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Prices of paddy, wheat and N,P,K fertilizers have been estimated at Rs. 900, Rs. 1,150, Rs. 2,000, Rs. 1,500 and Rs. 1,000 per metric ton, respectively.

It is evident from Table I that the aggregate cost-benefit ratio is 1 : 11 when costs and incomes of only rice, wheat and fertilizers have been taken into account. The opportunity cost of the investment on the block structure has also been examined and the benefits are found above the opportunity cost. If other benefits accruing from the investment in the block structure are also added, the cost-benefit ratio will be further widened indicating more profits from the investment in the block structure. Yet, this study has its own limitations where many important variables of production and income have been omitted due to paucity of reliable data.

Implications of the Findings

On the basis of the above findings following observations may be derived for policy implications.

(*a*) The entire rural structure should be distinguished on the basis of social and economic variables of development and economic inputs should be allowed to raise the primitive society to the level of break-even point of development. The extension input, though initiated along with the economic input, be given special emphasis after the break-even point of development or when the society reaches the take-off stage.

(*b*) The costs and benefits of extension input should be viewed in its totality and, therefore, all the field extension programmes must be evaluated at frequent intervals to assess the impact of these programmes, which will help guide the planning of extension, economic input mix.

A STUDY INTO THE NATURE AND IMPACT OF AGRICULTURAL EXTENSION IN THE PUNJAB STATE

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The need to establish effective systems of agricultural extension as instruments in the process of diffusion and adoption of new farm technology has undoubtedly been increasingly recognized in India in recent years. But, unfortunately, there has been rather inadequate awareness about the nature and magnitude of the extension services available to the farmers. Further, there is almost a total lack of evidence on the impact or contribution of extension input, although a large number of studies have attempted to examine the role of research in agricultural productivity. Notable among these are

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the excellent attempts made by Griliches,[1] Arndt and Ruttan,[2] Evenson,[3] Evenson and Jha,[4] Mohan, Jha and Evenson,[5] Kislev and Evenson,[6] and more recently by Kahlon, Saxena, Bal and Jha.[7] This conspicuous lack of literature on the economics of extension is partly attributable to the fact that it has been more difficult to adequately model the role of extension in sufficient richness to allow proper identification of its contribution to production. So, the importance of empirical explorations in this direction need hardly be over-emphasized in view of the magnitude of the resources allocated in the establishment of extension organizations in India in the past and the continuing emphasis laid on these institutions in the Sixth Five-Year Plan Draft. The present study make an attempt to fill this glaring gap.

Specifically, the objectives of the present study were (*i*) to examine the nature and extent to different extension services available to the farmers, and (*ii*) to study the impact of extension input on productivity in agriculture.

DESIGN OF STUDY

The study is primarily based on data collected for the year 1974-75 under a major ICAR Scheme on the Cost of Cultivation of Principal Crops in Punjab being implemented by the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana.

The design of the study was multi-stage stratified random sampling. The data regarding gross value of output per hectare in rupees and different input variables had already been compiled. But a major lacuna in these data was the lack of information regarding extension services provided to these farmers. This conspicuous gap was filled by collecting supplementary information regarding the sources of extension services available to the farmer on the basis of schedules specially prepared for this purpose. The members of the field staff who were actually posted in the study area during that year were also consulted to help identify the degree of extension contacts of individual farmers and the extent of their contact with mass media, etc. Further, weights were assigned to different items of extension input as follows:

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1. Zvi Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovations", *Journal of Political Economy*, Vol. LXVI, No. 5, October 1958, pp. 419-431.
2. Thomas M. Arndt and Vernon W. Ruttan, "Valuing the Productivity of Agricultural Research: Problems and Issues", ADC/RTN Conference on Resource Allocation and Productivity in National and International Agricultural Research, Virginia, January 26-29, 1975.
3. Robert E. Evenson, "The Contribution of Agricultural Research to Production", *Journal of Farm Economics*, Vol. 49, No. 5, December 1967, pp. 1415-1425.
4. Robert E. Evenson and Dayanatha Jha, "The Contribution of Agricultural Research System to Agricultural Production in India". *Indian Journal of Agricultural Economics*, Vol. XXVIII, No. 4, October-December 1973, pp. 212-230.
5. Rakesh Mohan, Dayanatha Jha and Robert E. Evenson, "The Indian Agricultural Research System", *Economic and Political Weekly*, Vol. VIII, No. 13, March 31, 1973.
6. Yoav Kislev and Robert E. Evenson: Agricultural Research and Productivity—An International Analysis, Yale University, New Haven, U.S.A., 1973 (mimeo.).
7. A. S. Kahlon, P. N. Saxena, H. K. Bal, and D. Jha, "Productivity of Agricultural Research in India", ADC/RTN Conference on Resource Allocation and Productivity in National and International Agricultural Research, Virginia, January 26-29, 1975.

Extension input		Weights assigned	
Visits by different extension agencies	Agricultural Officer (AO)	5	
	Agricultural Inspector/Sub-Inspector (AI/ASI)	5	
	Farm Advisory Service (FAS) of Punjab Agricultural University (PAU)	5	
	Block Development and Panchayat Officer (BD & PO)	5	
	Village Level Worker (VLW)	5	25
Visits to different extension agencies	AO	5	
	AI/ASI	5	
	FAS (PAU)	5	
	BD & PO	5	
	VLW	5	25
Access to mass media	Literature		
	Changi kheti	10	
	Daily newspaper	10	
	Other sources		
	Dehati programme	10	40
	Melas	10	
Training in improved farming			10
	Total		100

These weights were assigned on the basis of general knowledge of the field staff regarding the importance of different types of extension inputs, and is as such highly subjective. On the basis of the above weighting scheme, the total score for each of the farmers comprising our sample was prepared and the composite extension input thus quantified was used as a separate variable to fit the production function. In order to see whether the inclusion of the extension input so defined had improved or deteriorated the explanatory value of the function, another function was also fitted by omitting the extension input variable. The exact specifications of the variables was as follows:

Y = gross value of output per hectare in rupees,

X_1 = human labour per hectare (in hours),

X_2 = cropping intensity,

X_3 = bullock labour per hectare (in pair hours),

X_4 = seed plus fertilizer expenses per hectare (in rupees),

X_5 = irrigation expenses per hectare (in rupees),

X_6 = machinery expenses per hectare (in rupees) and

X_7 = extension input.

TABLE I—DISTRIBUTION OF FARMERS ACCORDING TO EXTENSION SERVICES IN THE PUNJAB, 1974-75

	Visits by extension agencies						Visits to extension agencies						Training in farming	Access to mass media			
	AO	AI/ASI	FAS (PAU)	BD & PO	VLW	Total	AO	AI/ASI	FAS (PAU)	BD & PO	VLW	Total		*Changi kheti*	Daily newspaper	*Dehati* programme	University *melas/ divas*
Number of farmers having contacts	3	41	25	2	49	—	16	42	21	31	49	—	11	12	14	43	34
Percentage	6·00	82·00	50·00	4·00	98·00	—	32·00	84·00	42·00	62·00	98·00	—	22·00	24·00	28·00	86·00	68·00
Total number of contacts	3	77	40	2	349	471	17	61	31	41	140	290	—	—	—	—	—
Intensity	0·06	1·54	0·80	0·04	6·98	9·42	0·34	1·22	0·62	0·82	2·80	5·80	—	—	—	—	—

TABLE II—REGRESSION COEFFICIENTS FOR THE VARIOUS INDEPENDENT PARAMETERS OF THE COBB-DOUGLAS FUNCTIONS WITH AND WITHOUT EXTENSION CONTACTS

Sr. No.	Constant term	Human labour per hectare (hours) (X_1)	Cropping intensity (X_2)	Bullock labour per hectare (pair hours) (X_3)	Seed + fertilizer per hectare (Rs.) (X_4)	Irrigation expenses per hectare (Rs.) (X_5)	Machinery expenses per hectare (Rs.) (X_6)	Extension rank (X_7)	R^2
1.	0·439184	0·251129^{NS}	0·812529**	—0·030749^{NS}	0·268077**	—0·023416^{NS}	0·008498^{NS}	—	0·7311***
		(0·183298)	(0·297632)	(0·038955)	(0·080872)	(0·055408)	(0·043048)		
2.	0·647891	0·193407^{NS}	0·841709**	—0·04141^{NS}	0·235398**	—0·05239^{NS}	—0·000180^{NS}	0·177891**	0·7674***
		(0·173969)	(0·280371)	(0·036909)	(0·077203)	(0·053361)	(0·04061)	(0·069799)	

*** Significant at 1 per cent level.
** Significant at 5 per cent level.
* Significant at 10 per cent level.
NS=Not significant.
Note:—Figures in parentheses are the standard errors.

RESULTS AND DISCUSSION

Table I depicts the nature and extent of extension services available to the farmers in the study area. It would be seen that the percentage of farmers visited by AO, AI/ASI, FAS (PAU), BD & PO and VLW were 6 per cent, 82 per cent, 50 per cent, 4 per cent and 98 per cent, respectively. On the other hand, the same agencies, namely, AO, AI/ASI, FAS (PAU), BD & PO and VLW were approached by 32 per cent, 84 per cent, 42 per cent, 62 per cent and 98 per cent of the farmers. Only 11 farmers out of 50 (22 per cent) got training in farming, 12 farmers (24 per cent) read *Changi kheti*, 14 farmers (28 per cent) purchased daily newspapers, 43 farmers (86 per cent) listened to the programme for the rural folk and 34 farmers (68 per cent) visited the *kisan melas/divas*.

Turning to the intensity of extension contacts, it would be seen that the intensity of visits by AO, AI/ASI, FAS (PAU), BD & PO and VLW was 0.06, 1.54, 0.80, 0.04 and 6.98, respectively. The aggregate intensity of visits by these agencies was found to be 9.42. This meant that each farmer was contacted 9.42 times on an average during the year. Likewise, the intensity of visits of these agencies, namely, AO, AI/ASI, FAS (PAU), BD & PO and VLW to the sample farmers was found to be 0.34, 1.22, 0.62, 0.82 and 2.80. On an overall basis, each farmer visited the extension agencies for an average of 5.80 times a year.

Table II presents the results of production function analysis. The type of function used was the Cobb-Douglas which possesses special properties such as ease of estimation and simplicity in interpretation and more particularly its appropriateness in depicting the relationship of inputs to output. It would be seen that the production function at serial number 1 without the extension input explained only 73.11 per cent of the variation in productivity. However, when extension input as defined in the design of study was included as an additional independent variable the explanatory value of the new production function was estimated at 76.74 per cent which was higher by 3.63 percentage points than in the function without this input. The regression coefficient of extension input in the new function was found to be 0.18 which was significant at 5 per cent level. This could be interpreted to mean that a one per cent increase in extension input would lead to 0.18 per cent increase in output or 100 per cent increase in this input would increase the value productivity per hectare by 18 percent. This is no mean contribution by any standard.

So, in view of the catalytic importance of the extension input in the rapid adoption of the new farm technology, there is an urgent need to strengthen and streamline the organizational framework of extension services. But in-depth studies need to be launched to evaluate the relative efficacy of different components of extension services with a view to generating knowledge about how best the objective of delivering information to the farmers can be achieved.