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Application of Correlation and Path Coefficient to find out Factors which affect total Production and Productivity of Moong

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ABSTRACT: Various models and techniques have used to investigate the effect of various factors associated with production. The most frequent use method to analysing the effect of each independent variable on the dependent variable is multiple regression analysis and especially path analysis. Path analysis is a direction specific. Basically, it's enables us to investigate the direct and indirect effect of various factors on a single factor. Here we try to find out various factors' direct and indirect effect on moong yield production. The data show plant height is the most directly affecting factor whereas pest Jassid is the most indirectly effecting factors of moong yield production.

Keywords: Correlation, regression analysis, path coefficient, Moong.

INTRODUCTION

Moong or green gram *(Phaseo/us radiatus* or *Vigna radiata)* is one of the most important short duration pulse crops grown in India. It ranks third among all pulses grown in India after chickpea and pigeon pea In India, summer moong is cultivated in 0.289-million-hectare area, with the production of 0.087 million tonnes with the productivity of 302 kg/ha (Anonymous, 2020-21). In Madhya Pradesh, the total cultivated area is 0.0079 million hectares with total production of about 0.026 million tonnes with the productivity of 309 kg/ha (Anonymous, 2020- 21).

Correlation coefficients measure the absolute value of relationship between variables in a given set of data. Correlation does not say anything about the cause-and-effect relationship. Whereas path coefficient measures the direct influence of one variable upon another and permits the separation of correlation coefficient into components of direct and indirect effects. It is a very important statistical tool that indicates which variables (causes) exert influence on other variables (effects).

Path analysis was developed as a method of decomposing correlations into different pieces for interpretation of effects. Path analysis is closely related to multiple regression; you might say that regression is a special case of path analysis. Malik (1987) noticed that correlation and path analyses were carried out using data on seed yield/plant and 12 related characters in 40 elite genotypes yield was positively and significantly correlated with plant height. Yucel (2004) studied the phenotypic correlation coefficients between seed yield per plant and some yield components, and determine the direct and indirect effect of six components on seed yield per plant in narbon bean (*Vicia narbonensis* L.). Shanmugasundaram (1982) used to find relationship among plant characters, when selecting traits to combine for yie1d improvement The yield component with the largest and most consistent correlation coefficient in a wide array of experiments is pods-per-plant, a close positive relationship to yield being reported in all experiments. Saini (2019) study on growth rate and estimation of direct and indirect effect on total barley production in Jaipur district of Rajasthan.

MATERIALS AND METHODS

In present investigation, attempts to find direct and indirect effect of factors on moong's production and productivity. By fitting correlation and path analysis on moong crop data which are taken from department of entomology of Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh.

The following dependent and independent yield attributing characters recorded for the crop under study:

Y: Seed yield per plant (g): The total seed yield per plant recorded on electronic balance.

X_1: Plant Height (cm): The height of the plant from the base of the plant to the apex was recorded at the time of maturity.

X_2: Total pod per plant: The total number of pods per plant was recorded at the time maturity.

X_3: Pod length per plant (cm): The pod length of the per plant was recorded at the time maturity.

X_4.: Plant weight (gm): Recorded the plant weight of selected plants.

X_5: Number of jassid per plant: The average number of jassid per plant was computed from the recorded data on the basis of eight weeks.

Path diagram and technique of path analysis

Path coefficient analysis method proposed by Wright (1921), which was further modified by Dewey and Lu (1959). Path coefficients obtain by simultaneous equations, which express basic relationship between correlation and path coefficients.

$r_{1y} = p_{1y} + r_{12}\, p_{2y} + r_{13}\, p_{3y} + \ldots\ldots\ldots\ldots + r_{1i}\, p_{iy}$

$r_{2y} = r_{21}\, p_{1y} + p_{2y} + r_{23}\, p_{3y} + \ldots\ldots\ldots\ldots + r_{2i}\, p_{iy}$

$r_{3y} = r_{31}\, p_{1y} + r_{32}\, p_2y + p_{3y} + \ldots\ldots\ldots\ldots + r_{3i}\, p_{iy}$

… … …. …. ….

$r_{iy} = r_{i1}\, p_{1y} + r_{i2}\, p_{2y} + r_{i3}\, p_{3y} + \ldots\ldots\ldots\ldots + p_{iy}$

were,

r_{iy} = coefficient of correlation between causal factors x_i and dependent character y

r_{ij} = coefficient of correlation between causal factors x_i and x_j

P_{iy} = direct effect of character X_i on character Y

Path Coefficient P_{iy} from X_i to y can be calculated directly from above standardized normal equations. Substituting the numerical values of correlations and solving, we obtain the values of P's. For solving above equations. First take the inverse of the correlation matrix of appropriate variables and then multiply by r_{1y}. r_{2y} ....r_{iy}, as the case may be.

The total contribution of all the X' variables towards the determination of Y is

$R^2 = P_{1y}\, r_{1y} + p_{2y}\, r_{2y} + P_{3y}\, r_{3y} + \text{----------} + P_{iy}\, r_{iy}$

i.e., R^2 = Coefficient of multiple determination.

RESULT AND DISCUSSION

A path diagram to describe and summarize the situation of path analysis in moong crop considering the above respective variables was presented. The classical diagram is given in Fig. 1

Fig. 1 corresponds to the models given below:

$Y = \sum_1^5 p_{0I}\, X_I + U$

$Y = P_{01+P02} + P_{03} + P_{04} + P_{04} + P_{05} + U$

where P_{01}, P_{02}, ... P_{05} are the path coefficients and U, the residual.

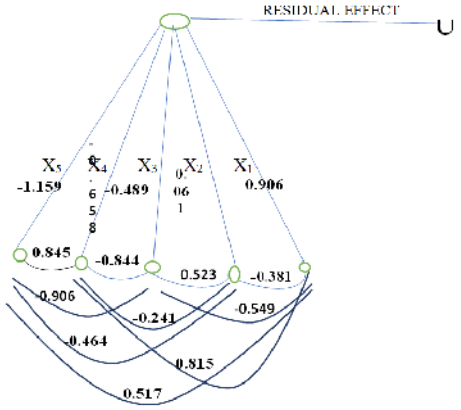

Fig. 1. Path diagram including the variables X1, X2, X3, X6, towards the determination of seed yield of moong crop effect of jassid.

The fact that all the independent variables considered above were correlated and shown in path diagram by a double headed and curved arrow. A double - headed arrow was used to denote a correlation, indicating the symmetrical nature of a correlation coefficient. In tracing the paths of a diagram, a double - headed curve might be used in either direction. Here, a simple technique for the calculation of path coefficients taking correlation matrix among X's variables had been used. For this purpose, a zero-order correlation matrix was given in Table 1.

Table 1: A zero-order correlation matrix among X's variables in moong jassids.

	Plant height (c.m.)	Plant weight (g)	No. of pod /plant	Pod length/plant (c.m.)	No. of jassid /plant	Yield/plant (g)
	X_1	X_2	X_3	X_4	X_5	Y
X_1	1.000	-0.3810	-0.5490	0.8151	0.5167	0.0163
X_2	-0.3810	1.000	0.5230	-0.2408	-0.4639	0.1562
X_3	-0.5490	0.5230	1.000	-0.8440	-0.9061	0.6513
X_4	0.8151	-0.2408	-0.8440	1.000	0.8448	-0.5006
X_5	0.5167	-0.4639	-0.9061	0.8448	1.000	-0.8322

The path coefficients Poi from Xi to Y, i= 1,2,3, ...5 we calculated directly from following standardized normal equations

$P_{01}+P_{02}r_{12}+P_{03}r_{13}+P_{04}r_{14}+P_{05}r_{15} = r_1y$

$P_{01}r_{12}+ P_{02}+P_{03}r_{23}+P_{04}r_{24}+P_{05}r_{25} = r_2y$

$P_{01}r_{13}+P_{02}r_{23}+P_{03}+P_{04}r_{34}+P_{05}r_{35} = r_3y$

$P_{01}r_{14}+P_{02}r_{24}+P_{03}r_{34}+P_{04}+P_{05}r_{35} = r_4y$

$P_{01}r_{15}+P_{02}r_{25}+P_{03}r_{35}+P_{04}r_{45}+P_{05} = r_5y$

Substituting the numerical values of the correlation given in Table 1 and solving, the values of P's were obtained. For solving the above equations, the inverse of correlation matrix of appropriate variables was computed and then multiplied by r_{1y}, r_{2y}, …., r_{5y} as the case may be.

The path coefficient from residual to Y could also be determined (Li, 1975). The values of path coefficients taking all the variables X_1, X_2, X_5 towards seed yield of moong (Y) were computed using the above technique and given in Table 2.

Table 2 revealed that the values of path coefficients toward seed yield of moong taking all the variables mentioned above. The variables plant height (0.9064), plant weight (0.0609), had positive direct effect while the variables no. of pod per plant (-0.4887), pod length per plant (-0.6577) and no. of jassid per plant had the negative direct effects (-1.1595) towards seed yield of moong crop. The direct effect of plant weight was least. The pod length and no. of jassids/plant had the negative

direct effects towards seed yield of moong but they had influenced indirectly through plant height and no. of pod/plant.

The values of path coefficients were calculated on the dependent variable Y of the variables X1, X3,.X.., X5 which are given in Table 2.

Table 3 reveals that the variables X_5; number of jassid per plant had highest and negative direct effects followed by number of pods per plant (-2.1945) and pod length per plant (-1.4739) while the variable plant height (2.0206) had positive direct effect on seed yield of moong. The indirect effect number of jassid per plant vs. number of pods per plant (2.2844) was highest and positive indirect effect but other indirect effect of other combinations had also played an important role toward seed yield of moong crop.

Table 2: Values of path coefficients of the variables X_1, X_2, X_3, X_4 X_5 towards determination of seed yield of moong.

	Plant height (c.m.)	Plant weight (g)	No. of pod /plant	Pod length/plant (c.m.)	No. of jassid /plant	Correlation with y
	X_1	X_2	X_3	X_4	X_5	Y
X_1	**(0.9064)**	-0.3454	-0.4976	0.7388	0.4684	0.0163
X_2	-0.0232	**(0.0609)**	0.0318	-0.0147	-0.0282	0.1562
X_3	0.2683	-0.2556	**(-0.4887)**	0.4125	0.4428	0.6513
X_4	-0.5361	0.1584	0.5551	**(-0.6577)**	-0.5556	-0.5006
X_5	-0.5991	0.5379	1.0506	-0.9795	**(-1.1595)**	-0.8322

The bracketed figures denote the direct effect and the rest are indirect effects.
The sum of each row should be equal to the corresponding correlation coefficient with Y

Table 3: Values of path coefficients of the variables X1, X2, X3, towards determination of seed yield of moong.

	Plant height (c.m.)	No. of pod /plant	Pod length/plant (c.m.)	No. of jassid /plant	Correlation with y
	X_1	X_3	X_4	X_5	Y
X_1	**(2.0206)**	1.0559	-1.2085	-1.9609	-0.0930
X_3	-0.9722	**(-2.1945)**	1.2844	2.2844	0.9053
X_4	1.6567	1.9124	**(-1.4739)**	-2.6758	-0.5806
X_5	1.3627	2.1039	-1.3564	**(-2.9077)**	-0.7974

The bracketed figures denote the direct effect and the rest are indirect effects.
The sum of each row should be equal to the corresponding correlation coefficient with Y

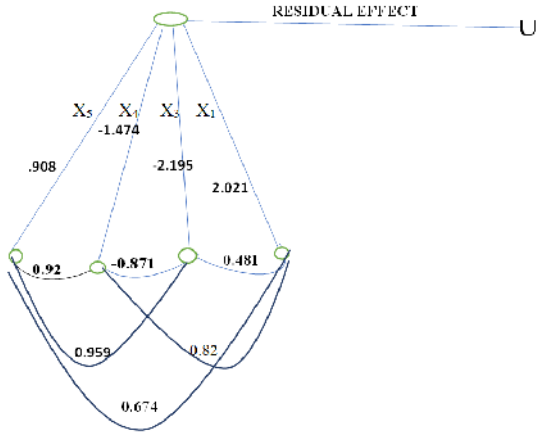

Fig. 2. Path diagram including the variables X1. X3, X. X5, towards the determination of seed yield of moong crop effect of jassid.

CONCLUSIONS

Path analyses showed that out of 5 yield attributing characters *viz.*, plant height, plant weight, number of pods per plant, pod height per plant and no. of jassid per plant studied. Plant height (0.9064) had more direct effect and number of pod per plant vs no. of jassid per plant (1.0506) had more indirect effect towards seed yield in jassid on moong crop.

FUTURE SCOPE

Correlation and Path Coefficient analysis should be tried to identify the factor which affect production and productivity of crop and Yield reduction may also be estimated due to jassids.

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Conflict of Interest. None.

Appendix- I. Weekly observations on population o f moong jassids

Plan Ht No.	Number of jassids per plant							
	I · 17/03/18	II 24/03/18	Ill 01/04/18	IV 08/04/18	V 15/04/18	VI 22/04/18	VII 29/04/18	VIII 06/05/18
1	1.	1	4	2	2	4	2	2
2	4	3	3	2	3	6	0	4
3	0	3	6	3	2	5	3	3
4	1	2	4	1	1	3	0	2
5	3	2	5	2	2	6	0	1
6	2	1	7	3	1	4	0	2
7	1	0	6	2	2	3	1	1
8	2	2	4	4	3	7	0	3
9	0	3	5	3	4	3	3	4
10	3	4	4	1	3	2	1	1
11	4	4	6	2	1	5	1	2
12	2	3	8	1	1	4	3	4
13	0	2	5	1	2	8	0	3
14	3	4	4	2	3	5	1	2
15	4	3	7	3	2	3	0	1
16 ·	3	4	5	1	1	7	0	0
17	2	4	6	1	1	5	0	1
18	1"	3	5	0	2	6	3	0
19	2	2	6	2	3	5	0	4
20	6	3	**8**	1	2	6	2	1
21	2	2	5	1	1	5	1	2
22	3	3	3	3	1	2	3	0
23	2	3	5	1	1	3	0	2
24	0	5	6	2	2	2	0	2
25	4	4	5	0	1	4	1	1
26	2	3	4	2	1	3	0	2
27	2	5	6	1	1	2	2	1
28	4	2	4	2	2	3	0	0
29	5	3	3	1	1	5	0	1
30	2	4	5	2	1	4	1	3
31	2	3	7	1	2	5	2	2
32	3	5	3	0	4	4	0	2
33	2	4	3	2	2	7	3	1
34	3	5	7	5. 1	1	5	0	1
35	1	5	4	2	2	4	0	2
36	4	4	5	2	5	7	0	0
37	0	5	0	3	2	5	1	0
38	2	4	5	2	3	6	0	3
39	1	3	5	3	2	4	3	1
40	7	2	0	2	3	6	1	1

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