**FACTORS INFLUENCING THE USAGE OF BIOFERTILIZERS IN HILL VEGETABLE CULTIVATION**

**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, like as eco-friendly bio fertilizers, are being used to counteract these negative impacts. Consequently, a deeper comprehension of farmers' preferences for bio fertilizers is required especially in hill vegetable cultivation. This study focuses into 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 driven farmers to use bio-fertilizers.

**Keywords:** Factors influencing; Biofertilizers; Factors analysis; Vegetable cultivation.

**INTRODUCTION:**

Organic farming is still 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 using 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.

**OBJECTIVE OF THE STUDY:**

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

**METHODOLOGY:**

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. In all, a total of 90 farmers 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. 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.

**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 |

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.

**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.

**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 |

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).

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

**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 |

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.

**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 |

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.

**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.

**REFERENCE:**

Banumathy, V. and Thennarasu, R. (2008). “A study on factors determining bio input adoption for sugarcane in Cuddalore district, Tamil Nadu”. *Agriculture Update.*, 3(3& 4): 238-241.

Chaturvhedi, S. (2006). “Bio-Waste from Jatropha Utilization as Bio-Fertilizer”. Project Report, NBRL Lucknow.

Ghosh, N. (2004). “Promoting biofertilizers in Indian agriculture”. Econ Polit Wkly, 5: 5617–5625.

Lin L, Ming SY. (2020). “Study on the Influencing Factors of Farmers’ Purchase Behaviour of Organic Fertilizers Based on Logistic Model”. *Current Journal of Applied Science and Technology*., (39):29-43.

[10.9734/cjast/2020/v39i3931101](https://doi.org/10.9734/cjast/2020/v39i3931101)

Pascale, S. D. and Barberi,G (1995). “Effects of soil salinity from long-term irrigation with saline-sodic water on yield and quality of winter vegetable crops”. Scientia Horticulturae, 64(3):145-157.

[https://doi.org/10.1016/0304-4238(95)00823-3](https://doi.org/10.1016/0304-4238%2895%2900823-3)

Sushil Kumar and Jabir Ali. “Analysing the Factors Affecting Consumer Awareness on Organic Foods in India”. *21st Annual IFAMA World Forum and Symposium on the Road to 2050.*

Venkatashwarlu B. (2008). “Role of bio-fertilizers in organic farming: Organic farming in rain fed agriculture”. Central institute for dry land agriculture, Hyderabad, 85-95.