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Analysis of technological gap in adoption of recommended cultivation technologies in chickpea (*Cicer arietinum*)

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Abstract
The study was conducted in Bhiwani district of Haryana state to analyze the technological gap between recommended and adopted cultivation technologies by the chickpea growers. A sample of 120 respondents was selected from four villages and the study revealed that an equally high technological gap was found in adoption of seed treatment and disease & cultural control (66.67%) followed by irrigation requirement (57.50%), chemical pest control (54%) and application of doses of manures and fertilizers (42.50%). It was also observed that the respondents' age and caste was found negatively and significantly correlated with technological gap in adoption of varieties and further analysis predicted that land holding, farm implements and mass media exposure were found positively and significantly correlated with technological gap in adoption of seed rate. The coefficients of determination (R2) were found 0.302 and 0.032 between personal variables and technological gap in adoption of varieties and seed rate, respectively.

Keywords: Adoption, chickpea, recommended technology, technological gap and varieties

Introduction
Gram commonly known as chickpea or Bengal gram is the important pulse crop of India. India alone has nearly 52.5 per cent of the world acreage and production of gram with 5630 thousands tones production in an area of 6670 thousands hectares and productivity 544 kg/ha. It occupies about 38 per cent of area under pulses and contributes about 50 per cent of the total pulse production of India. Madhya Pradesh full accounts a nearly 44 per cent of the production of the gram with 2475 thousands tones in an area of 2693 thousands hectares and productivity was 920 kg /ha. However, the average yield per hectare of chickpea in M.P. was very low as compared to average potential yield of chickpea because of partial adoption of production technology and lack of knowledge of chickpea production. A wide technological gap exists between the available techniques and its actual adoption by the farmers which is reflected through poor yield in the farmer's field. Keeping these above facts in view the study was proposed 'to access the technological gap in adoption of chickpea production technology'.

Methodology
The study was undertaken for the year 2016-17. A sample of 120 respondents was drawn from Bhiwani district purposively. Two blocks Tosham and Siwani were selected and from each block, two villages were selected randomly. Thus, total number of four villages was selected for sampling namely Khanak, Kirawar from Tosham block and Gaindawas and Barwa from Siwani block.
Adoption refers to continued use of improved practices or the permanent use of innovation by the farmers. The package of practices is a book comprising recommendation for different crops. If farmers fell short in adoption of this recommendation, gap appeared. This gap may be wide or narrow depending upon farmers and other sociological & psychological condition.
To find out the adoption level of the farmers, they were asked about use of improved practices. Some recommendations were such which farmers adopted in full, partially or somewhat adopted and there was no mid-way. There were some practices, which were adopted partially by the farmers. The full adoption was awarded three score and partially adoption was two and somewhat adoption was awarded one score. The level of adoption was determined by calculating the adoption index (AI) which has expressed as the percentage of the actual use of various components of the recommended chickpea production technology.

The Adoption Index (AI) was calculated by using the formula as given below:

$$AI = \frac{\text{Summation of the obtained adoption score}}{\text{Maximum possible obtainable adoption score}} \times 100$$

Technological gap

Technology gap refers to the gap between the recommendation made by the scientist and the extent of adoption of improved practices by the farmers.

The Technological gap in respect of all the components of recommended practices of chickpea was computed in percentage by the following formula.

$$\text{Technological gap index} = \frac{R\text{-}A}{R} \times 100$$

Where R denotes recommended package score, A denotes adoption score

Pearson's coefficient of correlation

This technique was used to find out the relationship between two variables. The formula used was as follows:

$$r = \frac{N \sum xy - \sum x \sum y}{(N \sum x)^2 - (\sum x)^2 . (N \sum y)^2 - (\sum y)^2}$$

Where,

r = Correlation coefficient

x = Score of independent variable

y = Score of dependent variable

N = Number of observation

Multiple regressions

This technique was used to know the partial and complete influence of independent variables. For the present study linear model of regression equation was used which is as follows:

$$Y_1 = a + b1x1 + b2x2 + \ldots\ldots\ldots + bnxn$$

Where,

Y1 = Dependent variable

x1...xn = Independent variables

a = Constant value

b1...bn = the regression coefficient for respective independent variables

Results and discussions

1. Technological gap

Table 1 concluded that the 66.67 per cent maximum technological gap was exist in the seed treatment or use of Rhizobium culture, disease control and cultural control with first rank, 57.50 per cent gap was found in practice of irrigation requirement with second rank, 54.00 per cent technological gap was found in chemical insect pest control with third rank, 42.50per cent technological gap was found that in application of dose of manures and fertilizers with fourth rank, 42.17 per cent technological gap was recorded in seed rate with fifth rank, 35.78 per cent technological gap was found in sowing time with sixth rank, 26.55 per cent gap was observed in adoption of varieties with seventh rank, 21.84 per cent gap was recorded in weed control with eighth rank, 20.34 per cent gap was found in sowing method with ninth rank and 15.34 per cent technological gap was observed in field preparation with tenth rank. The result has been found consonant with the result of Prasad and Singh (1996) who found that high technological gap existed in seed and seed treatment, water management, fertilizer management, pest control and disease control.

Table 1: Technological gap in adoption of recommended cutivation practices of Chickpea

S. No	Practices	Maximum obtainable score	Obtained Mean score	Percentage of adoption	Percentage of technological gap	Rank Order
1	Varieties	18	13.22	73.44	26.55	VII
2	Seed rate	06	03.47	57.83	42.17	V
3	Seed treatment	03	01.00	33.33	66.67	I
4	Field preparation	09	07.62	84.66	15.34	X
5	Time of sowing	09	05.78	64.22	35.78	VI
6	Method of sowing	06	04.78	79.66	20.34	IX
7	Manures and fertilizers	12	06.90	57.50	42.50	IV
8	Irrigation requirement	06	02.55	42.50	57.50	II
9	Weed control	06	04.69	78.16	21.84	VIII
10	Chemical insect pest control	06	02.76	46.00	54.00	III
11	Disease control	03	01.00	33.33	66.67	I
12	Cultural control	09	03.00	33.33	66.67	I
	Overall	93	59.20	63.65	36.35	

The maximum technological gap in case of seed treatment, diseases control and cultural control followed by irrigation requirement. The result and method demonstration should be conducted and efforts should be made to educate the farmers through training, field days etc. if possible subsidies should be provided to the farmers and loan should be given at cheaper rate of interest to the farmers in order to purchase the inputs like pesticides in time as per their requirement and discussed about water conservation method with the farmers to avoid irrigation problems.

1.1 Relationship between personal variables and technological gap in adoption of recommended package of practices

The data in Table 2 indicated that age and caste of the farmers was negatively and significantly correlated with technological gap in adoption of varieties. This clearly showed that if age of farmers was increased, then farmers had less adoption of varieties and vice-versa. There was no influence of caste on technological gap in adoption of varieties.

Table 2: Relationship between farmers' personal variables and technological gap in adoption of recommended package of practices of chickpea

S. No	Variables	Varieties	Seed rate	Seed treatment	Manures and fertilizers	Irrigation Requirement
1.	Age (X_1)	-0.20*	0.106	-0.75	0.197*	0.066
2.	Education (X_2)	0.71	-0.27	0.92	0.106	0.169
3.	Caste (X_3)	-0.017*	-0.03	0.067	0.037	-0.051
4.	Family type (X_4)	-0.042	-0.185*	-0.067	-0.034	-0.181
5.	Family size (X_5)	0.036	0.043	0.069	0.119	0.020
6.	Occupation (X_6)	0.034	-0.161	-0.087	-0.034	0.115
7.	Land holding (X_7)	0.011	0.204*	-0.007*	0.012	-0.249**
8.	Farm implements (X_8)	0.053	0.233*	-0.007*	-0.017	-0.066
9.	Mass media exposure (X_9)	-0.064	0.187*	-0.063	0.327**	0.136
10.	Extension contact (X_{10})	-0.118	0.130	0.043	-0.014	0.237*
11.	Irrigation facilities (X_{11})	-0.050	-0.140	0.047	0.205*	-0.007*

*Correlation is significant at 1 per cent level of significance
**Correlation is significant at 5 per cent level of significance

Regarding seed rate, it was revealed that family type is negatively and significantly correlated and land holding, farm implements and mass media exposure is positively and significantly correlated with technological gap in adoption of seed rate. If family consists of fewer members, farmer did not apply higher seed rate of chickpea because of lack of labor availability and vice versa. If farmer has more land, then farmer applied more seed rate as compared to small farmer, if farmer has implements that are more technical, then farmer applied more seed rate, if farmer has more exposure with mass media, then farmer applied more seed rate and vice – versa.

Results obtained in case of seed treatment indicated that landholding and farm implement was negatively and significantly related with technological gap in adoption of seed treatment. It clearly showed that if landholding is more, then farmer did not adopt the practice of seed treatment because more money and time was invested in practice of seed treatment in case of large landholding and vice- versa.

Results revealed in case of manures and fertilizers, the age, mass media exposure and irrigation facilities were positively and significantly correlated with technological gap in adoption of manures and fertilizers. It clearly showed that if age of farmer was increased then farmer applied more dose of manures and fertilizers, farmer who had more exposure to mass media applied right dose of manures and fertilizers and vice versa and farmer who had more irrigation facilities applied more manures and fertilizers.

Regarding irrigation requirement, it was revealed that land holding and irrigation facilities were negatively and significantly correlated with technological gap in adoption of irrigation requirement. If land holding was small, then farmer applied more water in field and vice versa. If farmer had more irrigation facilities, then farmer largely fulfill the requirement of water in field and vice versa.

1.2 Regression between personal variables and technological gap in adoption of recommended package of practices

Table 3 highlights that regression coefficient (0.229) in case of mass media exposure at 5 per cent level of significance showed that with one unit increase of mass media exposure of farmers there will be a corresponding increase of adoption level of varieties by the farmers. In case of extension contact, regression coefficient (0.311) was significant at 5 per cent level of significance showed that with one unit increase of extension contact of farmers with extension workers there will be a corresponding increase of adoption level of varieties by the farmers. While rest of the independent variables had no significant impact on adoption level of varieties by the farmers.

The 'F' value was found significant (5.142) at 5 per cent level of significance.

Table 4 shows that regression coefficient (0.032) was non-significant between independent variables and adoption level of seed treatment at 5 per cent level of significance.

The 'F-value' was found significant (0.390) at 5 per cent level of significance.

Table 3: Regression between farmers' personal variables and technological gap in adoption of recommended varieties

S. No	Personal variables	'b' value	't' value	S.E.
1	Age (X_1)	0.092	0.104	0.272
2	Education (X_2)	-0.080	-0.945	0.347
3	Caste (X_3)	-0.021	-0.251	0.802
4	Family type (X_4)	0.130	0.502	0.136
5	Family size (X_5)	-0.010	-0.120	0.905
6	Occupation (X_6)	0.067	0.796	0.428
7	Land holding (X_7)	0.002	0.022	0.982
8	Farm implements (X_8)	0.229	2.741*	0.007
9	Mass media exposure (X_9)	0.311	4.701*	0.000
F-value = 5.142 R-square = 0.302				

Regression significant at 5 per cent level of significance

Table 4: Regression between farmers' personal variables and technological gap in adoption of recommended seed treatment

Personal variables	'b' value	't' value	S.E.
Age (X_1)	0.047	-0.476	0.023
Education (X_2)	0.076	0.760	0.019
Caste (X_3)	0.072	0.737	0.030
Family type (X_4)	-0.033	-0.327	0.043
Family size (X_5)	-0.058	-0.588	0.027
Occupation (X_6)	-0.068	-0.689	0.041
Land holding (X_7)	-0.009	-0.093	0.017
Farm implements (X_8)	-0.049	-0.501	0.016
Mass media exposure (X_9)	-0.029	-0.290	0.012
F-value = 0.390 R-square = 0.032			

Regression significant at 5 per cent level of significance

Conclusion

It could be concluded that high technological gap perceived by the respondents in adoption of seed treatment, disease control and cultural control. This was followed by practice of irrigation requirement, chemical insect-pest control, application of dose of manures and fertilizers and adoption of varieties. While least technological gap was recorded in practice of sowing method, weed control and field preparation.

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