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IMPACT OF DIVERSIFICATION ON INCOME, EMPLOYMENT AND CREDIT NEEDS OF SMALL FARMERS IN PUNJAB

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Dairying, being a self-income generating enterprise, is an important alternative to diversify the arable farming for getting more, stable and continuous farm income and higher employment opportunities on smaller farms.[1] However, an omnipresent problem facing the farmer these days lies in the decision-making about the profitable levels of diversification of crop farming with dairying so as to maximize his farm profits by increasing the productivity of milch animals and crops per unit of land and time within the framework of scarce resources.[2] Also, the optimum levels of diversification of crop enterprises with dairy and its impact vary for different regions of the country because of the variation in the agro-climatic conditions and resource endowments of the farmers. Hence, for the efficient utilization of scarce resources and having higher income, productivity and employment opportunity, it is most essential that the optimum combination of dairy and crop enterprises is developed for different agro-climatic situations and its impact is examined on income, employment and credit needs.

The present investigation is aimed at examining the impact of diversified optimum plans developed with existing and improved levels of technology in the context of augmenting income, employment and credit requirements of small farmers in Patiala district of Punjab State.

METHODOLOGY

To meet the objective of the present investigation it was decided to select an area where the crop and dairy enterprises were taken together by the farmers and the infrastructure for the extension of improved crop and milk production technology, credit supply and marketing of milk were already existing. Patiala district of Punjab provided a suitable background and was selected for the present study.

The stratified random sampling procedure was adopted for the selection of villages and farmers. Based on the similar topography and agro-climatic conditions, the district was divided into three homogeneous zones[3] and two villages from each zone were randomly selected. The present investigation relied on the data collected for a broad study for 49 small farmers (1-3 ha.) selected randomly from the population and maintaining at least one milch animal. The input-output and price data for the crops and dairy enterprise were collected by the survey method on specially designed and pre-tested schedule pertaining to the agricultural year (1978-79).

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1. Amrik S. Saini and D.S. Sidhu, "Impact of Dairy Enterprise on Farm Income in Punjab", *Journal of Research*, Vol.14, No.2, 1977.

2. See Interim Report of the National Commission on Agriculture on Milk Production through Small and Marginal Farmers and Agricultural Labourers, Ministry of Agriculture, Government of India, December 1971, pp.48-50.

3. Zone I : In this zone, paddy and maize were the major crops in the *kharif* season and wheat was the principal crop in the *rabi* season. It comprised Rajpura and Fatehgarh Saheb tehsils.

Zone II : Paddy, maize and groundnut were the major crops in the *kharif* season and wheat was the important crop in the *rabi* season. It represented Nabha tehsil only.

Zone III : Paddy was the only major crop in the *kharif* season and wheat was the principal crop in the *rabi* season. It included Patiala and Samana tehsils.

To examine the impact of diversified crop and milk plans on income, employment and credit requirements of small farmers, the data of the sampled farms were pooled and arranged to form synthetic farm situations with operational holdings of 2.53 (zone I), 2.47 (zone II) and 3.0 hectares (zone III). Mixed Integer Programming Model was used to develop the optimal plans as presented below:

$$\text{Maximize } Z = \sum_{j=1}^{r} C_j X_j + \sum_{j'=r+1}^{K} C_j^* X_j^*$$

$$(j = 1, 2, 3, \ldots\ldots r)$$

$$(j' = r+1, r+2, \ldots\ldots K)$$

Subject to :

1. $\sum_{j=1}^{r} a_{ij} X_j + \sum_{j=r+1}^{K} a_{ij} X_j^* \lessgtr, =, \geqslant b_i$ $(i = 1, 2, 3, \ldots\ldots n)$

2. $X_j \geqslant 0; X_j^*$ (is integer) $= 0, 1, 2, 3, 4, \ldots\ldots$

where X_j^* is integer activity and other notations are the same as that of linear programming model.

Z = total returns to fixed farm resources from all the activities,

X_j = level of the jth real activity,

C_j = returns to fixed farm resources per unit of ith activity.

b_i = availability of ith resource, and

a_{ij} = amount of the ith resource required by one unit of jth activity.

RESULTS AND DISCUSSION

To examine the impact of diversification on income, employment and credit requirements, four optimum plans with crops and dairy enterprise were developed which are presented in Table I.[4]

The existing farm plans on the small farms showed that paddy and wheat were the important crops in the *kharif* and the *rabi* season respectively in all the three zones, though their proportion to the cultivated area varied. The average number of buffaloes maintained by the farmers was relatively higher in zone I as compared to the other two zones while the reverse was true for the cross-bred cows. The local cow was maintained only by a few farmers of zone I. A close examination of the optimum farm plans indicated that the land use pattern required significant changes from that of the existing plan. The number of crops to be grown on the farms was substantially reduced in all the zones and the crops with relatively low profitability were removed while the area under more profitable crops was increased. The introduction of dairy enterprise both with existing and improved technology exhibited that for profit maximization in zone I, the farmers should increase the number of cross-bred cows and decrease the number of buffaloes. In zone II the number of cross-bred cows should be increased more with improved technology as compared to existing technology while the number of buffaloes was almost the same as was observed for existing plan. In zone III, optimum plan with the existing technology suggested that only six buffaloes should be kept while with improved technology the farmer should keep five cross-bred cows and one buffalo only. The introduction of cross-bred cows and buffaloes in the optimum plans required increased area under fodder crops and warranted reallocation in the area devoted to different crops. Interestingly, the increase in area under fodder crops necessitated a simultaneous decrease in the area under the major crops, *i.e.*, paddy and wheat in the *kharif*

4. P_0 Existing plan already taken by the farmers.

P_1 Optimum plan at existing technology with borrowed funds and without dairy enterprise.

P_2 Optimum plan at existing technology with borrowed capital and dairying.

P_3 Optimum plan at improved technology with borrowing and without milch animals.

P_4 Optimum plan at improved technology with borrowing and dairy enterprise.

TABLE I. EXISTING AND OPTIMUM PLANS ON SMALL FARMS

(area in hectares)

Enterprise	Zone I					Zone II					Zone III				
	P_0	P_1	P_2	P_3	P_4	P_0	P_1	P_2	P_3	P_4	P_0	P_1	P_2	P_3	P_4
Kharif season															
Paddy	1.41	1.63	0.76	1.05	0.51	0.76	1.73	0.63	1.34	—	1.33	1.99	1.59	1.69	1.00
Maize	0.20	—	0.55	0.07	0.24	0.38	0.21	0.22	—	0.30	1.15	—	—	0.33	0.24
Groundnut	0.05	0.40	—	0.40	0.40	0.22	0.01	—	0.50	0.47	0.14	0.38	—	0.40	0.40
Bajra	—	—	—	—	—	0.04	—	—	—	—	0.20	—	—	—	—
Cotton	0.12	—	—	0.18	—	0.10	—	—	0.16	—	0.08	0.15	0.15	0.15	—
Sugarcane	0.09	—	—	0.40	0.40	0.10	—	—	—	0.50	0.08	0.20	0.20	—	0.20
Pulses	0.03	0.05	0.05	0.05	0.05	0.09	0.15	0.15	0.10	0.10	0.06	0.15	0.15	0.10	0.10
Chillies	0.02	0.20	0.20	0.20	—	0.05	0.25	0.25	0.25	—	0.05	—	—	0.20	—
Fodder	0.28	—	0.79	—	0.75	0.25	—	1.10	—	0.98	0.32	—	0.40	—	0.93
Oilseeds	0.03	0.07	—	—	—	0.05	—	—	—	—	0.10	—	0.38	—	—
Fixed activity	0.18	0.18	0.18	0.18	0.18	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13
Rabi season															
Wheat	1.43	1.93	1.19	1.53	1.05	1.52	1.82	1.27	1.73	0.80	1.70	2.20	1.89	1.79	1.24
Barely	0.12	—	—	—	—	0.08	—	—	—	—	0.28	—	—	—	—
Sugarcane	0.09	—	—	0.40	0.40	0.10	—	—	—	0.50	0.08	0.20	0.20	—	0.20
Vegetable	—	—	—	—	—	0.06	0.30	0.40	0.40	0.20	0.16	0.35	0.32	0.35	0.15
Pulses	0.16	0.50	0.79	0.50	0.50	0.12	0.15	0.15	0.24	0.24	0.20	0.15	0.15	0.76	0.76
Fodder	0.44	—	0.45	—	0.48	0.38	—	0.55	—	0.63	0.30	—	0.34	—	0.55
Fixed activity	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total cultivated area	2.53	2.53	2.53	2.53	2.53	2.47	2.47	2.47	2.47	2.47	3.00	3.00	3.00	3.00	3.00
Total cropped area	4.75	5.06	5.06	5.06	5.06	4.68	4.94	4.94	4.94	4.94	5.46	6.00	6.00	6.00	6.00
Cropping intensity(%)	187.77	200.00	200.00	200.00	200.00	190.28	200.00	200.00	200.00	200.00	182.00	200.00	200.00	200.00	200.00
Milch animals															
Buffalo (No.)	2.33	—	1	—	1	1.81	—	2	—	2	1.86	—	6	—	1
Cross-bred cow (No.)	0.11	—	5	—	5	0.68	—	4	—	6	0.40	—	—	—	5
Local cow (No.)	0.83	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE II. INCOME, HUMAN LABOUR UTILIZATION AND PRODUCTIVITY FOR EXISTING AND OPTIMUM FARM PLANS

Particulars	Zone I					Zone II					Zone III				
	P_0	P_1	P_2	P_3	P_4	P_0	P_1	P_2	P_3	P_4	P_0	P_1	P_2	P_3	P_4
1. Returns (Rs.)	10,445	10,899	13,629	17,437	22,550	10,466	12,578	14,114	20,987	26,740	11,967	12,978	20,006	23,348	30,379
(a) Change over existing plan (Rs.)	—	454 (4.35)	3,184 (30.48)	6,992 (66.94)	12,105 (115.89)	—	2,112 (20.18)	3,648 (34.86)	10,521 (100.53)	16,277 (155.49)	—	1,011 (8.45)	8,039 (67.18)	11,381 (95.10)	18,412 (153.86)
(b) Change over previous plan (Rs.)	—	454 (4.35)	2,740 (25.16)	3,808 (27.97)	5,113 (29.32)	—	2,112 (20.18)	1,536 (12.21)	6,873 (48.70)	5,753 (27.42)	—	1,011 (8.45)	7,028 (54.15)	3,342 (16.70)	7,031 (30.11)
2. Human labour (man-hours)	5,937	3,827	7,312	5,413	10,180	5,970	3,994	8,097	6,687	12,354	8,432	4,089	8,355	7,214	11,400
(a) Change over existing plan	—	−2,110 (−35.54)	1,375 (23.16)	−524 (−8.83)	4,243 (71.47)	—	−1,976 (−33.10)	2,127 (35.63)	717 (12.01)	6,384 (106.93)	—	−4,343 (−51.51)	−77 (−0.91)	−1,218 (−14.44)	2,968 (35.20)
(b) Change over previous plan	—	−2,110 (−35.54)	3,485 (91.06)	−1,899 (−25.97)	4,767 (88.07)	—	−1,976 (−33.10)	4,103 (102.73)	−1,410 (−17.41)	5,667 (84.75)	—	−4,343 (−51.51)	4,266 (104.33)	−1,141 (−13.66)	4,186 (58.03)
3. Productivity (returns/hectare) (Rs.)	4,129	4,308	5,387	6,892	8,913	4,237	5,092	5,714	8,497	10,826	3,980	4,326	6,669	7,783	10,126
(a) Change over existing plan	—	179	1,258	2,763	4,784	—	855	1,477	4,260	6,623	—	346	2,689	3,803	6,146
(b) Change over previous plan	—	179	1,079	1,505	2,021	—	855	622	2,783	2,329	—	346	2,343	1,114	2,343

Figures in parentheses indicate the percentage change.

TABLE III. CAPITAL AND CREDIT REQUIREMENTS FOR THE OPTIMUM FARM PLANS

(Rs.)

Particulars	Zone I				Zone II				Zone III			
	P_1	P_2	P_3	P_4	P_1	P_2	P_3	P_4	P_1	P_2	P_3	P_4
A. Kharif capital												
1. Owned	985	985	985	985	1,066	1,066	1,066	1,066	797	797	797	797
2. Generated through dairying	0	4,715	0	9,975	0	3,652	0	13,276	0	6,312	0	9,975
3. Total available (1+2)	985	5,700	985	10,960	1,066	4,718	1,066	14,342	797	7,109	797	10,772
4. Requirement	1,534	5,781	5,391	9,434	1,857	5,309	5,514	11,288	1,531	4,849	5,681	10,772
5. Deficit/surplus*	-549	-81	-4,406	1,526	-791	-591	-4,448	3,054	-734	2,260	-4,884	0
B. Rabi capital												
1. Transferred from kharif	0	0	0	1,526	0	0	0	3,054	0	2,260	0	0
2. Generated through sale of kharif crops	8,111	5,068	16,294	10,427	8,928	4,945	15,679	9,179	9,898	7,877	17,215	12,232
3. Generated through dairying	0	10,246	0	13,475	0	10,552	0	17,424	0	5,040	0	13,475
4. Family consumption	2,532	2,532	2,532	2,532	2,775	2,775	2,775	2,775	2,629	2,629	2,629	2,629
5. Repayment of kharif crop loan with interest	581	86	4,660	0	837	627	4,704	0	775	0	5,165	0
6. Total available	4,998	12,696	9,102	22,896	5,316	12,095	8,200	26,882	6,494	12,548	9,421	23,078
7. Requirement	2,351	8,331	5,749	14,666	4,880	8,490	6,398	19,976	3,394	8,933	9,212	20,656
8. Deficit/surplus	2,647	4,365	3,354	8,230	436	3,605	1,802	6,906	2,100	3,615	209	2,422
C. Medium-term capital												
1. Available	4,050	4,050	4,050	4,050	4,888	4,888	4,888	4,888	4,619	4,619	4,619	4,619
2. Requirement	0	15,500	0	23,000	0	14,700	0	30,000	0	14,400	0	23,000
3. Deficit/surplus	4,050	-11,450	4,050	-18,950	4,888	-9,812	4,888	25,112	4,619	-9,781	4,619	-18,381

* Figures with negative signs indicate capital deficit or credit requirement for that season and values with positive signs mean capital surplus in that season which becomes capital available for the next season.

and the *rabi* season respectively. The optimum plans developed with and without dairy enterprise showed that each piece of land should be double cropped and, therefore, the cropping intensity increased to 200 per cent.

Diversification and Farm Income

The diversification of crop farming with milch animals under existing and improved levels of technology resulted in considerable increase in farm income[5] of small farmers in all the optimum plans of all the zones (Table II). The increase in the income of plan IV (P_4) over the farmer's plan (P_0) was observed to be the maximum representing 116, 155 and 154 per cent for zones I, II and III respectively. The effect of diversification on farmer's income was the highest in plan II (P_2) of zone III (54 per cent) followed by plan IV of the same zone (30 per cent) where six milch animals were introduced in each plan. Overall, the diversification of arable farming with livestock activities resulted in an increase in income ranging from 12.21 per cent to 54.15 per cent. This showed that the dairy enterprise can easily justify its role to diversify the crop farming for higher income on the small farms.

Diversification and Employment

A close examination of Table II revealed that the labour employment decreased considerably in all the plans generated without dairy enterprise. On the other hand, plans developed with livestock activity led to a marked increase in human labour employment in all the zones. The maximum increase in human labour employment due to diversification was observed in plan II (P_2) of zone III (104.33 per cent) followed by plan II in zone II (102.73 per cent) and minimum in plan IV (P_4) of zone III (58.03 per cent). It clearly indicated that to increase the employment potential on the small farms which hardly have any off-farm employment opportunity, keeping of high-yielding milch animals along with crop farming would prove to be a sound proposition to solve the much debated problem of unemployment/under-employment on these farms.

Diversification and Credit Needs

The plans developed without dairy enterprise indicated the credit need in the *kharif* season whereas the plans generated with milch animals did not exhibit any credit need (Table III) which was due to the self-income generating[6] nature of the dairy enterprise. From this it may be established that dairying decreases the need for short-term credit by providing daily income which becomes sufficient to meet the day to day expenses of farmers. However, all the optimum plans generated surplus *rabi* capital in all the zones.[7] To diversify the crop farming with dairying, the farmers needed considerable amount of medium-term credit, reflecting thereby the direct relationship with the number of milch animals that entered in the optimum plans. This envisaged that to diversify the farming business with dairy animals, sufficient facilities should be made available to finance the farmers for good cause.

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5. The difference in objective functions of optimum plans II and I, and optimum plans IV and III indicates the effect of diversification on farmers' income at existing and improved levels of technology respectively.

6. Provision was made in the model to supplement capital through income generated from milch animals in the *kharif* and the *rabi* season. For details, see Amrik Singh :.Optimum Resource Allocation and Normative Milk Supply Functions for Patiala District, Punjab, Ph. D. Dissertation, Kurukshetra University, Kurukshetra, 1982 (unpublished).

7. A word of caution is necessary here to mention that optimum plans were developed only for one agricultural year and no account of risk factor involved in crop and dairy enterprise was taken. If this factor was considered the entire surplus would have been exhausted completely, rather a deficit could have cropped up.

CONCLUSIONS

The diversification of crop farming with high-yielding milch animals can play an important role in increasing income and employment on small farms. Dairying, being a self-income generating enterprise, reduces the short-term credit requirement by supplying regular income to the farmers. However, its requirement for medium-term credit increases manifold with the introduction of high-yielding milch animals of improved breeds. Thus, the study suggests that the financing institutions should come forward unhesitatingly to provide medium-term credit on easy terms to the small farmers to diversify their arable farming with dairy enterprise, which would reduce the income variability and dynamise the entire gamut of income potential and which offers the single best measure to solve the chronic problem of unemployment/under-employment of family labour on these farms.