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GROWTH AND AREA RESPONSE OF COMMERCIAL CROPS IN PUNJAB: SOME POLICY ISSUES

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The cropping pattern of Punjab is dominated by paddy-wheat rotation. The over-dependence of Punjab on these two crops has led to some serious ecological and production-related marketing problems. Thus a strong need is being felt to bring about diversification in Punjab agriculture. Cultivation of traditional commercial crops offers a viable alternative to this rotation. Thus substitution of commercial crops for wheat and paddy will help stabilise as well as increase the production of these crops in the country, because these crops can be grown with a higher degree of certainty in Punjab as most of its area is irrigated.

In this context, an effort is made here to examine the changes in the composition and growth of commercial crops like cotton, sugarcane, oilseeds and potato in Punjab. This paper also analyses the factors responsible for determining the area under these crops. The analysis can help the policy makers to bring about desired shifts in cropping pattern and consequently in the production of these crops in the State.

COMPOSITION AND GROWTH RATES OF COMMERCIAL CROPS

Table I indicates that the proportion of area under commercial crops which include cotton, oilseeds, sugarcane and potato to the gross cropped area in the State decreased from 17.63 per cent in 1965-66 to 10.95 per cent in 1984-85. However, the emphasis placed on increasing the production of commercial crops by the government helped to increase the area under these crops to 12.24 per cent in 1985-86. The area under cotton remained fluctuating in this period. It was 9.39 per cent of the total cropped area in 1965-66 but it declined to about 7 per cent in 1970-71, again increased to 9.6 per cent in 1980-81 and then came down again to only 7.81 per cent in 1985-86. Oilseeds registered a declining trend in its area throughout from 4.79 per cent in 1965-66 to 2.82 per cent of the total cropped area in 1984-85. It increased marginally to 2.94 per cent in 1985-86. Among the oilseeds, groundnut crop continuously lost its importance as its area decreased from 2.78 per cent in 1965-66 to as low as 0.63 per cent in 1985-86. The area under rapeseed and mustard increased from 1.72 per cent in 1965-66 to 2.11 per cent in 1985-86.

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TABLE I. AREA UNDER DIFFERENT CROPS IN PUNJAB (1965-66 TO 1985-86)

Year	('000 hectares)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Total cropped area	Rice	Wheat	Total cereals	Total pulses	Ground-nut	Rapeseed and mustard	Total oilseeds	Cotton	Sugarcane	Potato	Total commercial crops	
1965-66	..	4,889	292 (5.97)	1,550 (31.70)	2,458 (50.27)	644 (13.17)	136 (2.78)	84 (1.72)	234 (4.79)	459 (9.39)	164 (3.46)	14 (0.28)	862 (17.63)
1970-71	..	5,678	390 (6.86)	2,299 (40.48)	3,514 (61.88)	414 (7.29)	174 (3.06)	103 (1.81)	295 (5.19)	397 (6.99)	128 (2.25)	17 (0.30)	819 (14.42)
1975-76	..	6,255	567 (9.06)	2,439 (38.99)	3,891 (62.22)	441 (7.05)	168 (2.69)	122 (1.95)	315 (5.03)	580 (9.27)	114 (1.82)	27 (0.43)	1,011 (16.16)
1980-81	..	6,763	1,183 (17.49)	2,812 (41.58)	4,513 (66.73)	341 (5.04)	83 (1.23)	136 (2.01)	238 (3.52)	649 (9.59)	71 (1.04)	40 (0.60)	979 (14.47)
1984-85	..	7,013	1,644 (23.44)	3,094 (44.11)	5,152 (73.66)	203 (2.89)	45 (0.64)	138 (1.96)	198 (2.82)	472 (6.73)	79 (1.12)	34 (0.50)	768 (10.95)
1985-86	..	7,153	1,714 (23.96)	3,112 (43.50)	5,169 (72.26)	225 (3.14)	45 (0.63)	151 (2.11)	211 (2.94)	559 (7.81)	78 (1.09)	43 (0.60)	876 (12.24)

Figures in parentheses indicate percentages of area under each crop to the total cropped area.
Source: Statistical Abstract of Punjab, various issues.

The area under sugarcane registered a declining trend over time. It was 3.46 per cent of the total cropped area in 1965-66 which came down to 1.09 per cent in 1985-86. Potato which is the most important commercial vegetable crop in Punjab has gained significance over time. Its area tripled from 14 thousand hectares in 1965-66 to 43 thousand hectares in 1985-86. However, the area under this crop is still very small in percentage terms.

The trends in the area, productivity and production of commercial crops can further be captured through their growth rates (Table II). The compound growth rates per annum of area under groundnut, *desi* cotton and sugarcane were found to be significantly negative. The area growth rate of

TABLE II. COMPOUND GROWTH RATES OF AREA, YIELD AND PRODUCTION FOR DIFFERENT CROPS IN PUNJAB (1965-66 TO 1985-86)

Crops	Compound growth rates of		
	Area	Yield	Production
Rice	10.71*	4.89*	16.14*
Wheat	2.71*	2.79	5.58*
Pulses	-4.47	-1.00 ^{NS}	-5.43*
Groundnut	-8.12*	-0.375	-8.47*
Rapeseed and mustard	-0.217 ^{NS}	3.24	3.00*
Cotton <i>desi</i>	-4.711*	-2.47*	-7.09*
Cotton American	5.932*	-0.888 ^{NS}	5.02*
Sugarcane	-3.21*	3.40*	0.092 ^{NS}
Potato	5.73*	2.631*	8.48*

*Significant. NS=Non-significant.

rapeseed and mustard was also negative but not significant. The growth rates of American cotton and potato were positive and significant. The growth rates of productivity of rapeseeds and mustard, sugarcane and potato were positive and significant whereas the growth rate of *desi* cotton was negative and significant. The productivity of groundnut and American cotton did not show any change. Consequent upon the growth of area and productivity, the production of rapeseed and mustard, American cotton and potato increased at the rate of 3, 5 and 8.58 per cent per annum respectively in 1967-68 through 1985-86. On the other hand, a significant decline in the production of groundnut and *desi* cotton was witnessed over this period. There was no significant improvement in the production of sugarcane over time.

Thus it should be of considerable interest to know how the area under these crops responds to various stimuli, given the production technology that

determines the yield levels as at present, if the State plans to diversify its cropping patterns that would substitute commercial crops for cereals at the margin.

AREA RESPONSES

In light of the changes in the composition and growth of traditional commercial crops, it becomes pertinent to discuss the factors which are responsible for bringing about these changes and can be potential agents of change. For this purpose, the Nerlovian Lagged Adjustment Model was used. Since there is scope for reallocation of area from paddy and wheat to these crops at the margin, Nerlove's lagged adjustment model was preferred over its other versions (for details, see Raj Krishna, 1963). In the case of traditional commercial crops, since the green revolution only a marginal improvement has taken place on the productivity front and it is only the expansion of area which is the main source of growth of their output. Hence, area response function by and large stands for the supply response for these crops in Punjab. The estimation equation of these crops is as follows:

$$A_t = b_0 + b_1 P_{t-1} + b_2 Y_{t-1} + b_3 \sigma_{pt} + b_4 \sigma_{yt} + b_5 I_t + b_6 W_t + b_7 A_{t-1} + \epsilon_t$$

where

- A_t = area under the crop in the year t (in thousand hectares),
- P_{t-1} = price of the crop in Rs./quintal deflated by the price of substitute crop in the year $t-1$,
- Y_{t-1} = yield of the crop in kg. per hectare deflated by the yield of the substitute crop in the year $t-1$,
- σ_{pt} = standard deviation of the preceding three years' prices of the crop,
- σ_{yt} = standard deviation of the preceding three years' yields of the crop,
- I_t = gross irrigated area (in thousand hectares),
- W_t = rainfall in the planting period in the year t (in mm),
- A_{t-1} = area under the crop in the year $t-1$ (in thousand hectares),
- b_i = the parameters to be estimated.

For estimation purposes, secondary time-series data for different variables for the period 1967-68 through 1985-86 were used. In the *rabi* season, wheat was the only competing crop for rapeseed and mustard whereas in the *kharif*, cotton for groundnut and paddy for cotton and sugarcane were selected as competing crops on the basis of their growth period, cultural requirements and suitability of soil for the crops.

The results of the area response function for different crops are presented in Table III. In rapeseed and mustard, which is the most important oilseed crop, both the relative yield and price were found to be significantly affecting the area under this crop. Price risk also played a significant role in reducing the area under it. The effect of increase in the irrigated area

turned out to be negative which implies that as the irrigated area increased, the area under rapeseed diminished. There was no significant association between the current area and the lagged area. This means that the area under rapeseed/mustard cannot be expanded at the cost of wheat unless the production technology improves enough to increase their yields substantially and to reduce the sensitivity of these crops to weather risks. Or the price margin should be such that it should cover the economic disadvantage on productivity and provide for covering the risk factor in these crops. Otherwise, as new areas are brought under cultivation, howsoever small these areas may be, or irrigation coverage is extended, wheat will continue to expand and rapeseed/mustard crop would not figure up anywhere.

Groundnut proved to be a very inferior crop in Punjab. In spite of the improvements in its yield and price over time as well as the stability in its prices, the area under groundnut was on continuous decline. This happened due to higher profitability of American cotton as a competitive crop. Irrigated area had also inverse relationship with the area under groundnut. The decline in the area under this crop was gradual as indicated by the significant positive relationship between the current area and the lagged area. Thus at the present level of technology and input-output price relationship,

TABLE III. AREA RESPONSE OF COMMERCIAL CROPS IN PUNJAB (1967-68 TO 1985-86)

Variable	Rapeseed and mustard	Groundnut	Cotton American	Sugarcane	Potato
Intercept	-35.84	446.13	-505.17	-9.75	18.66
Relative yield	537.94* (135.19)	-9.58 ^{NS} (8.19)	420.57 ^{NS} (592.16)	3.90 ^{NS} (9.95)	-3.58* (0.805)
Relative price	45.88* (11.89)	-64.06** (35.65)	33.08* (12.50)	14.96* (4.45)	9.62* (4.41)
Standard deviation of price ..	3.56* (0.211)	0.487** (0.273)	0.036 ^{NS} (0.94)	-0.05 ^{NS} (0.10)	0.228 ^{NS} (0.183)
Irrigated area	-0.173 ^{NS} (0.180)	-0.101* (0.019)	0.131** (0.065)	—	0.0023 ^{NS} (0.0016)
Rainfall	0.134 ^{NS} (0.175)	0.036 ^{NS} (0.028)	0.242 ^{NS} (0.247)	—	—
Lagged area (t-1)	0.199 ^{NS} (0.162)	0.348* (0.167)	0.738* (0.241)	0.88* (0.16)	0.429* (0.132)
Lagged area (t-2)	—	—	—	-0.34* (0.18)	—
Lagged area (t-3)	—	—	—	0.17 ^{NS} (0.14)	—
R ²	0.80	0.97	0.92	0.91	0.949
Durbin-Watson's statistics ..	2.11	1.69	1.86	1.70	2.32

Figures in parentheses indicate the standard errors of the coefficients.

* Significant at 5 per cent level. NS=Non-significant.

** Significant at 10 per cent level.

there is little scope for expansion of area from groundnut. Rather, this trend of replacement of area from groundnut is expected to continue.

American cotton is an area-specific crop confined to the southern districts of Punjab due to soil and water constraints. Thus the scope for diversion of area from cotton to any other crop and even to paddy is only of marginal nature. In American cotton, the relative yield was not contributing significantly to the area under it whereas relative prices, irrigated area and lagged area played significant role in increasing the area under this crop. The yield risk, price risk and rainfall were non-significant. This means, this crop is quite a sure crop under the given soil-climatic conditions and what matters is the output price. In the presence of assured price situation with easy market clearance, under the existing conditions the area under this crop is likely to keep expanding in the southern and south-western region of the State.

In sugarcane, the relative price and one year lagged area (A_{t-1}) had significant positive effect on the current area, whereas two-year lagged area (A_{t-2}) had negative significant effect, indicating the cyclic fluctuations in area and production. Other variables were found to be non-significant. This is because this crop is a three-year crop (plant + ratoon + ratoon). First ratoon automatically becomes second ratoon crop. Because second ratoon has to be uprooted in any case, it does not influence the area next year. In order to stabilise the area under this crop, what is needed most is a long range price policy and prompt lifting of the cane at that price. In the presence of this price and market situation, other factors turn out to be not significant as determinants of sugarcane area in the State.

The effect of relative price and lagged area in potato crop was positive and significant while that of other variables was non-significant, which means that price and market situation as it is, is quite favourable for this crop and needs to be kept up, if substantial area is to be brought under this crop.

EFFECT OF MECHANISATION, LABOUR USE AND FARM SIZE ON COMMERCIAL CROPS

Besides favourable prices and their stability, the mechanisation and composition of labour use have considerable impact on the area under commercial crops. A recent study (Sidhu, 1987) based on the data from the Comprehensive Scheme on Cost of Cultivation of Principal Crops in Punjab has brought out that mechanisation and casualisation of labour had inverse relationship with the area under commercial crops (Table IV). Due to the casualisation of agricultural labour over time (Minhas and Majumdar, 1987) and increased preference for leisure by the farm families as their incomes grow, the farmers put relatively less area under commercial crops as the use of family and permanent labour is relatively more on these crops. Consistently less availability of family labour and permanent labour on mechanised farms has also, therefore, led to a decrease in the area under commercial crops in the State. The same study, however, observed that there

TABLE IV. EFFECT OF MECHANISATION AND COMPOSITION OF LABOUR USE ON THE AREA UNDER COMMERCIAL CROPS, 1981-82

Particulars	Pure bullock operated farms	Pure tractor operated farms
Percentage of area under commercial crops	22.38	11.64
Family labour (hrs./ha.)	669.65 (66.17)	404.98 (40.08)
Permanent labour (hrs./ha.)	117.53 (11.61)	98.09 (9.71)
Casual labour (hrs./ha.)	224.88 (22.22)	507.36 (50.21)
Total labour (hrs./ha.)	1,012.06	1,010.43

Source: Sidhu (1987).

Figures in parentheses indicate the percentages of the total labour used.

was no clear-cut relationship between farm size and the area under commercial crops. This means mechanisation has adversely affected the area under commercial crops, irrespective of the size of the farm. With the progressive increase in farm mechanisation, the area under commercial crops is likely to decrease further. This leads to the observation that there is little distinction between the commercial crops and food crops in the Punjab agriculture. In fact, wheat and rice are the two most important commercial crops for the Punjab farmer and he responds to only the economic stimuli indicating that tradition has lost its significance in the Punjab agriculture.

CONCLUSION AND POLICY SUGGESTIONS

The analysis shows that the importance of traditional commercial crops such as cotton, oilseeds, sugarcane and potato has diminished over time. The introduction of new seed-irrigation-fertiliser technology supported by remunerative pricing policy encouraged the farmers to put more and more area under the two most profitable cereal crops, *i.e.*, paddy and wheat. Thus paddy and wheat have emerged as major commercial crops in Punjab. Development of new technology in cereals was responsible for replacing area from groundnut. In spite of relative improvements in prices and yield, the area under groundnut decreased because the crop became economically an inferior one. In all other traditional commercial crops relative price and price stability are the most important factors that influence the area under these crops. Therefore, only a long run price policy supported by efficient procurement system and market clearance which ensures economic advantage for these crops can boost and stabilise their production in Punjab. But comparative economic disadvantage as at present is quite significant and it may not be possible to boost the prices of these crops appreciably. Therefore,

more efforts need to be directed towards the improvement in their production technology along with work simplification technology, if these crops are expected to offer a viable alternative to the wheat-paddy rotation. Sugar mills, ginning factories, oil extracting plants and processing plants for potato also need to be set up at strategic places in order to improve value-added through processing of these crops. Otherwise, efforts of the State to diversify its cropping patterns through these commercial crops are not likely to bear fruit.

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