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rative one, is primarily composed of borrowers disbursing borrowed funds among themselves. With the State policy so firmly supporting and standing by it, the system has exhibited signs of forgetting the social purpose behind the State assistance that the credit is essentially a repayable loan and not an outright grant made to the members of the credit co-operative. In this context, a policy of guided (as opposed to voluntary and open) creation of co-operatives or of selective admittance of members may not necessarily be considered as incompatible with the essentials of co-operation.[12]

ADEQUACY AND PRODUCTIVITY OF CREDIT ON THE SMALL FARMS IN THE PUNJAB

K. C. Dhawan and A. S. Kahlon*

With the technological changes, the need for credit in the case of majority of cultivators arises from the fact that their own savings are normally not adequate to finance various activities on their farms. Moreover, while their income accrues during limited period of the year, their expenses are spread throughout the year.

Credit plays a crucial role in oiling the wheels of agricultural production. It is said to be the life blood of agriculture and, therefore, the need for timely and adequate farm finance is obvious. To obtain a substantial increase in agricultural production, the provision of credit must be accompanied by and co-ordinated with a sufficient amount of technical advice and availability of physical inputs.

The marginal value productivity (MVP) of capital in agriculture having increased with the inception of new technology, the farmers are likely to depend more and more on borrowed capital to be able to adopt the new farm technology. Again, the problem of agricultural finance in India is not merely one of inadequate supply of funds, rather it is aggravated by its ineffective utilization. Credit serves a useful purpose only when it is used for productive purpose to generate a surplus after paying the interest and capital. Otherwise, its diversion for consumption purposes would affect the repaying capacity of borrowers and create overdues and defaults.

More specifically, the objectives of the study are (i) to examine the adequacy of credit supplied by different institutions to the small farms and (ii) to evaluate the economic rationale of credit obtained for different inputs on the small farms.

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12. Yair Levi, "Cooperation: In Search of New Dimensions", in Chinchankar and Namjoshi (Eds.): *op. cit.*, p. 410.

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METHODOLOGY

The study was conducted in the Ferozepur district of the Punjab State. This district was purposively selected because it has the second largest number of holdings, which have less than 7.5 acres (1,06,251)* and secondly, there exists the Small Farmers' Development Agency (SFDA) to look after the farmers' needs, such as providing loans for dairy animals, for development of infrastructure and draught power in that area.

The multi-stage sampling technique was used to select the sample. The blocks formed the primary and operational holding the ultimate unit of sampling. Two development blocks *viz.*, Dharamkot and Khuvian Sarvar were selected randomly but later on it was found that these blocks suffered from a lot of variation in the cropping pattern. So, separate analysis was done for each block.

A complete list of villages in the selected blocks was obtained from the Block Development Officers. Out of 260 villages in the selected blocks, three per cent (seven) villages were randomly selected. Fifty per cent of the small holdings (below 7.5 acres) in the selected villages were chosen to estimate the credit needs of the farmers.

RESOURCE RESTRICTIONS

Irrigation, land and capital were the most limiting resources in farm production in the study area. There were certain periods during the year when family labour became inadequate to meet the demand for various farm operations and capital was inadequate to meet the farm expenses. Particularly, irrigation was the most limiting factor in this area, which hindered the full utilization of land to raise farm income.

Capital

Capital was one of the most limiting factors in farming as most of the farmers faced difficulty in meeting cash expenses for different farm operations as well as for purchasing the variable inputs. Capital resource restraint was developed assuming that most of the farmers sold their produce for cash during the post-harvest period to meet the expenses of the following crop season. The cash earmarked by them for *kharif* crops was categorised as *kharif* cash and that reserved for *rabi* as *rabi* cash. The capital resource availability on each synthetic farm situation was worked out as:

Availability of working capital=Sale of previous crops produced plus amount borrowed and other funds available in that season minus expenses on fixed activities and family needs.

This restriction was relaxed by allowing capital to be borrowed at 15 per cent interest rate per annum. The working capital requirement for selected crop enterprises was identfiied as cost of seed, fuel, manures and fertilizers and plant protection measures. The capital requirements did

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* Statistical Abstract of Punjab, 1977, Government of Punjab, Chandigarh, 1977.

not include the expenses on family labour, while cash needed for casual labour in the peak periods was directly included in the matrix.

Development of Input-Output Coefficients

The input-output coefficients were developed for selected production activities at the existing level of technology and at the improved level of technology. The improved level of practices included the complete package of practices recommended for various farm production enterprises by the experts of the Punjab Agricultural University, Ludhiana in respect of seed, doses of fertilizers, insecticides, irrigation, etc.

Yields

Information on actual yields of various farm production enterprises at the existing level of technology was collected from the farmers. The budgeted yields of various farm production enterprises are based on the improved level of practices recommended by the experts of the Punjab Agricultural University, Ludhiana.

Borrowed and Hired Activities

Capital is one of the many factors that open up the way for the adoption of new technology and to further increase production. As the existing capital resources were inadequate to increase production, capital was fed by capital borrowing activities in both *rabi* and *kharif* seasons. This activity was introduced to find the additional capital required during the crop seasons. Interest was charged at the rate of 15 per cent for half the growth period of crop enterprises as cost of borrowing (with negative sign) in the matrix.

The irrigation restriction was relaxed by introducing the borrowing activity for their respective periods to know the additional number of irrigation hours required. The payment for unit of purchased irrigation was shown as cost coefficient (with negative sign) in the matrix.

The additional credit requirement was found in the following ways:

(*i*) Credit requirement at an optimal plan with existing input-output coefficients without purchasing irrigation water.

(*ii*) Credit requirement at an optimal plan with existing input-output coefficients and purchasing of irrigation water.

(*iii*) Credit requirement at an optimal plan with improved practices and with existing resource position without purchasing irrigation water.

(*iv*) Credit requirement at an optimal plan with improved practices, with existing resource position and purchasing irrigation water.

ANALYSIS OF THE DATA

Linear programming technique was used to analyse the data. Credit requirement was estimated by developing an optimal plan through linear programming technique, using the following model:

Objective function is to maximize $Z = \sum_{j=1}^{n} C_j X_j$ ($j = 1, 2, \ldots, n$)

Subject to following restrictions

$$b_i \geqslant \sum_{j=1}^{n} a_{ij} X_j$$

$$X_j \geqslant 0$$

where

$Z = $ total returns to fixed farm resources,

$C_j = $ returns to fixed farm resources,

$X_j = $ level of jth activity,

$b_i = $ availability of ith resource,

$a_{ij} = $ input of b_ith resource for the jth activity.

Credit Requirement

The credit requirement, especially the short-term, included such working expenses or value of seeds, fertilizers, fuel and oil, custom charges, hired human labour charges, feed purchased, veterinary services, minor repairs, etc. The value of hand tools purchased during the year and replacement investment for implements, which are consumed in a year, were added to the working expenses. The short-term credit requirement was worked out after deducting the short-term capital availability from the total short-term capital requirements.

Productivity of Credit

To meet the said objective, Cobb-Douglas production function of the following form was used.

$$Y = aX_1^{b_1} X_2^{b_2} \ldots \ldots \ldots \ldots X_n^{b_n}$$

where Y is the dependent variable and X_1 through X_n are explanatory variables, 'a' is a constant and b_1 through b_n are the regression coefficients for X_1 through X_n factors of production respectively.

The Cobb-Douglas function was converted to the logarithmic form so that it could be solved by least squares method.

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 \ldots b_n \log X_n$$

RESULTS AND DISCUSSION

The amount of credit advanced and requirement of the small farmers at the existing level of technology are shown in Table I. A comparison of the requirement and supply of credit showed that the farmers were not able to obtain the required amount of credit even to run farming at the existing level of technology on the small farms.

Table II shows that out of the total credit supplied to the farmers, the share of commission agents was the highest (36.56 per cent), followed by co-operative societies at 34.38 per cent. The contribution of the Government *taccavi* loan was 19.06 per cent, whereas professional moneylenders advanced only 10 per cent of the total amount.

The crux of the problem lies in the inadequacy of institutional credit to the farmers. The farmers needed large amount of credit even at the exist-

TABLE I—AMOUNT OF CREDIT ADVANCED BY VARIOUS INSTITUTIONS AND REQUIREMENT OF SHORT-TERM CREDIT AT EXISTING LEVEL OF TECHNOLOGY IN THE STUDY AREA, FEROZEPUR DISTRICT OF PUNJAB, 1974-75

Sr. No.	Particulars		Average amount advanced/farmer's requirement (Rs.)
1.	*Kharif* season		
	(i)	Capital requirement	920·42
	(ii)	Capital availability	580·42
	(iii)	Credit requirement	340·00
2.	*Rabi* season		
	(i)	Capital requirement	556·27
	(ii)	Capital availability	256·27
	(iii)	Credit requirement	300·00
3.	*Kharif* and *rabi* seasons (1 + 2)		
	(i)	Total capital requirement	1,476·69
	(ii)	Total capital availability	836·69
	(iii)	Total credit requirement	640·00
4.	Percentage increase in credit requirement over farmer's owned capital		76·49

TABLE II—QUANTUM OF SHORT-TERM CREDIT ADVANCED BY VARIOUS INSTITUTIONS IN THE STUDY AREA, FEROZEPUR DISTRICT OF PUNJAB, 1974-75

Sr. No.	Source of credit	Total per cultivator (Rs.)	Percentage
1.	Government	122·00	19·06
2.	Comission agents	234·00	36·56
3.	Professional moneylenders	64·00	10·00
4.	Co-operative societies	220·00	34·38
5.	Total	640·00	100·00

ing level of technology, which other lending agencies were unable to provide. In order to improve the lot of the small farmers, the Government has to come forward in a big way to fill the gap.

A thorough examination of the small farmer's resources indicated that the amount of credit supplied by various institutions was not adequate to meet the requirements even at the existing level of technology. This gap could only be filled by pumping huge amounts of capital by the commercial institutions in order to help the small farmers and make most rational use of their farm resources to further raise their incomes.

Credit requirements based on optimal production plans at the existing level of technology of an average model farm situation were estimated. The capital requirement in the optimal production plan without and with irrigation purchasing activity was Rs. 989.55 and Rs. 1,050.08 during the *kharif* season and Rs. 568.88 and Rs. 951.07 during the *rabi* season respectively. The average capital availability on these farms was Rs. 580.42 during the *kharif* and Rs. 256.27 during the *rabi* season. So, the credit requirement in the *kharif* season was Rs. 409.13 and Rs. 469.66, whereas it was Rs. 312.61

and Rs 694.80 in the *rabi* season respectively. The total credit requirement worked out to the tune of Rs. 721.74 and Rs. 1,164.46 in the optimal production plans without and with purchase of irrigation respectively.

It was observed that there was increasing demand for credit even in an optimal plan developed at the existing level of technology with irrigation purchasing activity. Credit requirement increased by 86.26 per cent over the farm plan's credit requirement without purchasing irrigation, whereas it further increased to 139.17 per cent when the irrigation constraint was relaxed in the analysis.

The analysis of capital and credit needs showed that even in the existing plans, the farmers needed 76.49 per cent of cash over their owned capital to run the family business successfully. The cash requirements increased further by about 10 per cent when resources were rationalised without purchasing irrigation water and it almost doubled when resources were rationally budgeted for their use with irrigation purchasing activity. Thus, the optimal plans indicated that the rational use of resources would increase credit requirements substantially.

Credit Requirement Based on Optimal Production Plans
    at Improved Level of Technology

The introduction of new techniques of production and use of new inputs at the recommended level, which are both capital and labour intensive, require an additional amount of credit. So, the variable cost of different enterprises increased to a greater extent. Thus, almost all the resources, especially capital and irrigation acted as severe constraints on the production programmes of the small farmers.

The adoption of modern technology changes the relative economic position of one enterprise over the other. Therefore, the change in input-output coefficients of different enterprises has caused shifts in the existing production pattern. The normative plans so obtained were, therefore, examined with a view to studying the credit requirements of the small farmers.

The capital requirement in the optimal production plans developed at the improved level of technology with existing resource position without and with irrigation purchasing activity was Rs. 1,884.88 and Rs. 2,380.20 during the *kharif* season, whereas it was Rs. 1,274.27 and Rs. 3,433.30 during the *rabi* season respectively. The capital availability on these farms was Rs. 580.42 during the *kharif* season and Rs. 256.27 during the *rabi* season. So, the credit requirement in the *kharif* season was Rs. 1,304.46 and Rs. 1,799.78, whereas it was Rs. 1,018.00 and Rs. 3,177.03 during the *rabi* season. Moreover, the total credit needs were found to be Rs. 2,322.46 and Rs. 4,973.81 in the optimal production plans developed without and with purchase of irrigation respectively.

The credit requirement increased to 277.58 per cent over the farmer's owned capital owing to higher cash requirements of improved varieties of crops. The credit requirement further increased to 594.46 per cent when irrigation purchasing was allowed in the analysis, which made more rational

use of farm resources and also facilitated inclusion of more profitable activities in the optimal plans.

It was concluded from the results of credit requirements that successful implementation of high-yielding variety programme required a huge amount of cash to meet the operating expenses of different enterprises. Further, the amount advanced to the small farmers was inadequate. With this amount of finances, the farmers could not dream of adopting modern technology to its fullest extent. The Government has to come forward in a big way to fill the gap created by the adoption of new technology.

Productivity of Borrowed Loans for Different Inputs

The main objective of the functional analysis was to evaluate the economic rationale of borrowed loans for different inputs by the small farmers. This aim was met by calculating the marginal value productivities (MVPs) of different resources and then comparing them with their acquisition costs. An analysis was made by fitting Cobb-Douglas production function to farm data for inputs and outputs obtained through a survey conducted for the year 1975-76. The estimated production equation for the small farms, expressing total gross returns (Y) as a function of land (X_1), labour days used (X_4), expenditure on irrigation facilities (X_5), expenditure on implements and machinery (X_6), investment on draught animals (X_7), investment on milch animals (X_8) and expenditure on seeds plus manures and fertilizers (X_{15}), is given in Table III.

TABLE III—COEFFICIENTS OF PARAMETERS AND GEOMETRIC MEANS OF OUTPUTS AND INPUTS FOR SMALL FARM GROUP IN THE STUDY AREA, FEROZEPUR, 1975-76

Sr. No.	Variables	Regression coefficients	Geometric means
1.	Intercept	3·3051	—
2.	Gross returns (Y)	—	7,649·26 (Rs.)
3.	Operational area (X_1)	0·3135** (0·1610)	5·13 (acres)
4.	Labour days used (X_4)	—0·1865 (0·2322)	234·57 (man-days)
5.	Expenditure on irrigation facilities (X_5)	0·0935 (0·0836)	1,292·96 (Rs.)
6.	Expenditure on implements and machinery (X_6)	0·1168 (·1028)	539·82 (Rs.)
7.	Investment on draught animals (X_7)	—0·1103* (·0551)	159·51 (Rs.)
8.	Investment on milch animals (X_8)	0·1753** (0·0635)	465·93 (Rs.)
9.	Expenditure on seeds plus manures and fertilizers (X_{15})	0·3246** (0·0984)	1,390·18 (Rs.)
	R^2	0·8103***	

** Significant at 5 per cent level.
 * Significant at 10 per cent level.
*** In the analysis of variance, R^2 value was significant at 1 per cent level.
The number of observations in the small size-group was 32.
Figures in parentheses indicate the respective standard errors.

The table shows that the coefficient of land (0.3135) was significant at 5 per cent level, indicating that one per cent increase in land area would increase gross returns by 0.3135 per cent. The coefficient of labour was negative and non-significant due to excessive use of labour on the small farms. The coefficients of expenditure on irrigation facilities, implements and machinery were also not significant. The regression coefficient of expenditure on draught animals was significant at 10 per cent level but negative. This was owing to the higher fixed cost per acre of this resource on the small farms. Although custom-hiring services are becoming more popular, yet the small farmers have to maintain a pair of bullocks because of uncertainty of timely availability of custom services and even the volume of business was not enough to make the best use of this resource. The coefficients of expenditure on milch animals and expenditure on seeds plus manures and fertilizers were both significant at 5 per cent.

The value of R^2 is 0.813, which means that the fitted equation explained about 81 per cent of the variation in the gross returns (Y). The F-test was used to find out the significance of R^2, which was found significant at one per cent level.

The MVPs of different resources and ratios of these MVPs to their factor costs are given in Table IV. It will be seen from the table that the MVP of land was Rs. 467.79 per acre. The MVP of expenditure on implements and machinery was Rs. 1.66 per rupee invested. The MVPs of expenditure on milch animals and of expenditure on seeds plus manures and fertilizers came to Rs. 2.89 and Rs. 1.76 per rupee respectively. The MVP of expenditure on milch animals was higher than that of any other resource. It means that there is a good scope of raising income through dairy farming as well as through intensive use of chemical fertilizers on the small farms. Indirectly, it also revealed that the small farmers are using lower doses of fertilizer than the optimal.

The ratio of MVP of land to its factor cost was 1.04 which was not significantly different from unity. The ratio of MVP of labour to its cost was

TABLE IV—MVPs OF FACTORS OF PRODUCTION, RATIOS OF MVPs TO THEIR FACTOR COSTS AND PERCENTAGE OF BORROWED AMOUNT TO TOTAL AMOUNT USED ON DIFFERENT RESOURCES BY SMALL FARMERS IN THE STUDY AREA, FEROZEPUR, 1975-76

Sr. No.	Variables	MVPs of different inputs	Ratios of MVPs of different factors to their costs	Percentage of borrowed amount to total amount used
1.	Operational area (X_1)	467·79	1·04	—
2.	Labour days used (X_4)	—6·10	—0·76	13·97
3.	Expenditure on irrigation (X_5)	0·55	0·50***	49·10
4.	Expenditure on implements and machinery (X_6)	1·66	1·51***	32·81
5.	Investment on draught animals (X_7)	—0·53	—0·48***	19·80
6.	Investment on milch animals (X_8)	2·89	2·62***	38·50
7.	Expenditure on seeds plus manures and fertilizers (X_{15})	1·76	1·60***	66·5

*** Significantly different from unity at 1 per cent level.

0.76 which was negative as well as not significantly differen from unity. However, the ratio of MVP to the cost of investment on draught animals was —0.48 which was significant at 10 per cent level. This showed that the cost of draught animals was higher on the small farms than its optimal return and consequently farm income could be raised through reduction in this cost. The short run alternative was to retain the pair of bullocks, but in the long run, Government might help the small farmers through setting up custom-hiring service centres which would render sufficient services to the small farmers as and when needed at lower costs.

A significantly greater than unity ratio of MVP of expenditure on implements and machinery to its acquisition cost indicated that the farmers could enhance the expenditure on this input. As this variable also included the custom-hiring charges, the farmers should either go for custom-hiring or purchase their own implements and machinery.

The overall functional analysis brought out that the small farmers were rational in making investments (which included more than 32 per cent of borrowed amount) on implements and machinery, milch animals and seeds plus manures and fertilizers as the ratios of MVPs of these resources to their costs were significantly greater than unity. Thus, the small farmers can further increase their income by curtailing expenditure on labour and draught animals. So, the small farmers should decrease the expenditure on these inputs and it was not justified to borrow for these resources. However, it should not be misunderstood that the small farmers were totally irrational. In fact, the rigidities imposed by the fixed nature of these resources and limited off-farm employment opportunities compelled them to make less than optimum use of resources.

DEMAND FOR CREDIT IN ANDHRA PRADESH

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In this paper an attempt is made to forecast the demand for short-term farm credit in the selected districts of Andhra Pradesh. The role of credit in accelerating agricultural development needs no emphasis. The demand for short-term farm credit can be defined as the amount of money required by the farmers to meet the costs of inputs and in modernizing the equipment during a given period of time. In the State of Andhra Pradesh, the Primary Land Mortgage Banks (PLMBS) and the Multi-purpose Co-operative Credit Societies (MPCCS) are the major sources of institutional financing agencies supplying short-term and medium-term credit to the cultivators. They give credit to meet expenses such as for purchasing fertilizers, pesticides, high-yielding variety (HYV) seeds, electrifying the oil engines and motor pumpsets, reclamation of soil, etc. Besides the credit supplied by these agencies, credit

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