their Statistical significance.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.841
Bartlett's Test of Sphericity	Approx. Chi-Square	971.657
	Df	105
	Sig.	.000

It could be inferred from Table 2, that the value of KMO statistics was 0.841 (> 0.5), which indicated that the sample was adequate and good for conducting the factor analysis. In Bartlett's test, the approximate chi-square statistic was found to be 971.657 with 105 degrees of freedom which was significant at 0.01 levels. It could be concluded that for further analysis of data, Factor analysis is recommended as suitable technique.

Table 3. Total Variance Explained

Component	Initial Eigen values			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	7.970	53.132	53.132	7.970	53.132	53.132
2	1.277	8.513	61.645	1.277	8.513	61.645
3	1.072	7.146	68.791	1.072	7.146	68.791
4	.901	6.005	74.796			
5	.708	4.722	79.518			
6	.689	4.592	84.109			
7	.561	3.741	87.851			
8	.399	2.661	90.512			
9	.339	2.259	92.771			
10	.274	1.826	94.596			
11	.234	1.557	96.154			
12	.187	1.249	97.402			
13	.180	1.200	98.602			
14	.120	.803	99.405			
15	.089	.595	100.000			

Extraction Method: Principal Component Analysis

The principal component analysis (PCA) method provided the relationship between factors and variables within the analysis. A large collection of data is broken down into fewer components using principal component analysis, which finds groupings with significant inter-correlation in a collection of variables, each accounting for a portion of the total variability (Ankur Adhikari and Himanshu Punetha, 2022). Technically, it could be called as factor loadings. These factor loadings indicated the relationship between variables clearly, but do not group all of them with the factors clearly. From Table 3, it was clear that three components had an Eigenvalue of more than one. These three components explain about 68.791 per cent of the variance.

From table 4, it could be inferred that cross loadings had been attained. But to get a meaningful conclusion of grouping the variables under certain factors, the rotation of components was done using varimax rotation with Kaiser Normalization.

Table 4. Component Matrix

	Factors	Component 1	Component 2	Component 3
1	Quality of biofertilizers	.823	-.220	-.252
2	Effectiveness in crop performance	.793	.086	-.272
3	Own interest	.792	-.143	-.067
4	Subsidies given by government	.773	-.398	-.033
5	Availability of biofertilizers	.751	.173	-.077
6	Influence of advertisement	.731	-.140	-.070
7	Brand loyalty	.728	.504	.181
8	Environmental benefit	.726	.142	-.322
9	Dealers influence	.722	.284	.258
10	Experience in using biofertilizer	.715	.003	-.361
11	Low price of biofertilizers	.693	-.432	.223
12	Chemical free production	.689	-.206	.104
13	Fellow farmers influence	.688	.560	-.071
14	Higher price for the produce	.645	-.288	.290
15	Extension officers influence	.636	.109	.660

RESULTS AND DISCUSSION

Socio-economic characteristics of sample respondents

The socioeconomic data from the sample respondents was examined to gain a better understanding of the individuals. The socio-economic profile of the 90 respondents is categorised down in detail.

The demographic details of the respondents were presented in table 5. The survey found that male respondents (93 per cent) used bio fertilizer products at a higher rate than female respondents. According to the report, the largest age group of farmers is between the ages of 35 and 44 (47 per cent) and 45 and 54 (30 per cent). Married respondents (90 per cent) outnumbered those who were not married in terms of total respondents. Similar to family structure, joint families (22 per cent) were less common than nuclear families (78 per cent). The majority of respondents (50 per cent) have less than 20 years of farming experience, and the medium family size (54 per cent) was greater than other types. Under the farm size, small farmers (46 per cent) were more likely to use bio fertilizer products. Finally, the primary occupation of the farmer respondents was agriculture (52 per cent).

Table 5. Demographic characteristics of respondents

Demographic characteristics of respondent's farmers		
Gender	No of respondents (n=90)	Percentage (100%)
Male	84	93
Female	6	7
Age (Years)		
15-24	4	4
25-34	8	9
35-44	42	47
45-54	26	29
55 and above	10	11
Marital status		
Unmarried	9	10
Married	81	90
Family type		
Nuclear	70	78
Joint	20	22
Family size		
Small	18	20
Medium	49	54
Big	23	26
Educational status		
Illiterate	11	12
Primary school	17	19
Higher secondary	41	46
Graduation	17	19
Post graduate	4	4
Farming experience (Years)		
20 or less	45	50
21-30	32	36
31-40	8	9
41-50	3	3
Above 51	2	2
Farm size		
Marginal farmer	8	9
Small farmer	41	46
Medium farmer	36	40
Big farmer	5	5
Occupation type		
Agriculture	47	52
Agriculture + other	43	48

Factors influencing farmers towards usage of bio-fertilizers - Factor analysis

It could be inferred from the Table 6, that factor loadings are arrived after varimax rotation. Factor loadings having values equal to or greater than 0.5 are considered. First component had 7 factor loadings with eigen value greater than 0.5. Second component with 4 factor loadings and third component with 4 factor loadings with eigen value greater than 0.5. These components are assigned with suitable component names on the basis of their factors.

It could be inferred from the table 7, the first component was named as Product preference comprising of Experience in using biofertilizers, Effectiveness in crop performance, Environmental benefit, Quality of biofertilizers, Availability of biofertilizers, Own interest and influence of advertisement with variance of 53.132 percentage, the second component was named as Benefits availed comprising of Low price of biofertilizers, Subsidies given by government, Higher price for produce, Chemical free production with variance of 8.513 percentage and the Third component was named as Promotional effectiveness comprising of Brand loyalty, Extension officers influence, Fellow farmers influence and brand loyalty with variance of 7.146 percentage. It could be inferred from the factor analysis that Experience in using biofertilizers, Effectiveness of product, Environmental benefit, Quality of biofertilizers, Availability of biofertilizers, Own interest and influence of advertisement were the most influential factors in the usage of biofertilizers among the farmers.

Table 6. Rotated component matrix

	Factors	C 1	C 2	C 3
1	Experience in using biofertilizers	.735		
2	Effectiveness in crop performance	.723		
3	Environmental benefit	.722		
4	Quality of biofertilizers	.704		
5	Availability of biofertilizers	.554		
6	Own interest	.549		
7	Influence of advertisement	.513		
8	Low price of biofertilizers		.799	
9	Subsidies given by government		.714	
10	Higher price for produce		.701	
11	Chemical free production		.590	
12	Brand loyalty			.811
13	Extension officers influence			.711
14	Fellow farmers influence			.709
15	Dealers influence			.686

Table 7. Components and Factor

Components	Factor names	Variance explained	Factor loadings	Variables
1	Product preference	53.132	.735	Experience in using biofertilizers
			.723	Effectiveness in crop performance
			.722	Environmental benefit
			.704	Quality of biofertilizers
			.554	Availability of biofertilizers
			.549	Own interest
			.513	Influence of advertisement
2	Benefits availed	8.513	.799	Low price of biofertilizers
			.714	Subsidies given by government
			.701	Higher price for produce
			.590	Chemical free production
3	Promotional effectiveness	7.146	.811	Brand loyalty
			.711	Extension officers influence
			.709	Fellow farmers influence
			.686	Dealers influence

CONCLUSION

It could be concluded that there were three new extracted components found to have Eigen value more than one. The total variance explained by the study were 68.791 per cent. The study also concluded that product preference, benefits availed and promotion effectiveness were the key factors influencing farmers to use. The study revealed that Experience in using biofertilizers, Effectiveness of product, Environmental benefit, Quality of biofertilizers, Availability of biofertilizers, Own interest and influence of advertisement were the most influential factors in the usage of biofertilizers among the farmers. Factors like low price of biofertilizers, subsidies from the government, higher price for the produce and chemical free production are the benefits availed for the farmers.

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