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OPTIMUM CROPPING PATTERNS FOR UPPER-DHAIA REGION OF I.A.D.P. DISTRICT LUDHIANA (PUNJAB)

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Introduction

Scientific determination of optimum cropping patterns is the crying need of the day to give real practical meaning to the concept of Intensive Agricultural Development for increasing agricultural production. More so, because of the scarcity of production elements. During the last decade many changes have taken place in the physical, biological, economic, technological and institutional set-up of the Punjab State in general and Ludhiana district in particular. These changes naturally demand adjustments in the existing cropping patterns of different areas. Yield-increasing technology such as evolution of high-yielding varieties, quick maturing crop strains, greater use of fertilizers and enhanced irrigational facilities, have put the existing cropping patterns at below optimum.

Economic conditions have also changed because of the location of new markets, establishment of new processing units, added transportation facilities and changes in price structure. These changes have facilitated and increased the choice of enterprises. Continuous adjustments in cropping patterns are required to maximize the farm incomes consistent with the changed resource restrictions and techno-economic conditions of the farm organizations.

Objectives

This study is an attempt to analytically examine the cropping patterns of the I.A.D.P. district Ludhiana. More specifically, the objectives of this study are (i) to appraise the existing cropping patterns of the district; and (ii) to determine optimum cropping patterns based on (a) existing production techniques and (b) improved production techniques.

Design of the Study

The present study has covered the 'Upper-Dhaia' region of I.A.D.P. district Ludhiana, representing relatively heavier soils fit for cultivation of wheat, sugarcane, maize, cotton and rice and the lighter ones suited to the cultivation of groundnut. The Dehlon development block formed the operational area of the study because it represented farming characteristics of 'Upper-Dhaia' region with lift irrigation as its main source of irrigation. Five villages were selected at random with probability proportional to the cultivated area in each village of this block. A list of the operational holdings was prepared in all the five randomly selected villages. These holdings were pooled and the distribution transformed to obtain small, medium and large-sized holdings. Frequency distribution of each size-group gave 10-acre, 16-acre and 22-acre size holdings as modal class groups, representing the small, medium and large size-groups respectively.

The main source of farm power was bullocks on all the farms. The most prevalent source of irrigation was percolation wells on small farms and tube-wells on medium and large farms.

To obtain representative synthetic typical farm situations, data on resource use, land use capabilities, existing cropping patterns and input-output coefficients of 12 randomly selected farm situations from each modal group, were pooled and averaged. The resulting three synthetic farm situations were used for developing alternative budgets.

Budgeting technique was used for analysis. Net returns to fixed farm resources for various crop enterprises were calculated on per acre basis by deducting operational costs from the gross returns on each synthetic farm situation. The product-mix developed within the framework of the resource restrictions obtaining maximum returns to fixed farm resources from the farm as a whole, were considered as optimum¹ cropping patterns for small, medium and large units of farm organizations of the study area.

AN APPRAISAL OF THE EXISTING CROPPING PATTERNS

An appraisal of the existing cropping patterns, resource use levels and other organizational and operational weaknesses (Appendices 1-4) indicated that :

1. Some crops yielding relatively lower returns per acre, such as *desi* maize in *Kharif* and gram, barley and 'wheat plus gram' mixture in *Rabi* covered comparatively larger areas than crops obtaining higher returns per acre such as hybrid maize, groundnut, American cotton, sugarcane and wheat (Appendix 1). This was mostly due to low input requirements of these crops but this choice was in consistent with profit maximization principle.

2. Existing per acre yield levels of almost all crops were much below the potential levels (Appendices 2, 3, 4) and could be raised through the application of improved agricultural techniques such as intensive use of chemical fertilizers, water and pesticides.

3. Enterprise budgets showed that the practice of fallowing the land in *Kharif* season was uneconomical. On small, medium and large size farms, the percentage of fallow to the total cropped area was 10.10, 16.60 and 11.16 respectively.

4. The restricting resources such as farm family labour and operating capital remained under-utilized during various months which could be better utilized by working out better crop combinations.

5. In spite of relatively higher profitability and low input requirements, groundnut acreage was much less than the maximum permitted by the land suitability. Such unutilized irrigated groundnut land was more on the medium farm (2.31 acres) than on the large farm (1.73 acres) and the small farm (1.33 acres).

1. Optimum here means the most profitable crop enterprise-mix estimated through budgeting analysis, after considering alternative crop plans. Better use of farm resources and modern farm technology are inherent features of the alternative plans. The solutions are, therefore, close to the optimum, although it is difficult to say that these are the optimum solutions.

OPTIMUM CROPPING PATTERNS BASED ON EXISTING PRODUCTION TECHNIQUES

Adoption of yield-increasing inputs and other improved agricultural practices on the existing cropping patterns will greatly help to increase per acre yields and returns from the present crop complex of the cultivators. But the introduction of higher technology and new crops without any major enabling changes and augmentation of existing resources is by no means an easy task. However, adjustments in the combination of crops usually grown in the region should not be difficult, if farmers are convinced of the merits of such adjustments within the framework of farm resources.

Within the framework of the resource restrictions and using the input-output coefficients of the average existing production techniques, alternative crop combinations were developed, keeping in view the profitability and adaptability of each enterprise and complementary, supplementary relationships (Table I).

Small Size Farm (10 Acres)

Enterprise budgets indicated that hybrid maize yielded the highest returns per acre in this area. Its acreage was increased from 0.26 to 2 acres. One acre of *desi* maize was retained in the alternative plan for farmers' home consumption although it was less profitable because the farmers had still not developed a taste for hybrid maize meals. Irrigated groundnut acreage was increased from 0.77 to 1.25 acres because of its lower water and labour requirements. In the *Rabi* season, the whole area was put under irrigated wheat. Late sowings of wheat after American cotton could be done with wheat C-286. Gram could be purchased for cattle instead of raising on the farm. At the existing level of technology, fodder acreage was kept the same as a fixed activity.

Through these crop shifts, the returns to fixed factors (crops only) increased from Rs. 4,843.97 to Rs. 5,989.44, representing an increase of 23.65 per cent over the existing crop plan, and the cropping intensity increased from 178.8 per cent to 193 per cent. The utilization of labour and operating capital was better in the optimum plan. Farm labour was better employed throughout the year (Appendix 5).

Medium Size Farm (16 Acres)

Following a similar approach, the area under *desi* maize was reduced to one acre whereas the area under hybrid maize was increased from 0.53 to 4 acres because of higher profitability of the latter. Fallow land was reduced from 3.95 acres to 0.72 acre in *Kharif* and the acreage thus saved was put under groundnut. Acreage under American cotton was slightly increased from 2.92 to 3 acres. In the *Rabi* season gram, being the least profitable crop, was eliminated. The area saved from gram, barley and fallow was devoted to wheat which is a higher income-yielding crop.

By incorporating these adjustments in the crop combination, the returns to fixed factors (from crop enterprises) increased from Rs. 7,137.95 to Rs. 9,039.49, i.e., an increase of 26.64 per cent over the existing crop plan. The cropping intensity increased from 166.7 per cent to 190.8 per cent leading to better spread

TABLE I—OPTIMUM CROPPING PATTERNS AND RETURNS TO FIXED FARM RESOURCES WITH EXISTING PRODUCTION TECHNIQUES ON THREE DIFFERENT SIZED SYNTHETIC FARM SITUATIONS, DEHLON BLOCK, I.A.D.P. DISTRICT LUDHIANA

Crop enterprises	Small Farm				Medium Farm				Large Farm			
	Acre- age total cropped area	Percent- age of total cropped area	Returns to fixed factors		Acre- age total cropped area	Percent- age of total cropped area	Returns to fixed factors		Acre- age total cropped area	Percent- age of total cropped area	Returns to fixed factors	
			Per acre (Rs.)	Total (Rs.)			Per acre (Rs.)	Total (Rs.)			Per acre (Rs.)	Total (Rs.)
<i>Kharif Season</i>												
Desi Maize	1.00	5.00	263.86	263.86	1.00	3.12	233.25	233.25	1.50	3.41	253.35	380.02
Hybrid Maize	2.00	10.00	427.76	855.52	4.00	12.50	439.31	1,757.24	4.00	9.09	421.27	1,685.08
American Cotton	1.50	7.50	363.16	544.74	3.00	9.37	373.01	1,119.03	5.00	11.36	502.44	2,512.20
Desi Cotton	1.00	5.00	362.08	362.08	0.25	0.78	267.93	66.93	1.35	3.07	316.71	427.56
Groundnut irrigated	1.25	6.25	336.94	421.18	2.50	7.81	352.67	881.68	3.00	6.81	303.13	909.39
Groundnut unirrigated	0.27	1.35	237.84	64.22	0.75	2.34	297.55	223.16	—	—	—	—
Sugarcane (plant)	0.25	1.25	568.61	142.15	0.50	1.56	444.52	222.26	1.00	2.27	691.43	691.43
Sugarcane (ratoon)	0.75	3.75	659.78	494.83	1.00	3.12	639.03	639.03	1.00	2.27	894.10	894.10
<i>Kharif Fodders</i>	1.66	8.30	—	—	2.28	7.13	—	—	3.60	8.20	—	—
	9.68	48.40	3,148.58	15.28	47.73	5,142.63	20.45	7,499.78				
<i>Rabi Season</i>												
Wheat after Fallow irrigated	—	—	—	—	—	—	—	—	1.50	3.41	433.01	649.51
Wheat after <i>Kharif</i> irrigated	5.25	26.25	434.11	2,279.08	8.40	26.25	344.19	2,891.20	9.50	21.60	378.46	3,595.37
Wheat after American Cotton	1.50	7.50	374.52	561.78	3.00	9.37	335.22	1,005.66	5.00	11.36	323.34	1,616.70
<i>Rabi Fodders</i>	1.86	9.30	—	—	2.34	7.31	—	—	3.63	8.25	—	—
Sub-total	8.61	43.15	—	—	13.74	42.93	—	—	19.63	44.62	—	—
Total cropped area	18.29	91.55	—	—	29.02	90.66	—	—	40.08	91.10	—	—
Cropping intensity (%)	193.0	—	—	—	198.8	—	—	—	191.5	—	—	—
Returns to fixed farm resources (crops)	—	—	5,989.44	—	—	—	9,039.49	—	—	—	—	13,361.36

of labour utilization over various months. Extra labour required to be hired was not much and could be hired within the financial restrictions. There was greater utilization of available capital both in *Kharif* and *Rabi*.

Large Size Farm (22 Acres)

In the alternative plan most of *desi* maize acreage was replaced by hybrid maize, retaining 1.50 acres of *desi* maize for home consumption. Acreage under groundnut and American cotton was increased to utilize the fallow land, because growing of two crops instead of one was more profitable. The area under American cotton was increased from 3.50 acres to 5 acres because of its high profitability, cotton picking labour not being a restriction upto this limit. In the *Rabi* season, less profitable crops such as gram and barley were eliminated and wheat acreage was increased to replace gram, barley and fallow land. Wheat sowings could be adjusted over the period using early and late varieties like C-273 and C-286.

By introducing these shifts, the returns to the fixed farm resources increased from Rs. 11,235.59 to Rs. 13,361.36, showing an increase of 18.81 per cent over the existing crop plan. The cropping intensity increased from 178.15 per cent to 191.50 per cent ensuring greater utilization of all the fixed farm resources.

It was apparent that the present cropping patterns could be adjusted to improve the income level of the farmers within their existing farm resources and level of technology. There was however considerable scope for increasing farm incomes through improved production methods and practices.

OPTIMUM CROPPING PATTERNS BASED ON IMPROVED PRODUCTION TECHNIQUES

The relative profitability of crop enterprises has changed in recent years due to improvement in the use of new fertilizers, plant protection measures and evolution of new high-yielding varieties such as dwarf Mexican wheats PV-18 and Kalyan 227, hybrid maize, hybrid bajra 1 and napier grass, etc. As a result of all such technological and economic developments, the existing enterprise combinations have become less than optimum. There was thus a need to evolve new cropping patterns based on relative profitability of enterprises and their production relationships.

Crop Plans in Two Phases

(i) Without introducing any change in the existing cropping patterns, coefficients of the improved production techniques were used to estimate the returns to fixed farm resources.

(ii) As an improvement on (i), shifts in the cropping patterns were incorporated along with improved production techniques to obtain optimum cropping patterns (Table II).

Optimum Cropping Pattern on Small Size Synthetic Farm Situation

With the introduction of improved techniques, groundnut being most profitable in *Kharif*, its acreage was increased from 0.77 to 2 acres to its full land use

TABLE II—OPTIMUM CROPPING PATTERNS AND RETURNS TO FIXED FARM RESOURCES BASED ON IMPROVED PRODUCTION TECHNIQUES ON THREE SYNTHETIC FARM SITUATIONS, DEHLON DEVELOPMENT BLOCK, I.A.D.P. DISTRICT LUDHIANA

Crop enterprises	Small Farm				Medium Farm				Large Farm			
	Acre- age	Percent- age of total cropped area	Returns to fixed factors		Acre- cropped area	Percent- age of total cropped area	Returns to fixed factors		Acre- cropped area	Percent- age of total cropped area	Returns to fixed factors	
			Per acre (Rs.)	Total (Rs.)			Per acre (Rs.)	Total (Rs.)			Per acre (Rs.)	Total (Rs.)
<i>Khariif</i> Season												
Desi Maize ..	0.58	2.90	395.11	229.16	0.75	2.34	362.45	271.84	2.50	5.68	368.49	921.23
Hybrid Maize ..	2.00	10.00	651.35	1,302.70	4.25	13.28	613.49	2,607.33	4.50	10.23	619.40	2,787.30
American Cotton ..	2.00	10.00	615.05	1,230.10	3.00	9.38	563.88	1,691.64	4.00	9.10	572.69	2,290.76
Desi Cotton ..	0.50	2.50	546.20	273.10	0.50	1.56	493.57	246.79	1.50	3.41	507.50	761.25
Groundnut irrigated ..	2.00	10.00	656.15	1,312.30	3.00	9.38	640.56	1,921.68	4.50	10.25	643.50	2,895.75
Groundnut unirrigated ..	0.27	1.35	409.71	110.62	0.75	2.34	403.05	302.29				
Sugarcane (plant) ..	0.50	2.50	1,404.15	702.08	0.50	1.56	1,243.25	621.62	1.00	2.27	1,360.61	1,360.61
Sugarcane (ratoon) ..	0.50	2.50	1,476.19	738.09	1.00	3.13	1,386.55	1,386.55	1.00	2.27	1,445.09	1,445.09
Fixed activity— <i>Khariif</i> Fodders ..	1.65	8.25	—	—	2.25	7.03	—	—	3.00	6.82	—	—
Sub-total ..	10.00	50.00	5,898.15	16.00	50.00	9,049.74	22.00	50.00	12,461.99			
<i>Rabi</i> Season												
Wheat C273 after <i>Khariif</i> irrigated ..	4.48	22.40	572.95	2,566.82	7.00	21.87	525.32	3,677.24	9.50	21.59	503.06	4,779.07
Wheat PV-18 after <i>Khariif</i> /irrigated ..	1.00	5.00	1,152.81	1,152.81	2.00	6.25	1,132.47	2,264.94	2.75	6.25	1,106.51	3,042.90
Wheat C286 after Ameri- can Cotton ..	2.00	10.00	510.54	1,021.08	3.00	9.38	470.40	1,411.20	4.00	9.10	449.94	1,799.76
Gram irrigated ..	—	—	—	—	—	—	—	—	1.00	2.27	344.30	344.30
Fixed activity— <i>Rabi</i> Fod- ders ..	1.25	6.25	—	—	1.75	5.46	—	—	2.75	6.25	—	—
Sub-total ..	8.73	43.65	4,740.71	13.75	47.65	7,353.38	22.00	50.00	9,966.03			
Total cropped area ..	18.73	93.65	—	—	29.75	97.65	—	—	44.00	100.00	—	—
Cropping intensity (%) ..	—	197.30	—	—	—	195.31	—	—	—	200.00	—	—
Returns to fixed factors (crops only) ..	—	—	10,637.86	—	—	—	—	—	—	—	—	—
							16,403.12					22,428.02

capability in addition to 0.27 acre under unirrigated groundnut. The area under *desi* maize was reduced from 2.92 acres to 0.58 acre and the area thus saved was put under hybrid maize. The yield level of hybrid maize was budgeted at 20 quintals against 12 quintals of *desi* maize. The area under American cotton was increased to 2 acres whereas *desi* cotton acreage was kept at 0.50 acre to meet the household requirements. In the *Rabi* season, newly evolved high yield dwarf Mexican wheat PV-18 (22 quintals per acre) was introduced only on one acre to serve as demonstration for the farmer. Following, gram, barley and wheat + gram mixture were eliminated, being less profitable. Raising of fodders with improved techniques helped to produce larger quantity of fodders from the same area, so acreage under *Rabi* fodders was reduced from 1.76 acres to 1.25 acres.

Through these shifts in crop acreage and by using increased fertilizers, plant protection measures and new varieties such as wheat PV-18 and hybrid maize, the returns to fixed farm resources increased from Rs. 5,825.97 to Rs. 11,620.86, *i.e.*, an increase of 99.46 per cent over the existing crop plan. The gain due to the change in crop acreage based on improved technology was 32.30 per cent (Table III). For the proper execution of the normative crop plan, the farmers would

TABLE III—COMPARISON OF INCOME LEVELS OF EXISTING AND ALTERNATIVE CROPPING PATTERN BASED ON TWO LEVELS OF TECHNOLOGY ON SYNTHETIC FARM SITUATIONS DEHLON DEVELOPMENT BLOCK. I.A.D.P. DISTRICT LUDHIANA

Particulars	Small farm (10 acres) Returns to fixed farm resources (Rs.)		Medium farm (16 acres) Returns to fixed farm resources (Rs.)		Large farm (22 acres) Returns to fixed farm resources (Rs.)	
	Total	%	Total	%	Total	%
A. Based on existing production techniques						
(i) Existing cropping pattern ..	5,825.97		9,387.95		14,585.59	
(ii) Optimum cropping pattern ..	6,971.44		11,289.49		16,711.36	
Difference (gain) ..	1,145.47	19.66	1,901.54	20.25	2,125.77	14.57
B. Based on improved production techniques						
(iii) Existing cropping pattern ..	8,781.32		13,842.56		19,967.93	
(iv) Optimum cropping pattern ..	11,620.86		18,653.12		25,778.02	
Difference (gain)	2,839.54	32.30	4,810.56	34.75	5,810.09	29.10
C. Comparison of income levels due to shifts in production techniques and cropping patterns						
1. Gain due to change in technology only (iii—i)	2,955.35	50.73	4,454.61	47.45	5,382.34	36.90
2. Gain due to change in technology on optimum crop plans (iv—ii)	4,649.42	66.69	7,363.63	65.25	9,066.66	54.25
3. Gain due to change in technology and crop shifts (iv—i)	5,794.89	99.46	9,265.17	98.69	11,192.43	76.73

have to borrow a sum of Rs. 481.35 in *Kharif* and Rs. 227.34 in *Rabi* season which was within their borrowing capacity. There was some increase in hiring of casual labour during various months which was available in the area (Appendix 6).

Optimum Cropping Pattern on Medium Size Synthetic Farm Situation

Groundnut being the most profitable enterprise, its acreage was increased to its full land use capability classification, *i.e.*, from 0.69 to 3 acres. *Desi* maize was largely replaced by hybrid maize because the latter was more profitable. Only a small extent of land under *desi* maize (0.75 acre) was kept for household consumption. The yield of *desi* maize was budgeted at 12 quintals against 20 quintals of hybrid maize. The area under American cotton was increased to 3 acres while area under *desi* cotton was kept almost the same, *i.e.*, 0.50 acre because the former was more profitable. Fallowing activity was reduced and sugarcane acreage was increased from 1.21 to 1.50 acres. In the *Rabi* season, wheat after fallow activity and gram area were eliminated because this land could be put to better use. Wheat PV-18 was introduced in two acres because of its economic advantage. Sufficient irrigation was available from tube-well which necessitated intensive cropping plans for fuller utilization of water resources and other farm resources.

Through new crop combinations, the returns to fixed farm resources increased from Rs. 9,387.95 to Rs. 18,653.12, *i.e.*, an increase of 98.69 per cent over the existing crop plan. For the implementation of the normative plan, the farmers needed to borrow an amount of Rs. 424.59 in *Kharif* and Rs. 112.42 in *Rabi* which was within their borrowing capacity. There was increased demand for casual labour during most of the months but it could be hired because of easy availability (Appendix 6).

Optimum Cropping Pattern on Large Size Synthetic Farm Situation

Groundnut being the most profitable enterprise in *Kharif*, its acreage was increased to full land suitability limit of 4.50 acres. The area under American cotton was slightly increased. Hybrid maize replaced *desi* maize to a considerable extent. The budgeted yields of groundnut, American cotton and hybrid maize were 9, 5.50 and 20 quintals respectively against 4.66, 3.54 and 12.41 quintals at the existing level of technology. Fallowing practice was eliminated. The area under *Kharif* fodders was kept almost the same, *i.e.*, 3.50 acres although changes in sowing times were incorporated to provide green fodder throughout the year. Mixing of cowpeas with sorghum and maize fodder were introduced due to high yield potentials. In the *Rabi* season, the barley acreage was eliminated, although one acre under gram was retained for home consumption and because of lower water and labour requirements of this crop. Highly promising wheat PV-18 was provided on 2.75 acres. Output of fodder increased due to improved production technique, so the area under *Rabi* fodders was reduced from 3.63 to 2.75 acres and the acreage thus saved was put under commercial crops. For the implementation of the alternative plan, the farmers had to borrow Rs. 626.12 in *Kharif* and Rs. 463.72 in *Rabi* which were within their borrowing capacity. Hiring of casual labour was also increased during various months but there was no scarcity of casual labour in the area (Appendix 6). Through these adjustments, the returns to fixed farm resources increased by 76.73 per cent over the existing plan.

TABLE IV—OPTIMUM CROPPING PATTERNS AND NET FARM EARNINGS

Enterprises							Small model farm	Medium model farm	Large model farm
							(10 acres, Bullocks & Percolation well) Percentage acreage of the total cropped area	(16 acres, Bullocks & Tube- well) Percentage acreage of the total cropped area	(22 acres, Bullocks & Tube- well) Percentage acreage of the total cropped area
<i>Kharif Season</i>									
<i>Desi Maize</i>	..	..	..	..	..	..	2.90	2.34	5.69
Hybrid Maize	..	..	..	..	..	..	10.00	13.28	10.23
American Cotton	..	..	..	..	..	..	10.00	9.38	9.10
<i>Desi Cotton</i>	..	..	..	..	..	..	2.50	1.56	3.41
Groundnut irrigated	..	..	..	..	..	..	10.00	9.38	10.25
Groundnut unirrigated	..	..	..	..	..	..	1.35	2.34	—
Sugarcane (plant)	..	..	..	..	..	..	2.50	1.56	2.27
Sugarcane (ratoon)	..	..	..	..	..	..	2.50	3.13	2.27
Fixed activity — <i>Kharif Fodders</i>	..	..	..	..	..	..	8.25	7.03	6.82
<i>Rabi Season</i>									
Wheat C-273 after <i>Kharif</i> crops irrigated	..	..	..	..	..	..	22.40	21.87	21.59
Wheat PV-18 after <i>Kharif</i> crops irrigated	..	..	..	..	..	..	5.00	6.25	6.25
Wheat C-286 after American Cotton	..	..	..	..	..	..	10.00	9.38	9.10
Gram irrigated	..	..	..	..	..	..	—	—	2.27
Fixed activity— <i>Rabi Fodders</i>	..	..	..	..	..	..	6.25	5.46	6.25
Farm Animals									
Bullocks (No.)	..	..	..	..	..	..	2	3	4
Camel (No.)	..	..	..	..	..	..	1	—	—
Buffaloes (No.)	..	..	..	..	..	..	1	2	3
Calves (No.)	..	..	..	..	..	..	2	2	2
Cropping intensity (%)	..	..	..	..	..	..	197.30	195.31	200.00
Returns to fixed factors (Rs.)	..	..	..	..	..	..	11,620.86	18,653.12	25,778.02
Percentage increase over the existing cropping patterns							99.46	98.69	76.73
Net farm earnings (Rs.)	..	..	..	..	..	..	10,110.16	15,611.26	22,039.97
Percentage increase over the existing cropping patterns							127.32	138.86	99.03

CONCLUSIONS

The farm business analysis of all the farm situations indicated that through shifts in crop combinations and adoption of yield-increasing technology, the returns to the fixed farm resources increased by 99.46, 98.69 and 76.73 per cent on small, medium and large size farms over the existing cropping patterns respectively. Correspondingly, the percentage gain due to change in crop acreage based on improved technology was 32.30, 34.75 and 29.10 per cent. The comparison of the two optimum cropping patterns showed that with the adoption of intensive use of fertilizers, pesticides and other improved agricultural practices, the net returns to fixed farm resources increased by 66.69, 65.25 and 54.25 per cent on small, medium and large farms respectively. The net farm earnings increased by 127.32, 138.86 and 99.03 per cent on small, medium and large farms respectively and the corresponding increase in the cropping intensity was 18.5, 28.5 and 21.87 per cent.

The farmers of the study area and other areas having identical farming characteristics were recommended to adopt the optimum cropping patterns as shown in Table IV as broad guides to maximize their farm incomes.

Thus it could be concluded that the net returns to fixed farm resources and net farm earnings could be increased by rationalizing the farm resource use and by adopting improved production techniques in all the different sized synthetic farm situations. These optimum cropping pattern models will serve as broad guides both for the extension workers and farmers, in particular, to reorganize the farms in lesser time for maximizing farm incomes. This will in turn help to make intensive agricultural development programmes more successful and secure greater co-ordination between the efforts of different agencies engaged in this work.

APPENDIX I
EXISTING CROPPING PATTERNS AND RETURNS TO FIXED FARM RESOURCES BASED ON EXISTING PRODUCTION
TECHNIQUES ON THREE SYNTHETIC FARM SITUATIONS, DEHLON BLOCK: 1965-66

Crop enterprises	Small Farm				Medium Farm				Large Farm				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
<i>Kharif</i> Season													
Desi Maize	2.92	14.60	263.84	770.47	4.07	12.72	235.25	949.33	5.18	11.77	253.35	1,312.35	
Hybrid Maize	0.28	1.40	427.26	119.63	0.53	1.65	439.31	232.83	0.64	1.45	421.27	269.61	
American Cotton	1.20	6.00	363.16	435.79	2.19	6.84	373.01	816.89	3.50	7.95	502.44	1,758.54	
Desi Cotton	0.64	3.20	362.08	231.73	0.44	1.38	267.93	117.89	0.83	1.89	316.71	262.87	
Groundnut irrigated	0.77	3.85	336.94	259.44	0.69	2.16	352.67	243.34	2.77	6.29	303.13	639.67	
Groundnut unirrigated	0.27	1.35	237.64	64.22	0.64	2.00	297.55	190.43	—	—	—	—	
Sugarcane (plant)	0.25	1.25	568.61	142.15	0.31	0.97	444.52	137.80	0.70	1.60	691.43	484.00	
Sugarcane (ratoon)	0.63	3.15	659.78	415.66	0.90	2.81	639.03	575.13	1.10	2.50	894.10	983.51	
Fixed activity— <i>Kharif</i> Fodders	1.66	8.30	—	—	2.28	7.13	—	—	3.60	8.18	—	—	
Sub-total	8.62	43.10	—	2,430.09	12.05	37.66	—	3,263.64	18.32	41.63	—	5,710.55	
<i>Rabi</i> Season													
Wheat after Fallow irrigated	1.31	6.55	434.11	568.68	3.76	11.75	409.96	1,541.45	3.33	7.57	433.01	1,441.92	
Wheat after <i>Kharif</i> crop irrigated	3.93	19.65	374.52	1,471.86	5.83	18.22	344.19	2,006.63	9.69	22.02	378.46	3,667.28	
Gram irrigated	0.42	2.10	185.89	78.07	1.33	4.15	228.33	303.68	1.54	3.50	176.91	272.44	
Gram unirrigated	—	—	—	—	0.17	0.53	132.64	22.55	—	—	—	—	
Wheat + Gram irrigated	0.73	3.65	327.09	238.78	—	—	—	—	—	—	—	—	
Barley	0.23	1.15	206.46	47.49	—	—	—	—	0.78	1.77	183.84	143.40	
Fixed activity— <i>Rabi</i> Fodders	1.86	9.30	—	—	2.34	7.31	—	—	3.63	8.25	—	—	
Sub-total + Sugarcane	9.36	46.80	—	—	14.64	45.74	—	3,874.31	20.82	46.99	—	5,525.05	
Total cropped area	17.98	89.90	—	—	26.49	83.40	—	7,137.95	39.14	88.62	—	11,235.59	
Cropping intensity (%)	—	178.80	—	—	—	166.80	—	—	—	178.13	—	—	
Returns to fixed factors (crops)	—	—	—	4,843.97	—	—	—	—	—	—	—	—	

1. Cropping intensity = $\frac{\text{Cropped area}}{\text{Total cultivated area}} \times 100$.

APPENDIX 2
 RESOURCE USE PATTERN OF THE PRESENT FARM PLAN—SMALL SIZE SYNTHETIC FARM SITUATION, DEHLON BLOCK,
 I. A. D. P. DISTRICT LUDHIANA : 1965-66

Resources	(1)	(2)	Present Utilization											(11)
			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)				
Availability	Man hours	Desi Maize	Hybrid Maize	American Cotton	Desi Cotton	Ground-nut irrigated	Ground-nut unirrigated	Sugar-cane (plant)	Sugar-cane (ratoon)	Fixed activity— <i>Khariif</i> Fodders				
Man labour			(2.92)*	(0.28)	(1.20)	(0.64)	(0.77)	(0.27)	(0.63)	(1.66)				
January	..	697.20	58.40	—	24.00	—	—	—	91.00	229.32	—			
February	..	697.20	—	—	—	—	4.32	97.50	214.20	—	—			
March	..	517.92	—	—	—	—	2.16	37.00	—	—	—			
April	..	697.20	—	—	84.00	—	—	16.00	40.32	—	—			
May	..	697.20	—	—	91.20	42.24	—	12.00	30.24	—	—			
June	..	697.20	—	39.20	57.60	30.72	49.28	28.00	70.56	—	—			
July	..	517.92	367.92	15.68	28.80	15.36	68.53	13.50	15.12	91.30	—			
August	..	517.92	327.04	15.68	28.80	15.36	24.64	8.64	15.12	39.84	—			
September	..	517.92	163.52	6.72	28.80	15.36	—	12.00	30.24	39.84	—			
October	..	597.20	70.08	6.72	—	15.36	19.48	6.00	15.12	39.84	—			
November	..	697.20	—	8.96	—	19.24	92.40	6.00	15.12	—	—			
December	..	697.20	23.36	11.76	19.20	19.20	23.10	8.10	15.12	—	—			
Total	..	7649.28	1010.32	104.72	362.40	163.84	276.43	62.64	323.50	690.48	210.82			

* Figures in parenthesis indicate existing acreage under each crop enterprise

(Contd.)

APPENDIX 2—Contd.

Resources	Present Utilization										
	Availa- bility	Desi Maize	Hybrid Maize	American Cotton	Desi Cotton	Ground- nut irrigated	Ground- nut unirrigated	Sugar- cane (plant)	Sugar- cane (ratoon)	Fixed activity— <i>Kharif</i> Fodders	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Woman labour											
September	305.60	—	—	—	51.20	—	—	—	—	—	
October	305.60	—	—	120.00	76.80	—	—	—	—	—	
November	305.60	—	—	—	15.20	—	—	—	—	—	
December	305.60	140.16	15.68	48.00	—	—	—	—	—	—	
Operating Capital											
<i>Kharif</i>	Rs. 823.33	63.83	9.28	30.96	10.88	17.71	3.78	44.00	110.25	30.88	
<i>Rabi</i>	806.66	—	—	—	—	—	—	—	—	—	
Land											
<i>Kharif</i> land for Maize irrigated ..	6.37	2.92	0.28	—	—	—	—	—	—	—	
<i>Kharif</i> land for Cotton irrigated ..	7.56	—	—	1.20	0.64	—	—	—	—	—	
<i>Kharif</i> land for Groundnut irrigated ..	2.00	—	—	—	—	0.77	—	—	—	—	
<i>Kharif</i> land for Groundnut unirrigated ..	0.27	—	—	—	—	—	0.27	—	—	—	
<i>Kharif</i> land for Sugarcane ..	3.00	—	—	—	—	—	—	0.25	0.63	—	
<i>Kharif</i> land for <i>Kharif</i> Fodders ..	5.44	—	—	—	—	—	—	—	—	1.66	
<i>Rabi</i> land for Wheat irrigated ..	8.84	—	—	—	—	—	—	—	—	—	
<i>Rabi</i> land for Gram irrigated ..	2.10	—	—	—	—	—	—	—	—	—	
<i>Rabi</i> land for Gram & Wheat unirrigated ..	0.27	—	—	—	—	—	—	—	—	—	
<i>Rabi</i> land for Berseem & Sugar-cane ..	3.75	—	—	—	—	—	—	—	—	—	
Yield Levels (Per acre)											
Existing	Quintals	7.83	12.05	3.26	3.84	5.00	3.50	16.07	14.50	75.00	
Improved	Quintals	12.00	20.00	5.50	6.00	9.00	6.00	31.00	28.00	145.00	

(Contd.)

APPENDIX 4—*Contd.*

Resources	Present Utilization											Total	Surplus or Deficit
	Availability	Wheat after Fallow	Wheat after <i>Kharif</i>	Gram irrigated	Wheat + Gram mixture	Barley	Fixed activity—Berseem	<i>Senji</i>	Miscellaneous				
Labour	Man hours	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)		
Man labour		(1.31)*	(3.93)	(0.42)	(0.73)	(0.23)	(0.88)	(0.98)	—	—	—		
January	..	697.20	31.44	94.32	—	16.52	12.88	98.56	43.12	62.00	761.56	— 64.36	
February	..	697.20	—	—	12.60	16.52	—	98.56	43.12	56.00	542.82	+ 154.38	
March	..	517.92	31.44	94.32	—	16.52	5.52	109.12	33.32	62.00	391.40	+ 126.52	
April	..	697.20	73.36	220.08	12.60	75.84	21.16	109.12	—	60.00	712.48	— 15.28	
May	..	697.20	70.74	212.22	10.08	—	—	39.32	—	62.00	570.04	+ 127.16	
June	..	697.20	26.20	78.60	—	—	—	—	—	60.00	440.16	+ 257.04	
July	..	517.92	—	—	—	—	—	—	—	62.00	684.21	— 166.29	
August	..	517.92	31.44	—	—	—	—	—	—	62.00	574.56	— 56.64	
September	..	517.92	31.44	—	13.44	—	—	36.96	—	60.00	438.32	+ 79.60	
October	..	697.20	70.79	212.22	3.36	—	—	52.80	76.40	62.00	651.12	+ 46.08	
November	..	697.20	78.60	235.80	13.44	35.58	—	70.40	56.84	60.00	707.30	— 10.10	
December	..	697.20	31.44	94.32	10.08	17.52	16.10	98.56	43.12	62.00	498.98	+ 198.22	
Total	..	7,649.28	476.84	1,241.88	75.60	176.50	55.66	713.40	297.92	730.00	6,972.95	+ 676.33	
Woman labour		Woman hours											
September	..	305.60	—	—	—	—	—	—	—	—	51.20	+ 254.40	
October	..	305.60	—	—	—	—	—	—	—	—	196.80	+ 108.80	
November	..	305.60	—	—	—	—	—	—	—	—	135.20	+ 170.40	
December	..	305.60	—	—	—	—	—	—	—	—	203.84	+ 101.76	

* Figures in parenthesis indicate existing acreage under each crop enterprise.

(Contd.)

APPENDIX 2—*Concl'd.*

Resources	Availability	Present Utilization										Total	Surplus or Deficit
		Wheat after Fallow	Wheat after <i>Kharif</i>	Gram irrigated	Wheat + Gram mixture	Barley	Fixed activity—Berseem	<i>Senji</i>	Miscellaneous	(18)	(19)			(20)	(21)
		(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Operating Capital													
	Rs.												
<i>Kharif</i>	.. ..	823.33	—	—	—	—	—	—	433.43	755.00	+68.37		
<i>Rabi</i>	.. ..	806.66	50.92	153.27	9.16	19.53	6.99	26.40	433.43	724.20	+82.46		
Land	Acres												
<i>Kharif</i> land for Maize irrigated ..	6.37	—	—	—	—	—	—	—	—	3.20	+ 3.17		
<i>Kharif</i> land for Cotton irrigated	7.56	—	—	—	—	—	—	—	—	1.84	+ 5.72		
<i>Kharif</i> land for Groundnut irrigated	2.00	—	—	—	—	—	—	—	—	0.77	+ 1.33		
<i>Kharif</i> land for Groundnut unirrigated	0.27	—	—	—	—	—	—	—	—	0.27	—		
<i>Kharif</i> land for Sugarcane ..	3.00	—	—	—	—	—	—	0.25	—	1.13	+ 1.77		
<i>Kharif</i> land for Fodders ..	5.44	—	—	—	—	—	—	—	—	1.66	+ 3.78		
<i>Rabi</i> land for Wheat irrigated ..	8.84	1.31	3.93	—	—	—	—	—	0.98	6.22	+ 2.62		
<i>Rabi</i> land for Gram irrigated ..	2.10	—	—	0.42	0.73	0.23	—	—	—	1.38	+ 0.72		
<i>Rabi</i> land for Gram & Wheat unirrigated ..	0.27	—	—	—	—	—	—	—	—	—	—		
<i>Rabi</i> land for Berseem & Sugarcane ..	3.75	—	—	—	—	—	—	0.88	—	—	—		
Yield Levels (Per acre)													
Existing	Quintals	7.10	6.65	3.56	3.09	4.00	285.00	55.00	—	—	—		
Improved	Quintals	12.00	10.00	7.00	8.00	4.50	335.00	120.00	—	—	—		

APPENDIX 3

RESOURCE USE PATTERN OF THE PRESENT FARM PLAN—MEDIUM SIZE SYNTHETIC FARM SITUATION,
DEHLON BLOCK, J. A. D. P. DISTRICT LUDHIANA : 1965-66

Resources	Present Utilization										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Man labour	Man hours										
January	..	714.00	—	—	43.80	—	—	—	108.50	306.00	—
February	..	714.00	—	—	—	—	—	10.24	117.80	306.00	—
March	..	530.00	—	—	—	—	—	5.12	45.88	54.00	—
April	..	714.00	—	—	87.60	—	—	—	12.40	36.00	—
May	..	714.00	—	25.44	63.51	18.48	—	—	4.65	13.50	—
June	..	714.00	—	23.85	39.42	12.76	31.05	—	13.95	40.50	—
July	..	530.00	329.67	16.96	—	2.64	48.30	31.36	1.55	4.50	102.60
August	..	530.00	179.08	19.61	10.95	2.20	—	20.48	1.55	4.50	11.40
September	..	530.00	170.94	5.30	10.95	2.20	—	—	3.10	9.00	54.72
October	..	714.00	118.03	1.65	—	2.20	3.45	—	3.10	9.00	54.72
November	..	714.00	—	16.96	—	7.04	82.80	41.60	1.55	4.50	—
December	..	714.00	32.56	22.26	35.04	13.20	20.70	19.20	1.55	4.50	—
Total	..	7,833.60	911.68	132.03	291.27	60.72	186.30	128.00	315.58	792.00	223.44

* Figures in parenthesis indicate existing acreage under each crop enterprise.

(Contd.)

APPENDIX 3—Contd.

Resources	Present Utilization										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Woman labour		Woman hours									
September	..	360.00	—	—	—	35.20	—	—	—	—	—
October	..	360.00	—	219.00	—	52.80	—	—	—	—	—
November	..	360.00	—	219.00	—	35.20	—	—	—	—	—
December	..	360.00	95.36	29.68	—	—	—	—	—	—	—
Capital		Rs.									
Khariif	..	1,759.16	266.78	36.73	142.35	26.22	36.81	18.56	60.14	165.96	80.03
Rabi	..	1,612.50	—	—	—	—	—	—	—	—	—
Land		Acres									
Khariif land for Maize irrigated ..		10.26	4.07	0.53	—	—	—	—	—	—	—
Khariif land for Cotton irrigated ..		8.13	—	2.19	—	0.44	—	—	—	—	—
Khariif land for Groundnut irrigated ..		3.00	—	—	—	—	0.69	—	—	—	—
Khariif land for Groundnut un-irrigated ..		0.75	—	—	—	—	—	0.64	—	—	—
Khariif land for Sugarcane irrigated ..		3.00	—	—	—	—	—	—	0.31	0.90	—
Khariif land for Fodders ..		12.16	—	—	—	—	—	—	—	—	2.28
Rabi land for Wheat irrigated ..		14.19	—	—	—	—	—	—	—	—	—
Rabi land for Gram irrigated ..		2.08	—	—	—	—	—	—	—	—	—
Rabi land for Gram/Wheat un-irrigated ..		0.50	—	—	—	—	—	—	—	—	—
Rabi land for Berseem & Sugar-cane ..		3.50	—	—	—	—	—	—	—	—	—
Rabi land for Other Fodders ..		10.00	—	—	—	—	—	—	—	—	—
Yield Levels (Per acre)											
Existing	Quintals	7.52	13.50	3.54	3.15	3.51	4.33	13.41	13.75	73.00
Improved	Quintals	12.00	20.00	5.50	6.00	9.00	6.00	31.00	28.00	145.00

(Contd.)

APPENDIX 3—Contd.

Resources	Present Utilization										Surplus or deficit
	Availability	Wheat after Fallow irrigated	Wheat after <i>Kharif</i> irrigated	Gram irrigated	Gram un-irrigated	Fixed activity— <i>Rabi</i> Fodder-Berseem	<i>Senji</i>	Miscellaneous and cattle care	Total	Surplus or deficit	
Labour	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	
Man labour											
January	..	714.00	18.80	215.71	—	62.15	18.15	93.00	947.51	-233.51	
February	..	714.00	37.60	52.30	6.65	62.15	18.15	84.00	700.89	+ 13.11	
March	..	530.00	18.80	29.15	—	67.80	18.15	93.00	331.90	+ 193.10	
April	..	714.00	240.64	373.12	31.92	45.20	—	90.00	920.28	-206.28	
May	..	714.00	135.36	209.88	26.60	33.90	—	93.00	626.57	+ 87.43	
June	..	714.00	112.80	174.90	13.30	—	—	90.00	552.53	+ 161.47	
July	..	530.00	—	—	—	—	—	93.00	630.58	-100.18	
August	..	530.00	90.24	—	—	—	—	93.00	433.01	+ 97.39	
September	..	530.00	90.24	—	39.90	4.08	—	90.00	480.43	+ 49.97	
October	..	714.00	210.56	326.48	10.64	45.20	96.80	93.00	976.19	-262.19	
November	..	714.00	94.00	145.75	42.56	16.95	18.15	90.00	567.30	+ 146.70	
December	..	714.00	139.12	145.75	—	62.15	18.15	93.00	607.18	+ 108.82	
Total	..	7,833.60	1,188.16	1,679.04	171.57	395.50	187.55	1,095.00	7,774.37	+ 59.27	

* Figures in parenthesis indicate existing acreage under each crop enterprise.

(Contd.)

APPENDIX 3—Concl'd.

Resources	Present Utilization										Surplus or Deficit
	Availability	Wheat after Fallow irrigated	Wheat after <i>Khariif</i> irrigated	Gram irrigated	Gram un-irrigated	Fixed activity— <i>Rabi</i> Fodder-Berseem	<i>Senji</i>	Miscellaneous and cattle care	Total		
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)		
Woman labour											
September	360.00	—	—	—	—	—	—	35.20	+324.80		
October	360.00	—	—	—	—	—	—	271.80	+88.20		
November	360.00	—	—	—	—	—	—	254.20	+105.80		
December	360.00	—	—	—	—	—	—	212.64	+47.36		
Capital											
<i>Khariif</i>	Rs. 1,759.16	—	—	—	—	—	626.29	1,460.87	+298.29		
<i>Rabi</i>	1,612.50	211.01	322.57	48.85	2.36	172.89	73.05	1,457.01	+155.49		
Land											
<i>Khariif</i> land for Maize irrigated	Acres 10.26	—	—	—	—	—	—	4.60	+5.66		
<i>Khariif</i> land for Cotton irrigated	8.13	—	—	—	—	—	—	2.63	+5.50		
<i>Khariif</i> land for Groundnut irrigated	3.00	—	—	—	—	—	—	0.69	+2.31		
<i>Khariif</i> land for Groundnut un-irrigated	0.75	—	—	—	—	—	—	0.64	+0.11		
<i>Khariif</i> land for Sugarcane irrigated	3.00	—	—	—	—	—	—	1.21	+1.79		
<i>Khariif</i> land for <i>Khariif</i> Fodders	12.16	—	—	—	—	—	—	2.28	+9.88		
<i>Rabi</i> land for Wheat irrigated	14.19	3.75	5.83	—	—	—	—	9.58	+4.61		
<i>Rabi</i> land for Gram irrigated	2.08	—	—	1.33	—	—	—	1.33	+0.75		
<i>Rabi</i> land for Gram/Wheat unirrigated	0.50	—	—	—	0.17	—	—	0.17	+0.33		
<i>Rabi</i> land for Berseem & Sugar-cane	3.50	—	—	—	—	—	—	1.13	+1.37		
<i>Rabi</i> land for Other Fodders	10.00	—	—	—	—	—	—	1.21	+8.79		
Yield Levels (Per acre)											
Existing	Quintals 7.46	6.83	4.56	2.50	285.00	60.00	—	—	—		
Improved	12.00	10.00	7.00	5.00	335.00	120.00	—	—	—		

APPENDIX 4

RESOURCE USE PATTERN OF THE PRESENT FARM PLAN—LARGE SIZE SYNTHETIC FARM SITUATION,
DEHLON BLOCK, I. A. D. P. DISTRICT LU DHIANA : 1965-66

Resource	Present Utilization										
	Availa- bility	Desi Maize	Hybrid Maize	American Cotton	Desi Cotton	Ground- nut irrigated	Sugar- cane (plant)	Sugar- cane (ratoon)	Fixed activity— Kharif Fodders	Wheat after Fallow irrigated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Labour											
Man labour											
January	..	1,075.20	103.60	—	70.00	—	238.00	374.00	—	13.32	
February	..	1,075.20	—	—	—	—	273.00	374.00	—	13.32	
March	..	798.72	—	—	—	—	57.40	90.20	—	13.32	
April	..	1,075.20	—	157.50	—	—	30.80	48.40	—	106.56	
May	..	1,075.20	—	98.00	34.03	—	36.40	57.20	—	153.18	
June	..	1,075.20	442.90	53.76	106.00	121.88	8.40	13.20	29.99	99.90	
July	..	1,075.20	372.96	20.48	84.00	191.13	11.20	17.60	98.69	—	
August	..	798.72	207.20	23.04	14.00	88.64	11.20	17.60	45.39	79.92	
September	..	798.72	207.20	5.12	14.00	—	14.00	22.00	103.87	79.92	
October	..	1,075.20	145.04	2.56	—	11.08	5.60	8.80	69.48	186.48	
November	..	1,075.20	—	20.48	—	332.40	2.80	4.40	3.48	133.20	
December	..	1,075.20	41.44	26.88	56.00	83.10	2.80	4.40	—	119.88	
Total	..	12,072.96	1,313.14	152.32	529.50	828.23	691.60	1,031.80	350.90	999.00	

(Contd.)

* Figures in parenthesis indicate existing acreage under each crop enterprise.

1. Generally in the area women attend to special jobs such as picking of cotton, removal of maize cobs and husk covers, etc., so woman hours were worked out separately.
2. The land use capability categories obtained were not mutually exclusive but were mostly overlapping.
3. Requirements of half yearly and yearly operating capital was considered as in column 'Miscellaneous'.

APPENDIX 4—Contd.

Resources	Present Utilization										
	(1)	(2)	(3)	(4)	(5)	(5)	(7)	(8)	(9)	(10)	(11)
Woman labour											
September	..	385.60	..	..	..	66.40	..	..	..	..	..
October	..	385.60	..	350.00	..	99.60	..	..	..	..	..
November	..	385.60	..	350.00	..	66.40	..	..	..	..	..
December	..	385.60	248.60	55.84	140.00	..	..	..	..	..	..
Capital		Rs.									
<i>Khariif</i>	..	2,183.49	257.29	45.75	203.42	48.18	92.62	113.12	161.92	95.85	258.44
<i>Rabi</i>	..	2,180.03	..	..	..	..	..	..	..	..	..
Land		Acres									
<i>Khariif</i> land for Maize irrigated	..	13.50	5.18	0.64	..	..	..	..	..	..	..
<i>Khariif</i> land for Cotton irrigated	..	12.50	..	..	3.50	0.83	..	..	..	..	..
<i>Khariif</i> land for Groundnut irrigated	..	4.50	..	..	..	..	2.77	..	..	..	..
<i>Khariif</i> land for Sugarcane irrigated	..	4.00	..	..	..	..	..	0.70	1.10	..	..
<i>Khariif</i> land for <i>Khariif</i> Fodders	..	16.67	..	..	..	..	..	..	..	3.75	..
<i>Rabi</i> land for Wheat irrigated	..	21.08	..	..	..	..	..	..	..	..	3.33
<i>Rabi</i> land for Gram irrigated	..	2.75	..	..	..	..	..	..	..	..	..
<i>Rabi</i> land for Berseem & Sugarcane	..	3.83	..	..	..	..	..	..	..	..	..
<i>Rabi</i> land for Other Fodders	..	11.92	..	..	..	..	..	..	..	..	..
Yield levels (per acre)											
Existing	..	Quintals	7.87	12.41	4.58	3.56	4.66	16.82	16.61	75.00	8.08
Improved	..	Quintals	12.00	20.00	5.50	6.00	9.00	31.00	28.00	145.00	12.00

(Contd.)

APPENDIX 4—Contd.

Resources	Present Utilization										Surplus or Deficit	
	Availability	Wheat after <i>Kharif</i> irrigated	Gram irrigated	Barley irrigated	Fixed activity		Miscellaneous	Total				
					<i>Rabi</i> Fodders-Berseem	Other <i>Rabi</i> Fodders						
(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)					
Labour												
Man labour	..	..	..	..	..	..	..	..	..	..	..	..
January	1,075.20	38.76	—	28.08	83.20	48.00	124.00	1,120.96	—	—	—	—
February	1,075.20	38.76	6.16	—	83.20	57.20	112.00	957.64	—	—	—	—
March	798.72	38.76	—	3.12	76.80	57.20	124.00	460.80	—	—	—	—
April	1,075.20	310.08	46.20	56.16	76.80	4.60	120.00	957.19	—	—	—	—
May	1,075.20	445.74	36.96	15.60	83.20	—	124.00	1,084.31	—	—	—	—
June	1,075.20	290.70	—	—	—	—	120.00	867.07	—	—	—	—
July	1,075.20	—	—	—	—	—	124.00	1,009.92	—	—	—	—
August	798.72	—	—	—	—	—	124.00	780.07	—	—	—	—
September	798.72	—	56.98	—	32.00	—	120.00	658.41	—	—	—	—
October	1,075.20	542.64	12.32	—	54.40	151.36	124.00	1,317.08	—	—	—	—
November	1,075.20	387.60	49.28	—	83.20	31.32	120.00	1,181.44	—	—	—	—
December	1,075.20	348.84	—	35.10	83.20	61.76	124.00	999.85	—	—	—	—
Total	12,072.96	2,441.88	207.90	138.06	656.00	411.44	1,460.00	11,395.65	—	—	—	—

(Contd.)

APPENDIX 5

TEST SHEET OF RESOURCE USE PATTERN OF THE OPTIMUM CROPPING PATTERNS BASED ON EXISTING LEVEL OF TECHNOLOGY ON THE VARIOUS SYNTHETIC FARM SITUATIONS, DEHLON BLOCK, I.A.D.P. DISTRICT LUDHIANA

Resources	Unit	Small model farm (10 acres)			Medium model farm (16 acres)			Large model farm (22 acres)		
		Avail- ability	Require- ments	Surplus or Deficit	Avail- ability	Require- ments	Surplus or Deficit	Avail- ability	Require- ments	Surplus or Deficit
Labour										
Man labour										
January	..	697.20	688.68	+ 8.52	714.00	746.30	- 32.30	1,075.20	1,129.20	- 54.00
February	..	697.20	548.00	+ 149.20	714.00	805.30	- 91.30	1,075.20	1,226.40	- 151.20
March	..	517.92	503.10	+ 14.82	530.40	565.95	- 35.55	798.72	507.96	+ 290.76
April	..	697.20	737.24	- 40.04	714.00	1,062.72	- 248.72	1,075.20	1,031.28	+ 43.92
May	..	697.20	723.06	- 25.86	714.00	881.30	- 167.30	1,075.20	1,247.43	- 172.23
June	..	697.20	803.34	- 106.14	714.00	859.65	- 145.65	1,075.20	1,264.30	- 189.10
July	..	517.92	579.59	- 61.67	530.40	598.45	- 68.05	798.72	883.29	- 84.57
August	..	517.92	458.48	+ 59.44	530.40	448.45	+ 81.95	798.72	577.85	+ 220.87
September	..	517.92	357.96	+ 159.96	530.40	227.25	+ 303.15	798.72	384.33	+ 414.39
October	..	697.20	650.70	+ 46.50	714.00	807.15	- 93.15	1,075.20	900.88	+ 174.32
November	..	697.20	774.62	- 77.42	714.00	823.35	- 109.35	1,075.20	1,081.08	- 5.78
December	..	697.20	707.28	- 10.00	714.00	970.60	- 256.60	1,075.20	1,148.25	- 73.05
Total	..	7,649.28	7,484.65	+ 105.07	7,833.60	8,796.47	- 962.87	11,796.48	11,382.25	+ 414.23
Woman labour										
September	..	305.60	80.00	+ 125.40	360.00	20.00	+ 340.00	385.60	108.00	+ 277.60
October	..	305.60	270.00	+ 35.40	360.00	330.00	+ 30.00	385.60	662.00	- 276.40
November	..	305.60	230.00	+ 75.40	360.00	320.00	+ 40.00	385.60	608.00	- 222.40
December	..	305.60	220.00	+ 85.40	360.00	392.00	- 32.00	385.60	496.00	- 110.40
Operating Capital										
Kharij cash	..	823.33	815.95	+ 7.38	1,759.16	1,695.29	+ 53.87	2,183.49	2,106.50	+ 76.99
Rabi cash	..	806.66	750.86	+ 55.80	1,612.50	1,502.99	+ 109.51	2,180.03	2,219.07	- 39.04
Total	..	1,629.99	1,566.81	+ 63.18	3,371.66	3,198.28	+ 163.38	4,363.52	4,325.57	+ 37.95
Credit available										
Kharij	..	983.33	—	+ 983.33	1,066.67	—	+ 1,056.67	1,675.00	—	+ 1,675.00
Rabi	..	983.33	—	+ 983.33	1,066.67	—	+ 1,056.67	1,675.00	39.04	+ 1,635.96
Total	..	1,966.66	—	+ 1,966.66	2,133.34	—	+ 2,133.34	3,350.00	—	+ 3,310.96

APPENDIX 6

TEST SHEET OF RESOURCE USE PATTERN OF THE OPTIMUM CROPPING PATTERNS BASED ON IMPROVED LEVEL OF TECHNOLOGY ON THE VARIOUS SYNTHETIC FARM SITUATIONS, DEHLON BLOCK, I.A.D.P. DISTRICT LUDHIANA

Resources	Unit	Small model farm (10 acres)			Medium model farm (16 acres)			Large model farm (22 acres)		
		Avail- ability	Require- ments	Surplus or Deficit	Avail- ability	Require- ments	Surplus or Deficit	Avail- ability	Require- ments	Surplus or Deficit
Labour										
Man labour	Man hours									
January	..	697.20	775.42	- 78.22	714.00	955.25	- 241.25	1,075.20	1,153.00	- 77.80
February	..	697.20	894.34	-197.14	714.00	994.75	-280.75	1,075.20	1,325.00	-249.80
March	..	517.92	757.68	-239.76	530.40	632.25	-101.85	798.72	1,061.00	-262.28
April	..	697.20	859.68	-162.48	714.00	1,100.50	-385.50	1,075.20	1,509.50	-434.30
May	..	697.20	1,040.00	-342.80	714.00	946.50	-232.50	1,075.20	1,338.50	-283.30
June	..	697.20	566.40	48.48	530.40	868.75	-338.35	798.72	1,187.00	-525.20
July	..	517.92	496.12	21.80	530.40	592.50	62.50	798.72	805.00	- 6.28
August	..	517.92	442.40	75.52	530.40	444.50	85.90	798.72	336.50	+162.22
September	..	697.20	845.20	-148.00	714.00	646.50	67.50	1,075.20	910.50	+164.70
October	..	697.20	886.72	-189.52	714.00	1,133.50	-419.50	1,075.20	1,514.00	-438.80
November	..	697.20	864.58	-167.38	714.00	1,013.50	-309.50	1,075.20	1,291.25	-216.05
December	..	697.20	9,286.22	-1,636.94	7,833.60	10,544.50	-2,710.90	11,796.48	14,332.25	-2,555.77
Woman labour	Woman hours									
September	..	305.60	40.00	+265.60	360.00	40.00	+220.00	385.60	120.00	+265.60
October	..	305.60	260.00	+ 45.60	360.00	360.00	—	385.60	580.00	-194.40
November	..	305.60	240.00	+ 65.60	360.00	340.00	+ 20.00	385.60	520.00	-134.40
December	..	305.60	219.84	+ 85.76	360.00	394.00	— 34.00	385.60	532.00	-146.40
Operating Capital										
Kharif cash	..	823.33	1,204.68	-481.35	1,759.16	2,193.75	-424.59	2,183.49	2,809.61	-626.12
Rabi cash	..	806.66	1,034.00	-227.34	1,612.50	1,724.93	-112.43	2,180.03	2,643.75	-463.72
Total	..	1,629.99	2,238.68	-608.69	3,371.66	3,918.68	-537.02	4,363.52	5,453.36	-1,089.84
Credit available										
Kharif	..	983.33	-481.35	+501.98	1,066.67	-424.59	+642.08	1,675.00	-626.12	+1,048.88
Rabi	..	983.33	-227.34	+755.99	1,066.67	-112.43	+954.24	1,675.00	-463.72	+1,211.28
Total	..	1,966.66	-608.69	+1,257.97	2,133.34	-537.02	+1,596.32	3,350.00	-1,089.84	+2,260.16

1. Assuming 26 days of each month during non-peak period and 28 days of 10 hours each month during peak period, man labour hours were worked out. Months requiring more labour were considered to be peak.

2. Generally in the area women attend to special jobs like picking of cotton, removal of maize cobs and covers, etc., so women hours were considered separately. 3. Amount of labour shown as deficit, can easily be hired.