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A COMPONENT ANALYSIS OF THE GROWTH OF PRODUCTIVITY AND PRODUCTION IN RAJASTHAN: 1956-61 TO 1969-74

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This paper attempts an analysis of the growth of agricultural production in Rajasthan in terms of physical components. The factors identified in the analysis are area, level of productivity and prices. For the analysis of growth of aggregate farm output a general model is developed in which besides the 'internal' adjustments in these factors, 'external' movements, *viz.*, changes in the gross cropped area, changes in the level of productivity and changes in the general level of prices are included. The major focus of the analysis in this paper is on the growth of productivity, which is analysed in terms of internal adjustments, *viz.*, cropping pattern, yield rates and price structure only. With the help of these models the paper attempts to decompose aggregate production as well as productivity in terms of these components and their interactions. A preliminary hypothesis regarding the growth behaviour of these factors is also attempted with the help of the interaction terms. Section I presents a brief review of earlier studies in this area and the principal differences between the present study and the earlier ones. General theoretical models for such an analysis are developed in section II. Section III presents the results of the analysis while the interpretation and implication of the results are discussed in section IV.

I

REVIEW OF EARLIER STUDIES

The component analysis of the growth of crop output in India was pioneered by Minhas and Vaidyanathan,[1] who used for the first time an additive scheme of decomposition. With this scheme the growth of crop output was disaggregated into a set of physical factors, *viz.*, area, yield rate and cropping pattern as well as an interaction term between the latter two. The same model was later used by Misra[2] for the decomposition of crop output in Gujarat and by Rajender Sondhi and Karam Singh[3] who have used it for a comparative analysis of the pre-green revolution and the green revolution periods. Both these papers use a slightly modified version of the original

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1. B. S. Minhas and A. Vaidyanathan, "Growth of Crop Output in India, 1951-54 to 1958-61," *Journal of the Indian Society of Agricultural Statistics*, Vol. XVIII, No. 2, 1965.
2. V. N. Misra, "Growth of Crop Output in Gujarat: A Component Analysis," *Anvesak*, Vol. 1, No. 1, June, 1971.
3. Rajender Sondhi and Karam Singh, "Component Analysis of Foodgrain Economy of India," *Journal of Social and Economic Studies*, Vol. III, No. 2, September, 1975.

Minhas-Vaidyanathan scheme in so far as an interaction between area and other components is added.

The two factors which are ignored in the earlier studies are technological factors and price structure. Minhas and Vaidyanathan have indicated the importance of an analysis which includes the role of technological factors also. Nothing substantial has been done, however, in this direction. The role of price structure, on the other hand, is entirely ignored not only in the empirical work but also in the theoretical models that are developed for such an analysis. Prices reflect the relative importance assigned to different crops when used to obtain the money value of productivity or aggregate output. This may change over time because of changes in tastes and preferences or because of technical or physical constraints on specific crops. An analysis of productivity that ignores this aspect renders an important economic variable inoperative. Inclusion of changes in the price structure, on the other hand, can provide meaningful insight into the pattern of agricultural growth and has useful policy implications.

The present study strikes at the second deficiency of earlier studies and includes a variable on price structure. The technological aspect of growth will be dealt with separately in a forthcoming paper.[4] This study is different from the earlier studies in two respects. Firstly, the analysis proceeds mainly in terms of productivity which refers to the money value of agricultural output per hectare at the current price structure. Price structure, here, is treated as a variable and is defined as 'the set of current year prices such that the overall average price of agricultural commodities remains at a constant level, while at the same time it incorporates the movements in prices relative to each other.' This is done by decomposing the movements in the set of prices into external shifts, *i.e.*, the inflationary (deflationary) movements, and internal adjustments—termed as changes in the price structure. The external shifts in prices are eliminated from the gross movements to obtain the shifts in the price structure.

Secondly, the present study attempts to make a preliminary enquiry into the growth behaviour of important economic variables. This is done with the help of a disaggregated decomposition of overall productivity/production over crops, as well as the interaction terms of these variables. In the first instance, the very nature of the contribution of important components is explained with the help of shifts in the cropwise value of the components. In the second stage, the causes of shifts in the crop values are assessed. An overall hypothesis about the behaviour of these components is then framed by the help of their interaction terms after defining the flow of causation with regard to a set of factors.

4. "Technological Decomposition of the Movements in Yield Rates during the Period 1956-61 to 1969-74 in Rajasthan."

II

MODEL

The variables and notations used in the model are

y_c = yield rate of cth crop,
a_c = proportion of gross cropped area under cth crop,
p_{cr} = current price of cth crop,
Y = level of productivity—in value terms,
A_c = gross area under cth crop,
Q_c = physical output of cth crop,
p_c = deflated price of cth crop,
Q = gross agricultural output—in value terms,
$\triangle$ = symbol for change.

The superscripts 0 and 1 refer respectively to the base period and the current period. Thus for jth period (j = 0, 1)

$$a_c^j = \frac{A_c^j}{\Sigma_c A_c^j}, \quad y_c^j = \frac{Q_c}{A_c}$$

$$p_c^j = \frac{p_{cr}^j}{p_{00}^j / p_{00}^0}$$

where p_{00}^j is the Laspayer's index of agricultural prices during period j with a conveniently chosen base '00'. Considering period 0 of the model as the base period for the index, we have

$$p_0^j \quad \frac{\Sigma_c Q_c^0 p_c^j}{\Sigma_c Q_c^0 p_c^0}$$

Also,

$$Y^j = \Sigma_c a_c^j y_c^j p_c^j$$
$$Q^j = A^j Y^j,$$

where $A^j = \Sigma_c A_c^j$

The total change in productivity given by

$$Y^1 - Y^0 = \Sigma_c a_c y_c p_c - \Sigma_c^0 a_c^0 y_c^0 p_c^0$$

can be decomposed as

$$\begin{aligned}\triangle Y = {} & \Sigma_c a_c^0 y_c^0 . \triangle p. + \Sigma_c a_c^0 . p_c^0 . \triangle y. \\ & + \Sigma_c y_c^0 p_c^0 . \triangle a. + \Sigma_c a_c^0 . \triangle p. \triangle y. \\ & + \Sigma_c y_c^0 . \triangle a. \triangle p. + \Sigma_c p_c^0 . \triangle a. \triangle y. \\ & + \Sigma_c \triangle a. \triangle y. \triangle p. \qquad \ldots\ldots\ldots\ldots \quad (1)\end{aligned}$$

In the above decomposition scheme, the first term on the right hand side of (1) is the price effect. This gives us the impact of changes in the value of

average product per hectare due to the internal changes in relative prices assuming that all other variables have not changed during the period. The second term is the yield effect reflecting the impact of the growth of average yield on the increase in the level of productivity, keeping all other influences inoperative during the period. Likewise, the third term reflects the impact of cropping pattern changes during the current period as compared to the base period on the increase in productivity. Third, fourth and fifth terms are respectively the first order interactions between yield rate and cropping pattern, and cropping pattern and price structure. These effects signify the influence of any of the two factors over the other in bringing the productivity change. Thus, a positive interaction effect between yield or price and cropping pattern would imply that due to higher yields or higher relative prices of some crops the cropping pattern has changed in their favour. Similar is the interpretation with other interaction effects. The last term on the right hand side of (1) is the second order interaction term between the three variables considered. This gives the mutual interdependence between the three, if any.

In the general form the model of productivity can be decomposed as (Model II)[5]

$$\begin{aligned} Y^1 - Y^0 &= \Sigma\, a_c^1\, y_c^1\, p_c^1 - \Sigma\, a_c^0\, y_c^0\, p_{cr}^0 \\ &= p_0^1 \Sigma\, a_c^1\, y_c^1\, (p_{cr}^1/p_0^1) - p_0^0 \Sigma\, a_c^0\, y_c^0\, (p_{cr}^0/p_o^0) \\ &= p_0^1 \Sigma\, a_c^1\, y_c^1\, p_c^1 - p^0 \Sigma\, a_c^0\, y_c^0\, p_c^0 \end{aligned}$$

$$\begin{aligned} Y^1 - Y^0 &= (p_0^1 - p_0^0) \Sigma\, a_c^0\, y_c^0\, p_c^0 + p_0^1 \Sigma\, a_c^0\, y_c^0\, (p_c^1 - p_c^0) \\ &+ p_0^1 \Sigma\, a_c^0\, p_c^0\, (y_c^1 - y_c^0) + p_0^1 \Sigma\, y_c^0\, p_c^0\, (a_c^1 - a_c^0) \\ &+ p_0^1 \Sigma\, a_c^0\, (y_c^1 - y_c^0)\, (p_c^1 - p_c^0) + p_0^1 \Sigma\, y_0^0\, (a_c^1 - a_c^0)\, (p_c^1 - p_c^0) \\ &+ p_0^1 \Sigma\, p_c^0\, (y_c^1 - y_c^0)\, (a_c^1 - a_c^0) + p_o^1 \Sigma\, (a_c^1 - a_c^0)\, (y_c^1 - y_c^0)\, (p_c^1 - p_c^0) \quad \ldots\ldots (2) \end{aligned}$$

This version of the scheme (1) includes the general agricultural price inflation effect of the price movements. The first term of the above decomposition scheme is the increase in the value of productivity due to the inflationary pressure. This model is not relevant for the analysis of productivity *per se*. However, it can provide significant conclusions about the external growth of area, as will be seen in the model of production decomposition in these terms.

Model 1 version of the scheme for decomposing the production increase in the current period (period 1) over the base period (period 0) can be given as

$$\begin{aligned} Q^1 - Q^0 &= A^1 Y^1 - A^0 Y^0 \\ &= (A^1 - A^0)\, Y^0 + (Y^1 - Y^0)\, A^1 \quad \ldots\ldots\ldots\ldots (3) \end{aligned}$$

5. The author is indebted to Dr. Raj Krishna for suggesting this generalisation.

The complete decomposition of production can be obtained by substituting the decomposition (1) for productivity in the right hand side of (2) as

$$\begin{aligned} Q^1-Q^0 = {} & (A^1-A^0)\,\Sigma_c\, a_c^0\, y_c^0\, p_c^0 + A^1\,\Sigma_c\, a_c^0\, y_c^0\,(p_c^1-p_c^0) \\ & + A^1\,\Sigma_c\, a_c^0 p_c^0\,(y_c^1-y^0) + A^1\,\Sigma_c\, y^0\, p^0\,(a^1-a^0) \\ & + A^1\,\Sigma_c\, a_c^0\,(y_c^1-y_c^0)\,(p_c^1-p_c^0) + A^1\,\Sigma_c\, y_c^0\,(a_c^1-a_c^0)\,(p_c^1-p_c^0) \\ & + A^1\,\Sigma_c\, p_0^0\,(a_c^1-a_c^0)\,(y_c^1-y_c^0) + A^1\,\Sigma_c\,(a_c^1-a_c^0)\,(y_c^1-y_c^0)\,(p_c^1-p_c^0) \ldots . (4) \end{aligned}$$

The right hand side of the identity (3) can be further decomposed as

$$Q^1-Q^0 = (A^1-A^0)\,Y^0 + (Y^1-Y^0)A^0 + (A^1-A^0)\,(Y^1-Y^0) \ldots\ldots\ldots (5)$$

The additional interaction term does not seem to be of much interest unless the relationship between area and productivity or any component thereof is properly defined. Overall area increases are not likely to be influenced by the overall level of productivity or any of its components. It is controlled by factors that are not included in the model, such as increase in the demand for foodgrains as a result of population pressure or the government investment in land reclamation and irrigation extension, or the private investment due to the better returns even at increased cost of acquisition of land, etc. This, however, is not the case if the relationship is established in the other direction. Theoretically, this term may turn out to be negative due to diminishing marginal productivity of land in a situation where none of the technological forces is in operation or if the crop adjustments do not favour the crops with higher returns.

Componentwise, this interpretation stands for yield rate also. The interaction between gross cropped area and cropping pattern can provide an insight into the pattern of crop adjustments following area increases and show whether the additional land is going for crops with higher yield, or with higher profits (prices). The second order interaction term between yield rate, gross area and cropping pattern can throw some light on the question of allocation of the additional area. The interaction of area and internal price adjustments is not of any interest *per se*. However, the interaction of area and the 'external' price variation could be of crucial importance.

This can be seen if we use Model 2 version of the decomposition scheme (4). The identity

$$Q^1-Q^0 = A^1\, p_0^1\, Y^1 - A^0\, p_0^0\, Y^0 \qquad \ldots\ldots\ldots\ldots \quad (6)$$

where p and Y are values as defined earlier and Q^1 and Q^0 are respectively the money values of gross agricultural output at current prices during period 1 and period 0, can be written as

$$\begin{aligned} Q^1-Q^0 = {} & (A^1-A^0)\, p_0^0\, Y^0 + (p_0^1-p_0^0)\, A^0Y^0 + (Y^1-Y^0)\, A^0p_0^0 \\ & + (A^1-A^0)\,(p_0^1-p_0^0)Y^0 + (A^1-A^0)\,(Y^1-Y^0)p_0^0 + \\ & (Y^1-Y^0)(p_0^1-p_0^0)A^0 + (A^1-A^0)\,(Y^1-Y^0)\,(p_0^1-p_0^0) \ldots\ldots\ldots \quad (7) \end{aligned}$$

By doing this we get a relationship in the external values of the variables on area, price and productivity. The behaviour of these components can help us in analysing the growth pattern of agriculture vis-a-vis other sectors. The interaction between gross area and average price level, for example, can be usefully interpreted to find whether the rapid growth of gross cropped area is due to the terms of trade being in favour of agriculture or not. Bringing uncultivable land under cultivation is an increasingly costly investment and may be justified only in terms of better price relations for agriculture. This can be due to higher productivity level also and a second order interaction between Y, p and A can help us to understand this. The higher cost aspect in such a case would be nullified by higher productivity and a favourable trend in agricultural prices as compared to other sectors would increase the cropped area.

The complete decomposition scheme can be obtained by substituting for $Y^1—Y^0$ from (2). Such a decomposition would carry as many as 31 terms containing five individual effects, ten first order interactions, ten second order interactions, five third order interactions and one fourth order interaction. This would give us a complete picture of internal and external adjustments in agriculture as it involves pure external effect interactions, pure internal effect interaction as well as the interaction between internal and external effects although some of these would be of no practical significance.

It must be clearly mentioned here that the inferences drawn from the interaction effects merely help in establishing certain hypotheses about the past behaviour of certain variables. This should be backed by rigorous research to provide sufficient evidence to support or to contend these hypotheses.

For the decomposition of productivity of a region one can use model 1 so as to analyse the internal adjustments in agriculture. For an analysis of agriculture as a sector of overall economy, *i.e.*, for the analysis of external adjustments in agriculture model 4 (identity 7) can be used. The complete picture of agricultural growth can be analysed if the complete decomposition model 4 is used.

III

DATA AND RESULTS

Due to the lack of information on certain variables, only 17 major crops/crop groups covering 80 to 90 per cent of the gross cropped area were considered.[6] Five-year averages of all the relevant variables have been used

6. Following crops were considered:

Bajra	Gram	Sugarcane
Jowar	*Kharif* pulses	Chillies
Maize	Miscellaneous *rabi* pulses	Cotton
Wheat	Sesamum	
Barley	Rape and mustard	
Rice	Linseed	
Small millets	Groundnut	

Due to the homogeneity in observations, the crops sesamum, rape and mustard, linseed and groundnut were pooled and their analysis proceeded under the name oilseeds.

instead of the annual values. This was done in order to iron out wide random fluctuations in the level of productivity/production. These fluctuations are not even explained by the rainfall variation.[7] The period 1956-61 centred at 1958-59 and the period 1969-74 centred at 1971-72 were respectively taken as the base and the current period and are denoted by period 0 and period 1 respectively.[8]

Only model 1 version of the decomposition scheme is considered in the present analysis. The overall results of this analysis are presented in Table 1.

TABLE I—RELATIVE CONTRIBUTION OF DIFFERENT FACTORS IN THE GROWTH OF PRODUCTIVITY AND PRODUCTION

Effects	Productivity		Agricultural production
	Absolute money value (Rs./hectare)	Per cent share	Per cent share
(1)	(2)	(3)	(4)
Individual effects			
Area	—	—	38.46
Price structure	4.4743	12.65	7.83
Yield	36.5119	103.27	63.62
Crop pattern	(—)1.2552	(—)3.55	(—)2.19
Interaction effects			
Crop pattern and yield	2.0355	5.76	3.50
Yield and price structure	(—)2.4244	(—)6.86	(—)4·24
Crop pattern and price structure ..	(—)3.7329	(—)10.56	(—)6.52
Yield, crop pattern and price structure	(—)0.2525	(—)0.71	(—)0·44
Total	35.3567	100.00	100·00

A complete cropwise decomposition of the growth in productivity is given in the Appendix.

The overall growth in aggregate farm production during the period 1956-61 to 1969-74 approximated 40 per cent. This implies an annual compound rate of growth of 2.4 per cent. Yield increases alone accounted for 63.64 per cent or nearly two-thirds of the total output growth. The contri-

7. Normally, the variation in the yield rates/or the level of aggregate production could be smoothened by eliminating from these values the climatic effects. A regression exercise with the cropwise data on rainfall and yield rate, however, did not provide anything substantial.

8. It is significant to note here that the average annual rainfall during the two periods was the same at a level of 53 cm., although the variability in the rainfall data during the base period was higher than that of the end period.

bution of area growth was 38.45 per cent of the output growth. The other positive components of output growth are 7.82 per cent due to the changes in the relative price structure and 3.5 per cent due to the interaction between changes in the cropping pattern and yield. Negative components added upto 13 per cent of the total output growth. These include the cropping pattern effect (—2.19 per cent), interaction effect due to the changes in area and the price structure (—4.24 per cent) and interaction between changes in yields and the price structure (—6.52 per cent). The second order interaction term although negative was insignificant.

These values are in sharp contrast to the results given by Minhas and Vaidyanathan. The yield component which was negative for Rajasthan during 1951-61 in the former study is not only positive but has contributed more than the overall growth of productivity. The single major factor of output growth, *viz.*, area, during that period has gone down to second place. The changes in the cropping pattern which contributed 6.9 per cent in the former study give a negative contribution in this exercise. This implies that the cropping pattern shifts in favour of those crops for which the money value of the output per hectare was relatively low in the base period, are dominant. This could be due to a variety of reasons and is examined below. Price structure—a new component—has contributed positively even though the share of all the cereals in this component was negative.

The growth of productivity during the same period was 22 per cent, implying a 1.5 per cent annual rate of growth. The money value of the output per hectare increased from Rs. 162.43 during 1956-61 to Rs. 197.78 during 1969-74 at the current price structure. As mentioned earlier, the yield effect alone has contributed as large as 103 per cent of the total productivity growth. In the yield component bajra, wheat and oilseeds are the prime contributors. Out of the total yield effect of Rs. 36.51 in the per hectare money value of the output, these crops alone have contributed Rs. 31.03. This implies that the major part of productivity growth is shared by these crops. Due to the importance of its largest contribution the yield component of agricultural growth needs special attention. The remaining analysis is focussed on the interaction terms.

IV

INTERPRETATION AND IMPLICATION OF THE RESULTS

More profits in a crop are likely to induce more area under it if there are no technical constraints.[9] Profitability includes not only the higher relative price of the crop but also the increased yield (cost aspect being ignored).[10]

9. The extension of area under sugarcane or cotton is constrained, for example, by the availability of irrigation.

10. The only crops in this analysis for which prices have increased are pulses, oilseeds and chillies. There is no evidence, however, that the cost of cultivation of pulses or oilseeds is higher than most of the cereal crops.

Increases in both these variables should rationally increase the acreage allocation in favour of the respective crops. This fact should be reflected in the interaction terms of the changes in two variables respectively with the changes in the cropping pattern.

This hypothesis is not supported by the present analysis in so far as the relative price-cropping pattern relationship is concerned. The interaction term turns out to be negatively influenced mainly by pulses—for which the relative prices have increased but the share in the gross cropped area has reduced—and by cereals whose share in the gross cropped area has increased but the relative prices have declined.

This perverse behaviour of interaction between changes in the crop structure and price structure can, however, be explained by the help of certain institutional factors. The shifts in price structure during this period have been determined considerably by government policy. The state exerted its control over the price of cereals, particularly that of wheat and bajra, while all other crops were left to seek their own level. As a result, while the prices of pulses and oilseeds increased sharply during the drought conditions—a phenomenon common in the region—the increase in the prices of cereals was rather slow. These movements turned negative after the removal of the inflation effect of price movements. Under the rationality assumption this should result in a reallocation in favour of the more remunerative crops. This did not happen, as is evidenced by the interaction term, due to the effect of other variables.

An explanation for this may lie, for example, in the nature of subsistence farming. It is essentially the cereal crops which people need for their basic food. A mere increase in the relative price of some crop may not turn the cropping pattern in its favour unless the economy is producing surplus of every crop. In other words, movements in the crop structure are price responsive only if a large part of the produce is marketed and agriculture is commercialised. In subsistence agriculture such as in Rajasthan, where the bulk of agricultural output is meant for family consumption or barter transactions, price movements will have very little impact on the shifts in the cropping pattern. And the possible impact, if any, would be visible if the shifts in the same group of crops are considered. Bajra can be substituted for jowar or wheat can be substituted for barley if the price movements favourable to these crops occur. Area substitution from *moong* to bajra or jowar may not be explained by the help of price movements alone.

It is also interesting to note that the results of the present study as implied in the interaction terms are supported by another full fledged study which uses the conventional model of acreage response to price changes.[11] The

11. John Thomas Cummings, "The Supply Responsiveness of Indian Farmers in the Post-Independence Period—Major Cereals and Cash Crops," *Indian Journal of Agricultural Economics*, Vol. XXX, No. 1, January-March, 1975.

individual interaction values of wheat, barley and sesamum (oilseeds) are in confirmation with Cummings' study on the supply response of these crops. His finding for Rajasthan is that the supply response of what is generally considered inferior crop, *viz.*, barley is positive while in the case of wheat it is negative in half of the individual districts considered by him. The elasticity of sesamum was found to be confirmingly positive by him. In the present study also barley and oilseeds have a positive interaction term while it is negative for wheat (see Appendix).

In the absence of price as a guide variable, therefore, it is mainly the yield rate which would influence the reallocation of acreage. This fact is substantiated by the positive interaction term between cropping pattern and yield rate. Most of the crops for which there was substantial yield increase show favourable changes in the cropping pattern, while the crops whose yield rate has gone down show decrease in the proportion of area under them.

Cropwise, maximum increase in the acreage allocation goes to bajra whose share in the gross cropped area increased by 10 per cent, the increase in the yield rate being more than 50 per cent. Wheat registered an increase of 7 per cent in the acreage allocation and of 9.29 per cent in the yield rate. Similarly, oilseeds for which the yield increase was of the order of 40 per cent increased their proportion of gross acreage by 1 per cent contrary to these crops. Barley, gram and small millets have lost in both the yield rate as well as their share in the gross cropped area.

All those crops which show an increase in the yield rate but a decrease in the proportion of area have also recorded area increase in absolute. The area under *kharif* pulses and chillies, for example, increased by 11 and 13 per cent respectively, while that under cotton recorded marginal increase.

Finally, the behaviour of the interaction terms between yield rate and price structure can be understood by taking the causal flow from yield rate to price. A higher yield rate implies a higher level of production and this may cause prices to go down or increase less as compared to the overall price level. The increase in prices following an increase in demand would have, however, balanced the negative value if the prices of cereals were left to seek their own levels.

APPENDIX

COMPONENT ANALYSIS OF THE GROWTH OF PRODUCTIVITY IN RAJASTHAN: 1956-61 TO 1969-74

Crop	Value of the components during the base period			Change in the base period values			Individual effects		
							Relative prices	Yield	Crop pattern
	a_0^0 $\Sigma a_c^0 = 1$	y^0 (tonnes/ hectare)	p^0 (Rs./ tonne)	$\triangle a$	$\triangle y$ (tonnes/ hectare)	$\triangle p$ (Rs./ tonne)	$a^0y^0\triangle p$ (Rs.)	$a^0p^0\triangle y$ (Rs.)	$p^0y^0\triangle a$ (Rs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cereals									
Bajra	0.332115	0.2039	379	0.033765	0.1058	—84	—5.6883	13.3172	2.6903
Jowar	0.086767	0.2880	327	—0.009973	0.0704	—36	—0.8996	1.9974	—0.9392
Maize	0.048646	0.8066	306	0.007860	0.0087	—18	—0.7063	0.1295	1.9400
Wheat	0.098124	0.9005	442	0.006908	0.2824	—13	—2.7392	12.2497	2.7495
Barley	0.044297	1.1389	330	—0.009732	—0.0112	—17	—0.8576	—0.1637	—3.6595
Rice	0.007316	0.8591	587	0.001800	0.0763	—14	—0.0880	0.3275	0.9077
Small millets	0.006369	0.4047	170	—0.001423	—0.1111	—25	—0.0644	—0.1203	—0.0979
Pulses									
Gram	0.124080	0.6187	306	—0.021722	—0.0050	132	10.1334	—0.1898	—4.1125
Other *rabi* pulses	0.003076	0.3946	392	0.000490	0.1498	167	0.2027	0.1806	0.0758
Kharif pulses	0.147222	0.1895	416	—0.006379	0.0096	170	4.7429	0.5880	—0.5029
Cash crops									
Oilseeds	0.076557	0.2463	688	0.000970	0.1038	78	1.4708	5.4673	0.1644
Sugarcane	0.002611	22·0127	53	0.000035	5.5960	— 3	—0.1720	0.7744	0.0408
Chillies	0.002062	0.5887	1693	—0.000049	0.0256	12	0.0146	0.1894	—0.0488
Cotton	0.020753	0.1204	1244	—0.002550	0.0723	—350	—0.8745	1.8665	—0.3819
Total effect									
(Rs./hectare)							4.4743	36.5119	—1.2552
(Percentage effect) ..							(12.65)	(103.27)	(—3.55)

(Contd.)

APPENDIX (*Concld.*)

Crop	Interaction effects				△Y	Y^0	Y^1
	$p^0.\triangle a.\triangle y.$ (Rs.)	$a^0.\triangle y.\triangle p.$ (Rs.)	$y^0.\triangle a.\triangle p.$ (Rs.)	$\triangle p.\triangle a.\triangle y.$ (Rs.)	(Rs.)	(Rs.)	(Rs.)
(1)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Cereals							
Bajra	1.3539	—0.5783	—2.9516	—0.3001	7.7621	25.6652	33.4273
Jowar	—0.2296	0.1034	—0.2199	0.0253	—0.1622	8.1714	8.0092
Maize	0.0209	—0.1141	—0.0076	—0.0012	1.2612	12.0068	13.2680
Wheat	0.8623	—0.1928	—0.8590	—0.0605	12.0082	39.0554	51.0636
Barley	0.0360	0.1884	0.0084	0.0019	—4.4480	16.6484	12.2004
Rice	0.0804	—0.0216	—0.0078	—0.0020	1.1962	3.6894	4.8856
Small millets	0.0269	0.0144	0.0177	—0.0039	—0.2275	0.4381	0.2106
Pulses							
Gram	0.0332	—1.7740	—0.0819	0.0143	4.0227	23.4911	27.5138
Other *Rabi* pulses	0.0288	0.0323	0.0770	0.0123	0.6095	0.4758	1.0852
Kharif pulses	—0.0255	—0.2055	0.2403	—0.0104	4.8273	11.6058	16.4331
Cash Crops							
Oilseeds	0.0693	0.0186	0.6198	0.0079	7.8180	12.9729	20.7909
Sugarcane	0.0104	—0.0023	—0.0438	—0.0006	0.6064	3.0462	3.6526
Chillies	—0.0021	—0.0003	0.0006	—	0.0533	2.0551	2.1084
Cotton	—0.2294	0.1074	—0.5252	0.0645	0.0274	3.1083	3.1359
Total effect							
(Rs./hectare)	2.0355	—2.4244	—3.7329	—0.2525	35.3567	162.4299	197.7847
(Percentage effect)	(5·76)	(—6·86)	(—10·56)	(—0.71)	(100.00)	—	—