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Correlates of perception of green chilli growers regarding environmental risk in use of pesticides with their selected characteristics

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Abstract
The present research was undertaken on topic 'Perception of green chilli growers regarding environmental risk in use of pesticides in Vidarbha region of Maharashtra state' conducted purposively in two district viz, Amravati and Buldana as it considered as a progressive agricultural belt, best suited climate, soil, irrigation facilities, skill and intensive cultivation practices adopted by the green chilli growers and maximum area under green chilli crop. Ex-post facto research design was used for the present research. Out of two districts, two talukas and 20 villages had maximum area under green chilli were selected i.e Total 300 green chilli growers constitute the sample size. The findings of the research study relational analysis revealed that variables education, land holding, area under green chilli crop, annual income, source of information, risk orientation, economic motivation, knowledge about different areas of pesticides had positive and highly significant relationship, while other variables like age, experience in farming, size of family and attitude of the farmers towards pesticide use was observed negatively significant with their perception regarding environmental risk in use of pesticides, It was also observed that cropping pattern, irrigation facilities and availability of labour were observed non-significant relationship with their perception regarding environmental risk in use of pesticides. For extent of contribution of selected independent variables on the dependent variables, the variable education alone contributed to 51.40 per cent of total variation in perception of the green chilli growers regarding environmental risk in pesticide use, followed by education + land holding (60.00%), education + land holding + age (63.50%), while education + land holding + age + attitude of the farmers towards pesticide use (65.40%).

Keywords: Correlation, perception, pesticide application, green chilli

Introduction
With the growing demand for enhancing food grain production to feed more than 121 crore people at one end and increasing yield losses due to pest infestation on the other, the farmers of India till recently have been relying on pesticides and chemical fertilizers. It is estimated that about thirty percent of the potential of food production is lost due to insect pests, diseases, weeds, rodents and birds. In terms of money, it is estimated that every year crops worth Rs.6000 crore are lost due to pests. India, being a predominantly agricultural country, the foundation for the prosperity lies on agricultural production. Since, the task of feeding the large population, which is growing at phenomenal rate of 2.3 per year, is main problems of Indian agriculture to maintain per capita net availability of food grains which is admittedly inadequate. On the other hand there is huge loss of food grains due to damage caused by insect-pests, diseases and rodents. In India, the annual loss in food products by insect pests was estimated to the tune of 50 per cent amounting Rs. 90,000 crores. (Dureja & Gupta, 2009) [6]. In the light of this, it is evident that the yield of crop can be increased significantly by adopting integrated pest management approaches. Technologically, chemical control is still the most effective method of controlling most of the insect pests, diseases and weeds, despite intensive researches into alternative methods and is still remain the powerful tools for pest management in spite of recent popular pressure to control and limit their use (Smith and Pimentel, 1978) [14]. Exposure to pesticides both occupationally and environmentally causes a range of human health problems. It is estimated that nearly 10,000 deaths annually due to use of chemical pesticide worldwide, with about three-fourths of these occurring in developing countries. Horrigan, *et al*. (2006) [7]. Chilli is one of the most valuable crop of India.

Pungency in chillies is due to the active constituent "Capsaicin", an alkaloid, is extracted from chillies and is used to medicine. The fruit is actually called 'Chilli' and is used as a spice in a variety of cuisines all over the world in different forms as green chilli, dried red chilli (Jagtap, 2012) [8]. In a country like India where farming is a family affair, the problem of reaching the target group gets further compounded. The farming family as a whole needs to be educated, then only the damages could be checked or at least minimized to a safe level. Only when they start to understand and appreciate the risks involved in the use of pesticides, then only changes can take place in the desired direction i.e. IPM.

Material and Methods

Locale of the study

The present study was undertaken in purposively selected, Amravati and Buldana districts of Vidarbha region of Maharashtra state. Total two talukas namely Morshi and Chikhali were purposively selected for this study. For this study, Ex-post-facto research design was applied. Thus, from two talukas and 20 villages' 300 green chilli growers constitute the sample size.

Selection of respondents

The green chilli growers were selected from the list obtained from Taluka Agriculture Officer of Morshi and Chikhli taluka of Amravati and Buldana district. The farmers, who cultivated chilli crops for consecutive last three years, using pesticides and having minimum area 0.40 ha. under chilli cultivation, 15 green chilli growers were selected from each selected village by random sampling. Thus, from two talukas and 20 villages' 300 green chilli growers constitute the sample size. The whole sample was considered as respondents and they were interviewed for collection of data.

Measurement of Co-efficient of correlation

Co-efficient of correlation shows the relationship between the variables. The correlation coefficient gives two kinds of information (i) degree of relationship and (ii) direction of the relationship (positive or negative) between the variables. This relationship was obtained using following formula which is given by Karl Pearson.

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \ \Sigma y^2}}$$

Where as,

$x = (X - \overline{X})$, $y = (Y - \overline{Y})$

r = correlation coefficient

X = Independent variable

Y = Dependent variable

$\Sigma xy = \Sigma^n (\overline{X} - X)(\overline{Y} - Y)$, $\Sigma x^2 = \Sigma^n (X - X)^2$, $\Sigma y^2 = \Sigma^n (Y - Y)^2$

Step-wise regression analysis

The step-wise regression (multiple regressions) analysis was employed to predict the dependent variables and consequences by independent variables. In the stepwise method, the regression analysis was started with regression of y and x_1, ... x_k taken singly. The variable giving the highest accountability in sum of squares of Y was first selected. Then the bivariate regression in which X_i appeared was worked out. The variate, which gave the highest additional accountability in sum of squares in Y after fitting Xi variable, was selected. All the trivariate regression that included both X_1 and X_2 were computed. The analysis was continued till the last variate of which additional contribution was the least of all variables. The prediction equation used was as:

$$Y = a + b_1X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\ldots\ldots\ldots b_k X_k$$

Where,

Y = Dependent variable

a = Intercept

$b_{1,\ldots\ldots} b_k$ = Partial regression coefficients of respective independent variables

$X_{1,\ldots\ldots} X_k$ = Independent variables

"F'' test was used to test the significance of the partial regression co-efficient.

Results and Discussion

Relationship between selected characteristics of green chilli growers and their perception regarding environmental risk in pesticide use

The perception on particular topic is a unit act but a complex process involving sensory imitations. The action of individual chilli farmers is governed by personal, social, economic, psychological and cultural factors of chilli farmers involved in situation. Some farmers perceived more quickly on particular topic than others because of the difference in their selected characteristics. Thus, in nutshell it may be stated that the perception on particular topic differs when there are difference in personal, socio- economic and psychological characteristics of green chilli growers. Hence, considering the important of these characteristics and review of past research studies, an attempt has been made in this investigation to ascertain the relationship if any, between personal, socio-economic and psychological characteristics of the green chilli growers and their perception regarding environmental risk in pesticide use. This was determined and tested with help of Karl Pearson correlation and results obtained is presented in below

Table 1: Relationship between the selected characteristics of green chilli growers and their perception regarding environmental risk in use of pesticides (n=300)

Sl. No	Independent Variable	Correlation-Coefficient ('r' value)
1	Age	-0.551**
2	Education	0.733**
3	Experience in farming	-0.604**
4	Size of family	-0.202**
5	Land holding	0.228**
6	Area under green chilli crop	0.213**
7	Annual income	0.291**
8	Source of information	0.656**
9	Risk orientation	0.192**
10	Economic motivation	0.361**
11	Cropping pattern	0.045(NS)
12	Irrigation facilities	0.123(NS)
13	Availability of labour	-0.107 (NS)
14	Knowledge regarding different areas of pesticide	0.808**
15	Attitude towards pesticide use	-0.657**

NS = non-significant, * = significant at 0.05 level, ** = significant at 0.01 level

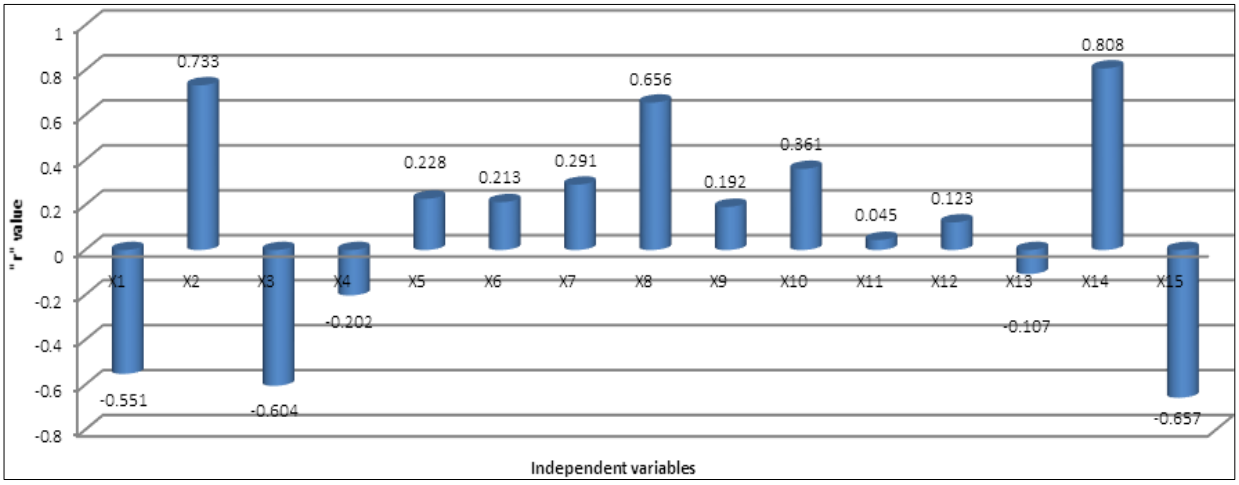

Fig 1: Relationship between the characteristics of green chilli growers and their perception regarding environmental risk in pesticide use

Age and perception

It is apparent from the data presented in the Table.1 that age of green chilli growers had negative but highly significant correlation (r = -0.551) with their perception regarding environmental risk in use of pesticides. It can be inferred that risk perception of green chilli growers was found more in case of young and middle age chilli farmers than old aged chilli farmers. It means younger green chilli growers seemed to be better in perception than aged. This finding is in the line with result of Sawant (2001) [13].

Education and perception

The data presented in table.1 reflect that perception of green chilli growers regarding environmental risk in use of pesticides had positive and highly significant (r = 0.733) correlation with their level of education, which indicate that green chilli growers perception regarding environmental risk in pesticide use was found more in case of educated green chilli growers.

Experience in farming and perception

As revealed from data presented in table 1 that there was negative but highly significant correlation (r = -0.604) between experience of green chilli growers and their perception regarding environmental risk in use of pesticides.

Size of family and perception

As revealed from data presented in table 1 that there was negative but highly significant correlation (r = - 0.202) between size of family of the green chilli growers and their perception regarding environmental risk in use of pesticides.

Land holding and perception

The data presented in table 1 clearly indicated that land holding of the green chilli growers had positive and highly significant correlation (r = 0.228) with their perception regarding environmental risk in use of pesticides.

Area under chilli crop and perception

The data presented in table 1 clearly indicated that area under chilli crop of green chilli growers had positive and highly significant correlation (r = 0.213) with their perception regarding environmental risk in use of pesticides.

Annual income and perception

It is apparent from the data presented in the table 1 that annual income of the green chilli growers had positive and highly significant correlation (r = 0.291) with their perception regarding environmental risk in use of pesticide.

Source of information and perception

The data presented in the table 1 clearly indicated that source of information of the green chilli growers had positive and highly significant correlation (r = 0.656) with their perception regarding environmental risk in use of pesticides.

Risk orientation and perception

The data presented in the table 1 clearly indicated that risk orientation of the green chilli growers had positive and significant correlation (r = 0.192) with their perception regarding environmental risk in use of pesticides.

Economic motivation and perception

The data presented in the table 1 reflect that perception of the green chilli growers regarding environmental risk in use of pesticides had positive and highly significant correlation (r = 0.361) with green chilli growers economic motivation.

Cropping pattern and perception

As revealed from data presented in table 1, that there was non-significant correlation (r = 0.045) between cropping pattern of the green chilli growers and

Irrigation facility and perception

It is apparent from the data presented in the table 1 that irrigation facility available with the green chilli growers had positive but non-significant correlation (r = 0.123) with their perception regarding environmental risk in use of pesticides.

Availability of labour and perception

As revealed from data presented in table 1 that there was negative and non-significant correlation(r = - 0.107) between availability of labour for the green chilli growers and their perception regarding environmental risk in use of pesticides.

Knowledge regarding different areas of pesticide and perception

It is obvious from the data presented in the 1 that perception of the green chilli growers regarding environmental risk in use of pesticides had positive and highly significant correlation (r = 0.808) with their knowledge level about different areas of pesticides. Knowledge is the bodies of understood information possessed by the green chilli grower about different areas of pesticide, majority of the green chilli

growers were found in medium to high level of knowledge about different areas of pesticides. It indicates that level of perception was observed more among those green chilli growers; those having medium to high level of knowledge about different areas of pesticides might be probable explanation of above finding. The finding is in line with the findings of Rathod (2009) and Badhe (2012) [3].

Attitude of farmers towards pesticide use and perception

The data presented in the table 1 clearly indicated that attitude of green chilli growers towards pesticide application had negative but highly significant correlation (r = - 0.657) with their perception regarding environmental risk in use of pesticides. This indicates that, risk perception of the green chilli growers about pesticide application was found similar up to the mark. Those who had unfavourable attitude towards pesticide application were found with better perception regarding environmental risk in use of pesticide This finding is in the line with finding of Kulkarni (1998), Rao and Dube (2001) [12], Sawant (2001) [13], Badhe (2012) [3], Madhu (2013) [9] and Preeti (2014) [10].

Extent of contribution of selected independent variables on the dependent variable of the green chilli growers

The relationship between independent and dependent variables was ascertained by computing correlation coefficients (r). The correlation coefficient provides the strength and direction of association between the two characters or variables, but does not reflect on predictive ability of independent variables to the dependent variable. Hence, in order to assess the amount of contribution (influence or predictive abilities) of each independent variable to the dependent variable, the stepwise regression analysis of the data was carried out by MATLAB software programme.The stepwise regression as stated by Efroymson's (1962) that, it is one such method which is widely adopted in multiple regression analysis. It has got the added advantages that at each stage of analysis; every variable is subjected to an examination for its predictive value. The multiple correlations coefficient (R) represents the correlation between the dependent variable and a set of independent variables fitted in multiple regression equation. The coefficient of determination (R^2) gives amount of variation accounted in dependent variables, when all independent variables were taken together in the equation. It is tested with 'F' test for its significance. The partial regression co-efficient (by_1j) represents the change in dependent variable (y) with a unit change in independent variable (x1) keeping other variables constant and it was tested with student's' t' test for its significance. The various independent variables had their own unit of measurement, which did not permit a comparison of the partial regression coefficient (by i.j) values. To facilitate comparison among the partial regression coefficient (by i.j) values, they were converted in to standardized partial regression coefficient (b'yi.j) values, which were free from the units of measurements. The independent variables were than ranked on the basis of standardized partial regression coefficient (b'yi.j) values (ignoring sign) to find out their relative importance in predicting the dependent variable.

Extent of contribution of selected independent variables on the perception of the green chilli growers.

Stepwise regression analysis with perception of green chilli growers as a dependent variable and fifteen independent variables was carried out. The final results are presented in table 2.

Table 2: Stepwise multiple regression analysis of perception of green chilli growers about environmental risk in use of pesticides

Sl. No.	Independent Variable	Partial regression coefficient (byi.j)	Standard error of regression coefficient (SE of byi.j)	't' values	Standard partial regression coefficient (b'y i.j)	Rank
1.	X2	1.540 **	0.361	4.272 **	0.286	1
2.	X5	2.950 **	0.765	3.856 **	0.231	2
3.	X1	-0.467 **	0.124	-3.76 **	-0.219	3
4.	X15	0.397 **	0.122	3.252 **	0.214	4

Constant; 14.68, 'F' value: 92.04 **, Multiple R = 0.809, R^2 = 0.654 (65.40 %), *Significant at 0.05 level of probability, **Significant at 0.01 level of probability, NS = Non-significant. As a result of stepwise regression analysis, the following regression model was obtained.

$Y_1 = 14.68 + 1.540\ X_2 + 2.950\ X_5 + - 0.467\ X_1 + 0.397\ X_{15}$

Where, X2 – Education, X5 - Land holding, X1- Age, X15 – Attitude of farmers towards pesticide use.

The partial regression coefficient (byi.j) values of these four variables were converted into standardized partial regression co-efficient (b'yi.j) values. The "t" values of partial regressions coefficients (b'yi.j) were found to be significant at 0.01 level of probability for the variables namely; education, land holding, age, attitude of farmers towards pesticide use. Based on the absolute values of standardized partial regressions coefficient (b'yi.j) they were ranked from highest to lowest order of contribution as shown in table 2.

Table 3: Stepwise extent of variation accounted by different independent variables on perception of green chilli growers about environmental risk in use of pesticides

Step No.	Variable included	Multiple correlation coefficient (R)	Total Variation accounted (% R^2)
Step-I	X2	0.717	51.40
Step-II	X2, X5	0.775	60.00
Step-III	X2, X5, X1	0.797	63.50
Step-IV	X2, X5, X1, X15	0.809	65.40

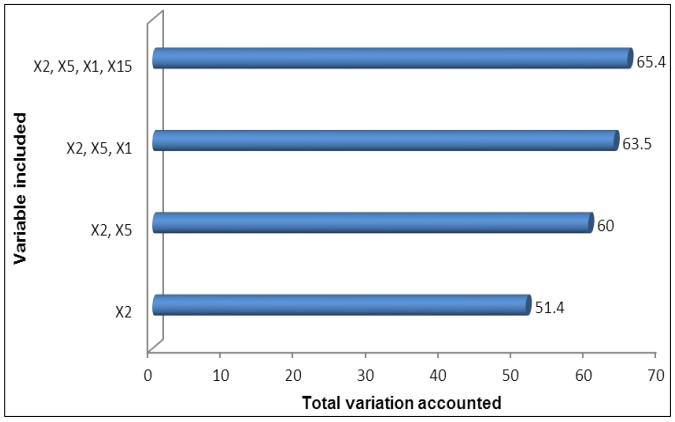

Fig 2: Stepwise extent of variation accounted by different independent variables on perception of green chilli growers about environmental risk in pesticide use

It is clear from data in table 3 that the variable, education alone contributed to 51.40 per cent of total variation in perception of the green chilli growers regarding environmental risk in pesticides use followed by education + land holding (60.00 %), education + land holding + age (63.50%) and education + land holding + age + attitude of farmers towards pesticides use (65.40%).

Conclusion

As regards multiple regressions, it can be concluded that perception of the green chilli growers regarding environmental risk in use of pesticides was found to be predicted by four independent variables such as education, land holding, age and attitude of farmers towards pesticide use which together had contributed 65.40 per cent. Looking to the standardized partial regression coefficients and their ranks, it can be concluded that education was found to be most important variable contributing to the perception of the green chilli growers regarding environmental risk in use of pesticides. The next important variable was land holding followed by age and attitude of farmers towards pesticide use.

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