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IMPACT OF COMMERCIAL CROPS ON FARM INCOMES AND RESOURCE USE IN JAIPUR DISTRICT OF RAJASTHAN

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DESIGN OF STUDY

The Fifth Five-Year Plan has envisaged an overall growth rate of 4.4 per cent in agricultural production. It is visualised that the increase in commercial crops will be at about 5.2 per cent. Such dimensions of growth in commercial crops envisaged in the Plan can be achieved only when concentrated efforts are made by the farmers, Government officials and the extension agencies. The farmer would deploy increasing acreage and other resources to commercial crops only when he is convinced of their relative profitability vis-a-vis foodgrain and other crops.

The present study was undertaken to examine the impact of commercial crops on farm incomes and resource use in Jaipur district of Rajasthan. Out of 758 villages in the district 15 villages were selected at random. The farmers in the selected villages were divided into three size-groups, *viz.*, small, medium and large. Forty-five farmers, fifteen from each size-group, were selected at random. Three farms, one from each size-group, were selected for re-organizing the existing crop plans. While selecting such farm, care was taken that the selected farm should be a representative unit in its size-group. The representative unit was that which was nearest to the average resource availability and cropping pattern of the group. The input-output coefficients used to develop the optimum plans were the average of all the holdings in each size-group.

Two alternative optimum plans were developed to examine the possibilities of increasing farm incomes from commercial crops. Linear programming technique was used for optimization. In Farm Plan I we optimized the net returns under the existing resource constraints and with the limits on the maximum area which the farmers wanted to put under the commercial crops.

In Farm Plan II the net returns were optimized under the existing resource constraints and with relaxed constraints of area under the commercial crops. It was hypothesized that if the farmers of the area can be given proper training in the cultivation of commercial crops along with the assured supply

of timely and sufficient irrigation, fertilizers, insecticides, pesticides, etc., they may no more consider commercial crops as very risky enterprises and therefore, may not hesitate to shift the area from low value grain crops to high value commercial crops.

Processes

The following crops (processes) listed by season, were considered as alternatives :

<i>Kharif</i>	<i>Rabi</i>
I. <i>Grain crops</i>	
Bajra (irrigated)	Wheat (farm)
Bajra (hybrid)	Wheat (Mexican)
Bajra (unirrigated)	Wheat (local)
Maize	Barley
	Wheat + Barley
	Barley + Wheat
II. <i>Commercial crops</i>	
Chillies	Onion, Garlic, <i>Zeera</i> , <i>Methi</i>
<i>Til</i> and <i>Kharif</i> legumes	

The Constraints

Although all the resources are equally important in production, the levels of activities are determined only by those resources which are available in most limited quantities. The following resource constraints were considered in this study.

1. *Land*
 - (i) *Kharif* land irrigated
 - (ii) *Kharif* land unirrigated
 - (iii) *Rabi* land
2. *Human labour*
 - (i) Mid-August — Mid-September
 - (ii) Mid-October — Mid-November
 - (iii) Mid-March — Mid-April
3. Irrigation—Mid-February—Mid-March
4. Working capital (cash)

5. Farmyard manure
6. Bullock labour
 - (i) Mid-July—Mid-August
 - (ii) Mid-October—Mid-November

The Model

Linear programming model of the following form was used.

$$\text{Max. } Z_0 = \sum_{j=1}^{17} x_j P_j$$

Subject to :

$$\begin{aligned} \sum_{j=1}^{17} a_{1j} x_j + A_1 T &= A_1 && \text{IK} \\ &&& \text{irrigated } kharif \text{ land} \\ \sum_{j=1}^{17} a_{2j} x_j - A_1 T &\leq A_2 && \text{UK} \\ &&& \text{unirrigated } kharif \text{ land} \\ \sum_{j=1}^{17} a_{3j} x_j &\leq A_3 && \text{R} \\ &&& \text{rabi land} \\ \sum_{j=1}^{17} a_{4j} x_j &\leq B_4 && \text{P} \\ &&& \text{bullock pair days} \\ \sum_{j=1}^{17} a_{5j} x_j &\leq L_5 && \text{human labour days} \\ \sum_{j=1}^{17} a_{6j} x_j &\leq C_6 && \text{cash} \\ \sum_{j=1}^{17} a_{7j} x_j &\leq F_7 && \text{farmyard manure} \\ \sum_{j=1}^{17} a_{8j} x_j &\leq A_8 \text{ (Max.)} && \text{Maximum area restrictions} \\ &&& \text{on } zeera, \text{ methi, onion and} \\ &&& \text{garlic} \\ x_j &\geq 0 && (j=1, \dots, 17) \quad A^r \leq 0 \end{aligned}$$

where

- Z = total returns to fixed farm resources,
 X_j = the level of process,
 F_j = net return per hectare of j^{th} activity,
 A^r = irrigable area transferred to unirrigated crops in the *kharif* season,
 a_{ij} = input-output coefficient of i^{th} resource and j^{th} activity.

RESULTS AND DISCUSSION

The final solutions were obtained by the use of simplex method. The results of the optimum plans were examined under three heads, *viz.*, changes in returns to fixed farm resources (*i.e.*, farm incomes), cropping pattern and resource use.

Returns to Fixed Farm Resources

The results of the two optimum plans indicate that there exists a significant scope for increasing incomes on farms of all sizes through the adoption of commercial crops. Table I shows that the share of the commercial crops in the total farm income, in the existing crops plans, was 11.58 per cent on the small, 25.24 per cent on the medium, and 37.87 per cent on the large sized farm respectively.

TABLE I—RETURNS FROM EXISTING AND OPTIMUM PLANS

Farm plan	Size-group				(Rupees)		
	Small	Medium	Large				
Existing situation							
Grain crops	5,990.25 (88.44)	6,925.00 (74.76)	8,496.70 (62.13)
Commercial crops	783.00 (11.56)	2,337.55 (25.24)	5,179.20 (37.87)
Total	6,773.25 (100)	9,262.55 (100)	13,675.90 (100)
Plan I							
Grain crops	7,603.02 (83.03)	10,132.25 (67.53)	5,980.90 (33.66)
Commercial crops	1,553.56 (16.97)	4,871.35 (32.47)	11,787.35 (66.34)
Total	9,156.58 (100)	15,003.60 (100)	17,768.25 (100)
Plan II							
Grain crops	4,973.76 (36.97)	8,065.50 (45.55)	11,435.76 (57.11)
Commercial crops	8,126.64 (63.03)	9,639.85 (54.45)	8,589.31 (42.89)
Total	13,100.40 (100)	17,705.35 (100)	20,025.07 (100)

Note: Figures in parentheses are the percentages to the total income in each size-group.

In the optimum plan I where only limited area was allowed under commercial crops, not only farm incomes increased substantially on farms of all sizes but the contribution of commercial crops in the total farm income also

increased greatly. On the large sized farms the share of commercial crops in the total farm income increased to as high as 66.34 per cent as against 37.87 per cent under the existing situation. This indicates that presently, the farmers were putting even lesser area under commercial crops than what they had actually intended. Firstly, this was due to lack of knowledge about the cultivation of commercial crops on the part of farmers and consequent apprehensions about the profitability of commercial crops and secondly, because of non-availability of inputs such as good quality seeds, insecticides, pesticides, fertilizers, etc., at the right time.

In the optimum plan II where restriction on area under commercial crops was relaxed, the farm incomes increased sharply on all categories of farms. The contribution of commercial crops in the total farm income increased considerably on the small and medium size farms. However, the contribution of commercial crops in the total farm income was reduced to 42.89 per cent on the large size farms. The possible reason for such a reduction was the limited quantity of irrigation water, which was required in large quantities for the adoption of commercial crops.

TABLE II—ADDITIONAL INCOME FROM OPTIMUM PLANS OVER EXISTING SITUATION
(Rupees)

Farm plan	Size-group		
	Small	Medium	Large
Plan I			
Grain crops	1,613.37 (67.69)	3,207.25 (55.86)	-2,515.80 (-61.48)
Commercial crops	770.56 (32.31)	2,533.80 (44.14)	6,608.15 (161.48)
Total	2,383.33 (100)	5,741.05 (100)	4,092.35 (100)
Plan II			
Grain crops	-1,016.49 (-16.06)	1,140.50 (8.56)	2,939.06 (46.29)
Commercial crops	7,343.64 (116.06)	7,302.30 (91.44)	3,410.11 (53.71)
Total	6,327.15 (100)	8,442.80 (100)	6,349.17 (100)

Note : Figures in parentheses are the percentages to the total additional income in each size-group.

Table II shows the additional income over the existing situation under the two optimum plans on different size of farms. The additional income due to reallocation of area under crop enterprises with maximum area restriction on commercial crops (plan I) was Rs. 2,383 on the small size farms, and Rs. 5,741 on the medium size farms and Rs. 4,092 on the large farms. The contribution of commercial crops in the additional income was 32.31 per cent

on the small size farms and 44.14 per cent on the medium size farms. On the large size farms, the contribution of commercial crops in the additional income was as high as 161.48 per cent (*i.e.*, Rs. 6,608.15) as against a reduction of 61.48 per cent (*i.e.* Rs. 2,515.80) from grain crops. The net increase in the income was found to be Rs. 4,092.35.

The reallocation of area under crop enterprises without any maximum area restriction on commercial crops (plan II) generated additional income of Rs. 6,327.15 on the small size farms, Rs. 8,442.80 on the medium size farms, and Rs. 6,349.17 on the large size farms. The contribution of commercial crops in the additional income was as high as 116.06 per cent (—16.06 from grain crops), 91.44 per cent and 53.71 per cent on the small, medium, and large size farms respectively.

Cropping Pattern

The cropping patterns presented in Table III indicate significant increase in the area under commercial crops in the optimum plans. In the existing plan of the total cropped area, the area under commercial crops was 23.08 per cent on the small farms, 22.69 per cent on the medium sized farms, and 45.09 per cent on the large farms. In optimum plan I, the area under commercial crops increased to 29.74 per cent, 52.05 per cent, and 60.11 per cent on the small, medium, and large size farms respectively. The area under commercial crops on the small and medium size farms increased further when the maximum area restriction on commercial crops was removed (plan II.) In plan II the area under commercial crops was as high as 61.6 per cent on the small size farms, and 62.04 per cent on the medium size farms. However, the area under commercial crops decreased to 26.11 per cent on the large size farms. The possible reason for this was the availability of limited irrigation resources in *rabi* where almost all the available irrigated area was devoted to *methi* alone.

It is revealed from Table III that in the optimum plans there appears a tendency towards specialisation in the production of only few crops. In plan I, in *rabi* season, barley has replaced other grain crops, including Mexican wheat having high income opportunities. This was because increased area under commercial crops did not spare much irrigation water for *rabi* grain crops, and water requirement for barley is relatively lower as compared to wheat crop. It was also revealed that in plan II commercial crops replaced grain crops altogether in *rabi* season on farms of all sizes.

Table III further indicates that the cropping intensity increased invariably in plan I but again decreased in plan II excepting on the small size farms where it remained constant. This was again due to increased area under commercial crops which left only small quantities of production resources for grain crops. The increase in area under commercial crops was less than the decrease

TABLE III—CROPPING PATTERN UNDER EXISTING AND OPTIMUM CROP PLANS

Enterprises	(hectares)									
	Small			Medium			Large			
	Existing Plan	Plan I	Plan II	Existing plan	Plan I	Plan II	Existing plan	Plan I	Plan II	
Grain crops										
<i>Kharif</i>										
Irrigated bajra	1.75	—	—	1.50	—	—	2.00	—	—	—
Hybrid bajra	0.25	2.52	2.88	0.50	3.90	4.75	—	—	—	6.04
Unirrigated bajra	—	—	—	1.50	—	—	4.80	6.55	5.88	—
<i>Rabi</i>										
Farm wheat	2.50	—	—	1.50	—	—	2.00	—	—	—
Mexican wheat	0.50	—	—	1.00	—	—	0.65	—	—	—
Barley	1.00	2.75	—	1.50	3.75	—	2.00	3.00	—	—
Total	5.00 (76.92)	5.27 (70.26)	2.88 (38.40)	7.50 (77.31)	7.65 (57.95)	4.75 (37.96)	11.45 (54.91)	9.55 (39.89)	11.92 (73.89)	—
Commercial crops										
<i>Kharif</i>										
Chillies	—	—	—	0.20	—	—	—	2.67	0.46	—
<i>Til</i> and legumes	1.50	1.98	1.62	1.50	4.55	3.70	8.50	8.72	—	—
<i>Rabi</i>										
Onion	—	—	—	0.25	0.50	1.18	0.20	—	—	—
<i>Zeera</i>	—	—	—	—	—	—	—	2.00	—	—
<i>Methi</i>	—	0.25	3.00	—	0.50	2.28	0.50	1.00	3.75	—
Garlic	—	—	—	0.25	—	—	0.20	—	—	—
Total	1.50 (23.08)	2.23 (29.74)	4.62 (61.60)	2.20 (22.69)	5.55 (42.05)	7.76 (62.04)	9.40 (45.09)	14.39 (60.11)	4.21 (26.11)	—
Total cropped area	6.50	7.50	7.50	9.70	13.20	12.51	20.85	23.94	16.13	—
Cropping intensity	144.4	166.7	166.7	114.8	156.2	148.8	85.1	97.7	65.8	—

Note : Figures in parentheses represent the percentage of total cropped area.

in the area under grain crops resulting in a decrease in cropping intensity on the medium and large size farms. In the case of small size farms, however, the productive resources were available in sufficient quantities and the increase in area under commercial crops did permit sufficient resources to put the remaining area under grain crops.

Resource Use

Table IV indicates that a shift from grain farming to commercial crop farming increased the use of human labour on farms of all sizes. Also the use

TABLE IV.—RESOURCE USE IN EXISTING AND OPTIMUM CROP PLANS

			Existing plan								
			Labour (man/days)			Bullock pairs			Cash (Rs.)		
			GC	CC	T	GC	CC	T	GC	CC	T
Small	PF ..		651	70	721	138	23	161	2,487	12	2,499
	PH ..		130	47	111	28	15	25	497	8	384
Medium	PF ..		899	206	1105	195	25	220	3,312	736	4,048
	PH ..		120	94	114	26	11	23	442	335	417
Large	PF ..		1176	531	1707	240	72	312	2,987	587	3,574
	PH ..		103	56	82	21	8	15	261	62	171
Plan I											
Small	PF ..		700	119	819	142	23	165	2,419	84	2,493
	PH ..		133	53	109	27	10	22	459	38	332
Medium	PF ..		990	358	1348	200	47	247	2,750	621	3,371
	PH ..		129	65	102	26	8	19	359	112	255
Large	PF ..		854	1343	2197	159	152	347	1,166	2,013	3,179
	PH ..		89	93	92	17	11	14	122	141	133
Plan II											
Small	PF ..		351	403	754	68	80	148	1,705	829	2,534
	PH ..		122	81	100	24	17	23	592	179	338
Medium	PF ..		554	616	1170	98	100	198	1,943	1,568	3,511
	PH ..		117	79	94	21	13	16	409	202	281
Large	PF ..		1077	488	1565	180	84	264	2,343	1,007	3,350
	PH ..		90	116	97	15	20	16	197	239	208

GC = Grain crops.
PF = Per farm.

CC = Cash crops.
PH = Per hectare of cropped area.

T = Total.

of bullock labour increased when only limited area was allowed under commercial crops (*i.e.*, plan I). Under plan II, when maximum area constraint was removed, the use of bullock labour decreased even below the use under the existing plan. This was due to the fact that commercial crops, excepting for field preparation, required much less bullock labour for other operations particularly post-harvest operations in comparison to the rain crops. The cash requirement, excepting on the small size farms, decreased slightly in the optimum plans. This no doubt looks somewhat strange that a shift from grain farming to commercial crop farming reduces the cash requirement. There are probably two reasons for this. Firstly, the decreased cropping intensity reduced the total cash requirement. Secondly, the cash requirement of *til* and *kharif* pulses, which occupied significant area in the optimum plans as commercial crops, was considerably lower than that of grain crops.

CONCLUSIONS

Though, it is not easy to estimate precisely the potentialities of agricultural development through the adoption of commercial crops on farm incomes, yet the present study has brought out following facts :

1. The productivity of land is generally determined by physical yields and by cropping patterns, *i.e.*, by the relative proportion of high value or commercial crops and low value or foodgrains crops. There appears a considerable scope to raise farm incomes and to introduce modifications in the cropping pattern incorporating more and more commercial crops without resorting to radical changes in the existing conditions like bringing large areas under irrigation.

2. The optimization exercises indicate that the introduction of commercial crops has brought down the cropping intensity significantly on the large and medium size farms. It is apprehended that the agreed policy and already enacted legislation on land ceilings might result in the adoption of more and more commercial crops for compensating the total cash returns of the erstwhile large and medium sized farms. Such an apprehension appears certainly to come into actual practice, unless really dynamic efforts are made to increase the present level of yields of even the latest high-yielding varieties of foodgrains crops.