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A Study on Problems of Farmers in Cultivation of Intercrops in Erode District – Factor Analysis

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Abstract

The green revolution is one of the greatest successes that the country has observed and resultantly achieved self-sufficiency and a good degree of stability in food grain production. However, the country still faces the challenges of comprehensive food security and malnutrition. It could be noted that higher their farm size, lower their overall problems of intercropping in farmers'. It is study that there intercropping yields additional income sometimes becoming major source of revenue for the farmers. It can be done for own purpose or for marketing purpose. Farmers cultivating intercrops face cultivation and marketing problems just like other crops too.

Keywords: Problems of Farmers, Cultivation of Intercropping, Cultivation Issues, Environment Issues.

Introduction

Intercropping is growing two or more crops together at the same time in the same space in a beneficial manner. Intercropping is the cultivation of two or more crops simultaneously on the same field. It also means the growing of two or more crops on the same field with the planting of the second crop after the first one has completed its development. The rationale behind intercropping is that the different crops planted are unlikely to share the same insect pests and disease-causing pathogens and to conserve the soil.

Row intercropping is working this arrangement with at least one of the components being planted in rows. Strip intercropping is a more industrialized version with rows of individual crops big enough to be harvested with machinery. Mixed intercropping is more like what we imagine as a guild, in which plants are bunched together more naturally but in purposeful ways. Relay intercropping is when the plants being intercropped are timed so that they are planted as the others are between flowering and harvesting. These are the basic four methods commonly employed. Sometimes they involve annual grains and vegetables, such as the mixed intercropping classic of corn, beans and squash. Sometimes there are perennial species with annual crops grown amongst them, say perennial garlic and basil with annual tomatoes. Perennials also work well with other perennials. In parts of the tropics, bananas, papayas, coffee, vanilla and cacao make a crackerjack intercropping team. Sometimes these work in organized rows, other times in other patterns, but the main thought is to make thoughtful combinations. In essence these are all forms of companion planting, in which one plant provides some useful component for another. The technique can be small in scale, something seen in a home garden, but strip cropping is also becoming more common for progressive industrial models.

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Statement of the Problem

Intercropping is a cropping system can be defined as a combination of crops in both time and space, and the basic biological requirement of a productive system is that it should provide a continuum of efficient crop growth for as much of the potential growing period as possible. This is a simple enough concept but actual practice can be complex where several crops are grown and interactions occur between them. This complexity is particularly great in the intercropping system where two or more crops are grown together on the same piece of land in competition with each other. At the same time, however, the intercropping system is perhaps the best example of how interactions between crops can be exploited to produce considerable yield benefits. Intercropping has many issues like difficulties in land preparation, high input Price, Scarcity of raw materials and trained labours, non-Suitable climatic condition and soil type, damages of crop while harvesting the other crop, difficulties in introducing new technologies, weeding and pest issues, environment and management issues etc. Against this background, the present study makes an attempt to examine the problems

of farmers in cultivation of intercrops.

Objective of the Study

The objective of the study is as follows:

- To examine the problems of farmers in cultivation of intercrops.

Area and Period of the Study:

The study on the problems of farmers in cultivation of intercrops is confined to Erode District only. The study was conducted from October 2017 to March 2018.

Collection of Data:

The study used both primary and secondary data. The required primary data are collected through well structured questionnaire. Secondary data are gathered through books, journals, magazines, websites and other research works.

Sampling Design

To achieve the objectives of the study, Erode district has been purposively selected as the study area. The population of the research consists of all the farmers who cultivate the intercrops in Erode district. The list of farmers cultivating intercropping could not be obtained. The method of sampling used for selecting sample respondents for the study is non-probability convenience sampling method. The sample size selected for the study is 500 farmers who cultivate intercrops.

Tools Used for Data Analysis

The statistical tools used for analysis are KMO test and Bartlett's test of Sphericity, Factor Analysis, Mean Score and Mean Rank Analysis.

Problems of Farmers in Cultivation of Intercrops – Factor Analysis

The problems of farmers in cultivation of intercrops are described here with the help of factor analysis. The technique of factor analysis provides a fascinating way of reducing the nature of variables in a research problem to a smaller and manageable number by combining related ones into factors. This relieves the confusion arising through overlapping measures of the variables. The cost of further research may be reduced by focusing efforts on fewer variables for study. Factor analysis has many alternative algorithms that can be used. The method used here is the principal component analysis. The primary decision in each stage of factor analysis is to decide how many factors are to be extracted from the data. The sample rule of them normally used says that all factors with an Eigen value of 1 or more should be extracted.

In order to explore the possibility of applying factor analysis to the data in hand, the inter-correlation matrix was first calculated by using Bartlett's test of Sphericity and Kaiser-Meyer-Olkin measure of sampling adequacy (KMO). The anti-image matrix was also calculated and the findings suggest that there is no need to drop any item and all items should be included in the final factor analysis procedure. Principal component method, the most commonly used method, was used to find the initial solution. The initial solution suggests that the factors have an Eigen value greater than 1 and the factor pattern is consistent across the sample, which is easy to interpret since the items loaded heavily on a single factor.

Before applying factor analysis, it has been decided to use Kaiser-Meyer-Olkin (KMO) Measure and Bartlett's test. The KMO measure of sampling adequacy is an index used to examine the appropriateness of factor analysis. High values (between 0.5 and 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate.

Bartlett's test of sphericity is a test statistic used to examine the hypothesis that the variables are uncorrelated in the population. In other words, the population correlation matrix is an identity matrix whereby each variable correlates perfectly with itself (r =1) but has no correlation with the other variables (r = 0). To be appropriate, this test should have a significance value less than 0.05.

Factor Analysis technique has been applied to find the underlying dimensions (factors) that exists in the original variables. Table 2.11 shows the findings of KMO and Bartlett's test.

Table 1
Problems of Farmers in Cultivation of Intercrops - KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.680
Bartlett's Test of Sphericity	Approx. Chi-square	1019.805
	Df	136
	Sig.	.000

Table 1 reveals that the calculated value of Kaiser-Meyer-Olkin measure of sampling adequacy is 0.680. It suggests that the factors extracted account for a substantial amount of variance. As this value is greater than 0.5, it has been decided to apply the factor analysis. KMO test yields a result of 0.680 which states that factor analysis can be carried out appropriately for these 17 variables which are taken for the study. The result of the test shows that with the significant value of .000 there is a significant relationship regarding the variables chosen. Furthermore, Bartlett's test of sphericity also suggests that the inter-correlation matrix is factorable and factor analysis can be applied to the current data as the correlation between different items is also statistically significant ($p<0.01$).

Factor Extraction

Using the Principal Component Analysis seven factors have been extracted based on the variance (Eigen value greater than 1). Table 2 shows the percentage of

variance, cumulative percentage and the total variance of the variable identified for the study.

Principal Component Analysis

Principal component analysis was a factor model in which the factors are based on the total variance. Another concept in factor analysis is the rotation of factors. Varimax rotations are one of the most popular methods used in the study to simplify the factor structure by maximizing the variance of a column of pattern matrix. Another technique called latent root criteria is used. An Eigen value is the column sum of squares for a factor. It represents the amount of variance in data. After determination of the common factors, factor scores are estimated for each other. The common factors themselves were expressed as linear combinations of the observed variables.

There are various problems faced by the farmers in cultivation of intercrops. These ranges of factors begin with 1 to 7. Based on the review of previous studies and a detailed discussion with the farmers all the relevant variables are included in the study. Seventeen variables are generated for measuring the problems faced by the farmers in cultivation of intercrops on a Likert's 5 point scale.

The seven factors extracted together account for 62.03 per cent of the total variance (information contained in the original seventeen variables). This is pretty good, because it is easy to economize on the number of variables (from 17 it has been reduced to 7 underlying factors), while there is a loss only about 37.97 per cent of the information content (62.03 per cent is retained by the 7 factors extracted out of the 17 original variables).

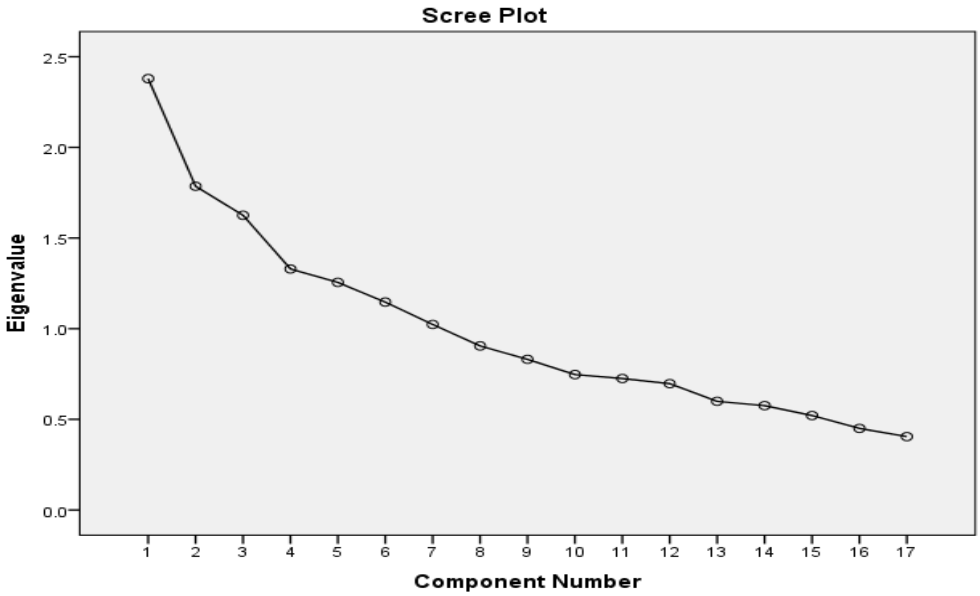
Table 2
Problems of Farmers in Cultivation of Intercrops -Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Component 1	2.379	13.995	13.995	2.379	13.995	13.995
Component 2	1.785	10.503	24.498	1.785	10.503	24.498
Component 3	1.626	9.562	34.060	1.626	9.562	34.060
Component 4	1.329	7.820	41.880	1.329	7.820	41.880
Component 5	1.255	7.384	49.264	1.255	7.384	49.264
Component 6	1.147	6.746	56.010	1.147	6.746	56.010
Component 7	1.023	6.019	62.029	1.023	6.019	62.029
Component 8	.905	5.323	67.352			
Component 9	.831	4.887	72.239			
Component 10	.747	4.393	76.632			
Component 11	.725	4.266	80.898			
Component 12	.697	4.099	84.997			
Component 13	.599	3.525	88.521			
Component 14	.576	3.386	91.907			
Component 15	.521	3.064	94.971			
Component 16	.450	2.647	97.619			
Component 17	.405	2.381	100.000			

Extraction Method: Principal Component Analysis.

The following figure gives the screen plot for the 17 variables taken for the study.

Chart 1
Screen Plot Showing Problems of Farmers in Cultivation of Intercrops



Rotated Component Matrix

Since the idea of factor analysis is to identify the factors that meaningfully summarize the sets of closely related variables, the rotation phase of the factor analysis attempts to transfer initial matrix into one that is easier to interpret. The rotated component matrix is used to assign variables to factors and to interpret factors. This matrix should be viewed column wise for each column (factor) the variables which have high (close to 1) loading should be identified and a combined meaning for the factor found. This leads to a phrase which is the name given to the factor. The scores of the variable leading to problems of farmers in cultivation of intercrops have been included for the factor analysis. Varimax rotation method is used to extract meaningful factors. The rotated component matrixes for the influencing variables are given in Table 3.

Table 3
Problems of Farmers in Cultivation of Intercrops -Rotated Component Matrix

Problems	Component						
	1	2	3	4	5	6	7
Large number of different crops in the field makes it difficult to weed	**.540**	-.233	.124	.325	-.200	.147	.113
Scarcity of raw materials	**.461**	.031	-.280	.042	-.192	-.304	.389
More Difficulty in land preparation	**.446**	.363	.136	-.114	.141	-.363	-.366
Scarcity of trained labour	**.444**	.020	-.369	.056	-.334	.203	-.143
Non-Suitable climatic condition	.268	**.684**	.030	.094	-.086	.313	.165
Lack of intercropping knowledge	.016	**.652**	.132	.142	.157	.326	-.132
Non-Suitable soil type	.298	**.515**	-.117	.083	.024	.053	.310
Damages of crop while harvesting the other crop	.414	-.177	**.592**	-.145	.045	.271	.194
Harvesting is difficult	.303	-.119	**-.590**	-.050	.271	.315	.227
Some cases yields are lower	.312	-.116	**.540**	-.289	.052	.048	-.338
New technologies such as row planting, modern weeding tools & improved varieties may be difficult to introduce	.333	-.279	-.078	**.556**	-.074	.204	-.397

Irregular supply of electricity	.358	-.054	-.168	**-.528**	-.131	.063	-.195
Difficult to cultivate between rows	.413	-.064	-.366	**-.519**	-.075	.004	-.201
Exploitation of environmental resources	.432	-.195	-.043	.274	**.632**	.129	-.052
Complex and extra burden to manage	.240	-.328	-.237	.175	**.503**	-.144	.284
Yearlong crop some pests can shift from one crop to another crop	.356	-.243	.434	.034	-.137	**-.485**	.199
High input Price	.422	.303	.187	.058	.142	-.055	**-.614**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 3 clearly discloses that the most important problems of farmers in cultivation of intercrops are 'Non-Suitable climatic condition' 'Lack of intercropping knowledge', 'Exploitation of environmental resources', 'High input Price', 'Damages of crop while harvesting the other crop', 'Harvesting is difficult', and 'New technologies such as row planting, modern weeding tools & improved varieties may be difficult to introduce' as the correlation coefficients are very high for these variables.

It is also noted from Table 3 that variables 'Large number of different crops in the field makes it difficult to weed', 'Scarcity of raw materials', 'More Difficulty in land preparations', and 'Scarcity of trained labour', are with the loadings of 0.540, 0.461, 0.446 and 0.444 respectively on factor 1 and this suggests that factor 1 is a combination of these variables. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 1 could be named as 'WEEDING, LAND PREPARATIONS AND SCARCITY'.

In case of the factor 2 columns, the variables 'Non-Suitable climatic condition', 'Lack of intercropping knowledge' and 'Non-Suitable soil type' are with the loadings of 0.684, 0.652 and 0.515 respectively on factor 2 and this suggests that factor 2 is a combination of these variables. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 2 could be named as 'CLIMATIC, INTERCROPPING AND SOIL TYPE'.

In case of the factor 3 columns, the variables 'Damages of crop while harvesting the other crop', 'Harvesting is difficult', and 'Some cases yields are lower' are with the loadings of 0.592, 0.590 and 0.540 respectively on factor 3 and this suggests that factor 3 is a combination of these variables. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 3 could be named as 'CROP DAMAGE, HARVESTING AND LOWER YIELD'.

In case of the factor 4 columns, 'New technologies such as row planting, modern weeding tools & improved varieties may be difficult to introduce', 'Irregular supply of electricity' and 'Difficult to cultivate between rows' are with the loadings of 0.556, -0.528 and -0.519 respectively on factor 4 and this suggests that factor 4 is a combination of these variables. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 4 could be named as 'TECHNOLOGY, ELECTRICITY AND CULTIVATION ISSUES'.

In case of the factor 5 columns, 'Exploitation of environmental resources' and 'Complex and extra burden to manage' are with the loadings of 0.632 and 0.503 respectively on factor 5 and this suggests that factor 5 is a combination of these variables. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 5 could be named as 'ENVIRONMENT AND MANAGEMENT ISSUES'.

In case of the factor 6 columns, 'Yearlong crop some pests can shift from one crop to another crop' is with the loadings of 0.485 on factor 6 and this suggests that factor 6 is a combination of this variable. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 6 could be named as 'PEST ISSUES'.

In case of the factor 7 columns, 'High input Price' are with the loadings of 0.614 on factor 7 and this suggests that factor 7 is a combination of this variable. At this point, a suitable phrase which captures the essence of the original variables to form the underlying concept, factor 7 could be named as 'HIGH INPUT PRICE'.

The factor analysis explained the seventeen variables into seven factors namely Weeding Land Preparations and Scarcity, Climatic Intercropping and Soil Type, Crop Damage Harvesting and Lower Yield, Technology Electricity and Cultivation Issues, Environment and Management Issues, Pest Issues and High Input Price. The number of variables in each factor, Mean score and Rank, Eigen value and the per cent of variation explained by each factor are presented in Table 4. Mean value computed on the basis of each variable loaded in the components divided by the number of respondents. Rank has been computed on the basis of grand mean of each construct. Eigen value is the eligibility to be considered as factor. Minimum of 1 Eigen value required. Variance is the influence of factor for explaining the perception and attitude of buyers.

Table 4
Problems of Farmers in Cultivation of Intercrops - Principal Component Analysis

S.No.	Name of the Factors	No. of Variables	Mean	Rank	Eigen Value	Per cent of Variation Explained	Cumulative Per cent of Variation Explained
1	Weeding Land Preparations and Scarcity	4	3.41	3	2.379	13.995	13.995
2	Climatic Intercropping and Soil Type	3	3.45	2	1.785	10.503	24.498
3	Crop Damage Harvesting and Lower Yield	3	3.00	4	1.626	9.562	34.060
4	Technology Electricity and Cultivation Issues	3	2.93	6	1.329	7.820	41.880
5	Environment and Management Issues	2	2.97	5	1.255	7.384	49.264
6	Pest Issues	1	2.93	7	1.147	6.746	56.010
7	High Input Price	1	3.56	1	1.023	6.019	62.029

The most important problems of farmers in cultivation of intercrops are Weeding Land Preparations and Scarcity and Climatic Intercropping and Soil Type factors as their Eigen values are 2.379 and 1.785 respectively. The Weeding Land Preparations and Scarcity factor consists of 4 variables with the variation explained of 13.995 per cent. The Climatic Intercropping and Soil Type factor consists of 3 variables and explains the problems of farmers in cultivation of intercrops to the extent of 10.503 per cent. The third and fourth factors are Crop Damage Harvesting and Lower Yield and Technology Electricity and Cultivation Issues as their respective Eigen values are 1.626 and 1.329. The per cent of variation explained by these two factors are 9.562 and 7.820 respectively.

The highly correlated variable of the Weeding Land Preparations and Scarcity factor is Large number of different crops in the field makes it difficult to weed. It has the factor loading of 0.540. The variable Non-Suitable climatic condition is the highly correlated variable of the Climatic Intercropping and Soil Type factor as it has the highest factor loading of 0.684. 'Damages of crop while harvesting the other crop' variable of the Crop Damage Harvesting and Lower Yield factor has the highest factor loading of 0.592. Regarding the Technology Electricity and Cultivation Issues factor, the variable 'New technologies such as row planting, modern weeding tools & improved varieties may be difficult to introduce' has the highest factor loading of 0.556.

The highly correlated variable of the Environment and Management Issues factor is 'Exploitation of environmental resources' which has the factor loading of 0.632. In case of Pest Issues factor, highest correlation is found in the variable Year long crop some pests can shift from one crop to another crop as it has the highest factor loading of 0.485. The highly correlated variable of the High Input Price factor is High Input Price. It has the factor loading of 0.614.

According to Mean Rank analysis, High Input Price factor is identified as the most important problems of farmers in cultivation of intercrops with the highest mean score of 3.56 and Climatic Intercropping and Soil Type is identified as the second most important problems of farmers in cultivation of intercrops with the second highest mean score of 3.45.

Conclusion

Results revealed that the most important problems of farmers in cultivation of intercrops are 'Non-Suitable climatic condition' 'Lack of intercropping knowledge', 'Exploitation of environmental resources', 'High input Price', 'Damages of crop while harvesting the other crop', 'Harvesting is difficult', and 'New technologies such as row planting, modern weeding tools & improved varieties may be difficult to introduce' as the correlation coefficients are very high for these variables. The most important problems of farmers in cultivation of intercrops are Weeding Land Preparations and Scarcity and Climatic Intercropping and Soil Type factors as their Eigen values are higher.

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