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and bajra, the shares of labour and fertilizer inputs have gone up substantially. It is quite clear that if the conflicting trends in input and output prices are not arrested, farming will soon cease to be a paying proposition. In other words, the present structure of input-output prices poses a threat to the viability of the new cereal production technology.

The factor demand analysis reveals that for wheat, relative price movements have affected the use of labour. There is a suggestion of this influence for bajra crop also. But with respect to fertilizers, no such influence could be discerned for either crop. This, we have argued, could be attributable to lack of variability in relative prices of fertilizers over a major part of the period analysed.

THE IMPACT OF THE INCREASE IN THE PRICES OF INPUTS ON THE PROFITABILITY AND PRODUCTION OF SUGARCANE AND PADDY IN MANDYA DISTRICT OF KARNATAKA

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INTRODUCTION

Prices have been increasing at a relatively high rate during the period covering the three years ending with 1975. This is apparent from the study of the price index. The general price index has risen from 132 in 1973 (base year 1961) to 143 in 1975.[1] Thus, the prices have increased by 12 points in two years in this period, as against 32 points in the eleven years prior to it. However, the increase in the price of all commodities has not been of the same dimension in all sectors of the economy. Agricultural prices, both of products and factors, especially of fertilizers and labour, have increased in greater proportion than of other commodities.

It is generally hypothesized that farmers, at least at the present time, respond to prices. When the prices of factors increase substantially, their input would be decreased. On the other hand, when the prices of products increase, the input of factors would be increased. Therefore, the relative prices are taken into account.

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1. *Commerce*, Annual Number, 1975.

OBJECTIVES

This study was undertaken to investigate the changes that have taken place in the level of the use of factors of production during the period between 1972-73 and 1975-76, when the factor prices had changed considerably. The objectives were the following : (1) to compare the input of important factors between the years 1972-73 and 1975-76; (2) to compare the costs and returns over this period; (3) to compare the productivity of the resources used; and (4) to compare the rate of return to the factors.

METHODOLOGY

The data collected for the year 1972-73, by using the cost accounting approach, for the Farm Management Record Project[2] financed by the Ford Foundation, were used as the benchmark for comparison. The sample studied consisted of 37 farmers in 14 villages selected from five out of the seven taluks of Mandya district. The five taluks covered were Mandya, Maddur, Malavalli, Srirangapatna and Pandavapura, which constitute the major part of the area irrigated from the Krishnaraja Sagar Project in Karnataka. The farmers were selected purposively, since they had to maintain detailed day-to-day accounts of the farm operation, for the purpose of farm business analysis which was the main objective of the project. However, the farmers of three different size-groups, *i.e.*, small, medium and large,[3] were included in the sample. There were 11 farms from the small size-group and 13 each in the medium and large size-groups. Efforts had been made to cover farms which were representative of the typical farm situations in the canal irrigated areas of Mandya district.

The information for the year 1975-76 was collected by contacting the farmers from the above sample using the survey approach in April, 1976. The data on the details of cultivation of crops were collected for individual plots.

The major irrigated crops in the district were paddy and sugarcane. Hence these two crops were included for this study. In the case of sugarcane a single variety, *i.e.*, CO 419, was used by all farmers in the area. On the other hand, both local and high-yielding varieties (HYV) of paddy were grown. Therefore, the data pertaining to the local and high-yielding varieties of paddy were analysed separately.

The data were tabulated and the mean levels of input and production estimated for the crops in the two years and compared. The changes in the

2. H. G. Shankaramurthy and K. C. Hiremath: Farm Business Analysis of Mandya District (I.A.D.P.) Karnataka State, Department of Agricultural Economics, University of Agricultural Sciences, 1973.

3. The size-groups were the following:
Small = 5 acres and below.
Medium = Over 5 acres and upto 10 acres.
Large = Over 10 acres.

use of inputs were compared with the changes in the prices. The cost and return from each crop were also estimated for the two years and compared. However, in estimating the cost, only the value of the material inputs and labour used were included. The interest charge, land revenue and depreciation have not been included, since they were not relevant to the objectives of the study.

Production function analysis was used to estimate and compare the productivities of the factors used. The form of the response function used was, $Y=A\ X_i^{b_i}$ where Y is the yield per hectare expressed in tons in the case of sugarcane and in quintals in the case of high-yielding and local varieties of paddy, A is a constant, X_i is the input per hectare of the ith factor and b_i is the elasticity coefficient. This model was selected because the number of observations was limited in some cases. Also, since the area has had irrigation for over 35 years and has had the Intensive Agricultural District Programme operating in it for 15 years, the levels of technology and input use were expected to be relatively homogeneous. The input factors considered for the analysis were farmyard manure used in terms of cart loads per hectare (X_1), quantity of nitrogen used in kilograms per hectare (X_2), quantity of phosphate and potash in kilograms per hectare (X_3), days of man labour per hectare (X_4), days of woman labour per hectare (X_5), days of plough units per hectare (X_6) and expenditure on plant protection chemicals in rupees per hectare (X_7).

The marginal products of the factors used in the production of the different crops were estimated for the two years and compared. Comparisons were also made between crops in terms of the value marginal products and between factors and crops in terms of the return for rupee value, *i.e.*,

$$\text{Value marginal product} = P_y \cdot \frac{\partial Y}{\partial X}$$

$$\text{Return per rupee} = \frac{P_y}{P_x} \cdot \frac{\partial N}{\partial P}$$

RESULTS

Sugarcane

The average inputs of factors and production of sugarcane in 1972-73 and 1975-76 and the changes in them are presented in Table I. During the period, the price[4] of sugarcane had increased from Rs. 120 to Rs. 134 per ton or by 12 per cent. On the other hand, the price of farm manure increased from Rs. 12 to Rs. 15 per cart load or by 25 per cent, that of nitrogen from

4. The prices considered are the average of those actually paid or received by the farmers.

TABLE I—AVERAGE INPUTS OF FACTORS AND PRODUCTION OF SUGARCANE

(per hectare)

Sr. No.	Item		Quantity 1972-73	Quantity 1975-76	Change	Percentage change
1.	Seed (number of sets)	.. ..	30,512	29,600	—912	—3
2.	Farmyard manure (cart load)	.. .. ..	25·92	31·16	5·24	20
3.	Fertilizers (kg.)	N	343	388	45	13
		P_2O_5	219	189	—30	—14
		K_2O	205	145	—60	—29
4.	Labour (days)					
	(*i*) Family labour	(*a*) Men	74·34	14·41	—60·20	—81
		(*b*) Women	0·19	—	—0·19	—100
		(*c*) Plough units* ..	23·00	28·69	5·69	25
	(*ii*) Hired labour	(*a*) Men	148·38	201·65	53·27	36
		(*b*) Women	90·14	90·49	0·35	0
		(*c*) Plough units* ..	11·22	10·63	—0·56	—5
5.	Production (tons)	.. ..	120·47	123·70	3·23	3

*A plough unit includes a pair of bullocks along with a man.

Rs. 2.70 to Rs. 4.82 per kg. or by 79 per cent, that of phosphate from Rs. 2.76 to Rs. 6.22 per kg. or by 125 per cent and of potash from Re. 0.97 to Rs. 2.27 per kg. or by 134 per cent, the hire charge of plough units from Rs. 7.50 to Rs. 15 per day or by 100 per cent, and wages from Rs. 2.50 to Rs. 5 per man per day, *i.e.*, by 100 per cent and from Rs. 1.50 to Rs. 3.50 per day for women, *i.e.*, by 133 per cent. Hence the increase in the prices of the factors was relatively much higher than that of the product. This was specially so in the case of phosphate and potash, as well as wages. It was observed that, in spite of this, the input of manure increased by 20 per cent, that of nitrogen by 13 per cent and that of hired man labour by 36 per cent. The input of phosphate and potash, however, decreased by 14 per cent and 29 per cent respectively. The input of hired plough units decreased by 5 per cent. It is surprising to note that the input of family labour decreased in the case of men by 81 per cent. Owned plough units were used to a greater extent, *i.e.*, by 25 per cent. The output increased slightly, *viz.*, by 3 per cent.

The costs and returns from the cultivation of sugarcane in 1972-73 and 1975-76 are presented in Table II. The cost incurred on account of all the factors increased between 1972-73 and 1975-76. The increase was as high

TABLE II—COSTS AND RETURNS FROM SUGARCANE

(*per hectare*)

Item	Costs/Returns (Rs.)		Change	Percentage change
	1972-73	1974-75		
I. *Costs*				
1. Seed	804·37	1,003·69	199·32	25
2. Farmyard manure	313·97	468·62	154·65	49
3. Fertilizers	1,836·31	3,563·02	1,726·31	94
4. Labour				
(*i*) Family labour	358·63	502·40	143·77	40
(*ii*) Hired labour	590·31	1,484·42	894·11	151
(*iii*) Total	948·94	1,986·82	1,037·88	109
5. Irrigation	61·75	111·15	49·40	80
6. Harvesting	1,051·65	1,472·53	420·88	40
7. Transportation	1,048·22	1,215·71	167·49	16
8. Total operational cost	6,065·21	9,821·54	3,756·33	62
II. *Returns*				
1. Gross returns	14,435·00	16,517·36	2,082·36	14
2. Returns over operational cost	8,369·79	6,695·82	—1,673·97	—20

as 151 per cent in the case of hired labour and 94 per cent in the case of fertilizer, where the additional expenditure was substantially high. The total operational cost increased by 62 per cent. As against this the gross return increased by only 14 per cent. As a result, the margin between return and operational cost decreased by Rs. 1,673.97 per hectare or 20 per cent. This would indicate that though the farmers do seem sensitive to some extent to price changes, they do not appear to analyse the profitability precisely but use inputs on the basis of their judgment of the requirements of the crop. In fact, the opinions expressed by the farmers at the time of the collection of data in April, 1976 made it clear that they were conscious that the level of use of factors, especially fertilizer, was beyond that justifiable under the current prices.

The estimated coefficients of the input factors are presented below :

Variable	1972-73		1975-76	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	38·97		37·23	
Farmyard manure(x_1)	—0·0141	0·0121	—0·0103	0·0117
Nitrogen(x_2)	0·1589	0·1244	0·1094	0·0877
Phosphate and potash(x_3)	—0·0690	0·1200	—0·0717	0·0637
Man labour(x_4)	0·1024	0·0834	0·1410	0·0501
Woman labour(x_5)	0·0391	0·0150	0·0038	0·0092
Plough units(x_6)	—0·0213	0·0910	0·0645	0·0609
Multiple regression coefficient	0·4760		0·5783	
Standard error of the estimate	0·2624		0·1364	
F value	1·5134		2·3446	
Number of cases	38		35	

Only nitrogen and man labour had substantial effects. Also, the elasticity reduces with increase of nitrogen from 1972-73 to 1975-76, while the elasticity of man labour increases with increased input. On the other hand, farm manure and phosphate and potash have negative elasticities in both the years, indicating that their marginal products are negative. Plough units have a negative elasticity in 1972-73. The sum of the elasticities or return to scale is 0.1961 in 1972-73 and 0.2367 in 1975-76.

The productivities of the factors that had substantial elasticities are presented below :

	1972-73	1975-76
Nitrogen (kg. per kg.)	60	105
Man labour (kg. per day) ..	53	229

The productivities of nitrogen and man labour showed considerable increase from 1972-73 to 1975-76, even though their inputs had also increased.

The marginal value productivities were the following :

	1972-73	1975-76
Nitrogen (Rs. per kg.)	7·20	14·07
Man labour (Rs. per kg.) ..	6·36	30·69

Considering the prices of the factors, the use of these factors was profitable in 1972-73. But the return had increased considerably more than the price in 1975-76. This justified the increased use of these factors in 1975-76.

High-Yielding Varieties of Paddy

The average inputs of factors and the output of HYVs of paddy in 1972-73 and 1975-76 as well as the changes in them are given in Table III. The price of paddy increased from Rs. 80 per quintal to Rs. 105 per quintal, *i.e.*, by 31 per cent during the period. Hence the price of the product increased in greater proportion than that of farm manure but in lesser proportion than that of all other factors. Again the increase was especially high in the case of phosphate, potash and wages. As could be expected, the input of manure increased by as much as 131 per cent. The input of nitrogen increased by 14 per cent and of hired plough units by 50 per cent, while that of phosphate and potash decreased by 24 per cent and 17 per cent respectively. The use of hired labour also decreased by 6 per cent in the case of men and 7 per cent in the case of women. On the other hand, the use of man labour of the family increased by 5 per cent. The production increased by 35 per cent.

TABLE III—AVERAGE INPUTS OF FACTORS AND PRODUCTION OF HIGH-YIELDING AND LOCAL VARIETIES OF PADDY

(per hectare)

Sr. No.	Item	Quantity				Change		Percentage change	
		1972-73		1975-76					
		HYV	Local	HYV	Local	HYV	Local	HYV	Local
1.	Seed (kg.)	65·47	55·89	82·23	70·29	16·76	14·40	26	26
2.	Farmyard manure (cart load) ..	17·07	7·57	39·50	22·16	22·43	14·59	131	193
3.	Fertilizers (kg.)								
	(*a*) N	119	83	136	96	17	13	14	16
	(*b*) P_2O_5 ..	63	40	48	45	—15	5	—24	13
	(*c*) K_2O ..	60	38	50	36	—10	—2	—17	—5
4.	Labour (days)								
	(*i*) Family labour								
	(*a*) Men ..	39·07	23·84	41·16	17·05	2·09	—6·79	5	—28
	(*b*) Women ..	0·82	2·32	—	—	—0·82	—2·32	—100	—100
	(*c*) Plough units*	17·22	13·40	19·08	21·02	1·86	7·62	11	57
	(*ii*) Hired labour								
	(*a*) Men ..	146·13	99·60	137·56	124·68	—8·57	25·08	—6	25
	(*b*) Women ..	115·77	92·16	107·10	85·15	—8·67	—7·01	—7	—8
	(*c*) Plough units*	8·11	7·48	12·20	6·01	4·09	—1·47	50	—20
5.	Production								
	(*i*) Grain (quintal)	45·07	35·20	60·80	47·56	15·73	12·36	35	35
	(*ii*) Straw (cart load)	8·57	8·00	20·37	9·90	11·80	1·90	138	24

*Plough unit consists of a pair of bullocks along with one man.

The costs and returns from the cultivation of HYVs of paddy in 1972-73 and 1975-76 are presented in Table IV. The cost incurred on account of all the factors increased considerably in the cultivation of HYVs of paddy. The increase was highest in farm manure, being 295 per cent. The cost on plant protection chemicals, fertilizers and labour increased by 162 per cent, 117 per cent and 110 per cent respectively. The total cost of the inputs increased by 131 per cent. On the other hand, the total revenue increased by 75 per cent. This was in contrast with the relatively lower increase in the revenue in the case of sugarcane. As a result, the margin over operational cost increased here by 31 per cent. In general, the use of factors by the farmers was relatively more reasonable. But even in this case the farmers felt they were using more of the factors than was really worthwhile, considering the relatively high increase in their prices.

TABLE IV—COSTS AND RETURNS FROM THE CULTIVATION OF HIGH-YIELDING AND LOCAL VARIETIES OF PADDY

(per hectare)

Item	Costs/returns (Rs.)				Change		Percentage change	
	1972-73		1975-76					
	HYV	Local	HYV	Local	HYV	Local	HYV	Local
I. *Costs*								
1. Seed	71·40	56·60	156·76	125·08	85·36	68·48	120	121
2. Farmyard manure	167·55	65·11	661·57	323·38	494·02	258·27	295	397
3 Fertilizers ..	537·59	385·68	1,165·45	878·69	627·86	493·01	117	128
4. Plant protection	30·18	4·21	78·94	11·61	48·76	7·40	162	176
5. Labour								
(*i*) Family labour	228·05	163·58	492·00	400·55	263·95	236·97	116	145
(*ii*) Hired labour	599·79	443·34	1,245·65	1,011·58	645·86	568·24	108	128
(*iii*) Total ..	827·84	606·92	1,737·65	1,412·13	909·89	805·21	110	313
6. Irrigation ..	37·05	37·05	61·75	61·75	24·70	24·70	67	67
7. Total operational cost ..	1,671·61	1,155·57	3,862·12	2,812·64	2,190·51	1,657·07	131	143
II. *Returns*								
1. Grains	3,606·54	2,830·59	6,207·57	4,848·21	2,601·03	2,017·62	72	71
2. Straw	170·55	196·61	404·04	305·60	233·49	108·99	137	55
3. Gross returns ..	3,777·09	3,027·20	6,611·61	5,153·81	2,834·52	2,126·61	75	70
4. Return over operational cost	2,105·48	1,871·63	2,749·49	2,341·17	644·01	469·54	31	25

The estimated coefficients of the input factors are the following:

Variable	1972-73		1975-76	
	Coefficient	Standard error	Coefficient	Standard error
Intercept	9·988		15·64	
Farmyard manure(x_1)	0·0244	0·0157	0·0205	0·0273
Nitrogen(x_2)	0·1571	0·1770	0·1201	0·1370
Phosphate and potash(x_3)	0·1105	0·2076	0·0791	0·1320
Man labour(x_4)	0·0342	0·1320	—0·0409	0·1259
Woman labour(x_5)	0·0477	0·0981	0·0871	0·1017
Plough units(x_6)	—0·0591	0·0920	0·0183	0·0970
Plant protection chemicals (x_7)	0·0144	0·0180	0·0108	0·0220
Multiple regression coefficient	0·5063		0·5029	
Standard error of the estimate	0·2660		0·1794	
F value	1·3294		0·8704	
Number of cases	35		26	

Nitrogen alone had an elasticity coefficient that was substantial. Phosphate and potash were the next important contributors, man labour and plough units exhibited even negative returns. Other factors did not appear important. The scale of return was of the order of 0.3292 in 1972-73 and 0.2951 in 1975-76.

The marginal productivities of nitrogen and phosphate and potash are given below :

	1972-73	1975-76
Nitrogen (kg. per kg.)	5	57
Phosphate and potash (kg. per kg.)	6	5

Hence the productivity of nitrogen was higher in 1975-76 than in 1972-73 though the change appears rather exorbitant, thus making the increase in the input of nitrogen reasonable. Similarly, the decrease in the productivity of phosphate and potash made the decision to reduce their input reasonable.

The MVP's were as follows :

	1972-73	1975-76
Nitrogen (Rs. per kg.)	4·00	59·85
Phosphate and potash (Rs. per kg.)	4·80	5·25

This again justified the increase in the input of nitrogen and the decrease in the input of phosphate and potash made by the farmers over the period.

Local Varieties of Paddy

The average quantity of inputs used for the cultivation of local varieties of paddy and the production as also the changes in them are presented in Table III. Between 1972-73 and 1975-76 the price of paddy increased in a greater proportion than that of farm manure, but in a lesser proportion than those of nitrogen, phosphate and potash, as also wages. The input of farm manure increased by 193 per cent. Not only that, the inputs of nitrogen and phosphate increased by 16 per cent and 13 per cent respectively. At the same time, the use of hired labour increased by 25 per cent in the case of men, by 8 per cent in the case of women and by 20 per cent in the case of plough units. The grain produced was more by 35 per cent.

The costs and returns from the cultivation of local paddy in the year 1972-73 and 1975-76 are given in Table IV. In this case also the cost increased on account of almost all factors which more than doubled. But it must be noted that the increase was relatively much higher in the case of farm manure than in the case of fertilizers. This fact is significant when it is noted that the increase in prices was considerably greater in the case of the latter when compared with that of the former. The expenditure on inputs increased by 143 per

cent. But the gross return increased only by 70 per cent. However, the return over the operational cost was higher by 25 per cent. Again it was apparent that the decisions of the farmers were sound on the whole.

The coefficients of the input factors that were estimated are given below:

Variable	1972-73		1975-76	
	Coeffi-cient	Standard error	Coeffi-cient	Standard error
Intercept	9·970		78·66	
Farm manure(x_1)	0·0118	0·0106	—0·0412	0·0283
Nitrogen(x_2)	—0·0247	0·0437	0·1290	0·1079
Phosphate and potash (x_3)	—0·0004	0·0572	0·0002	0·0243
Man labour (x_4)	0·0818	0·0798	0·2689	0·2580
Woman labour(x_5)	0·1667	0·0563	—0·3035	0·1003
Plough units(x_6)	0·1104	0·0691	—0·3157	0·2143
Plant protection chemicals(x_7)	0·0153	0·0125	0·0064	0·0189
Multiple regression coefficient	0·6358		0·9045	
Standard error of the estimate	0·1614		0·1582	
F value	2·2296		2·5707	
Number of cases	31		12	

The coefficients were not consistent. Nitrogen had negative elasticity in 1972-73, but positive elasticity in 1975-76. Man labour had a substantial elasticity only in the latter year. Woman labour and plough units had a substantial elasticity in 1972-73 but negative elasticity in 1975-76. The return to scale was of the order of 0.3609 in 1972-73 and—0.2559 in 1975-76.

Since the elasticities were not consistent, the sum of the elasticities were negative in 1975-76 and as the number of cases was limited, further analysis for the marginal productivities was not done.

The return per rupee spent in respect of the factors where the elasticity was substantial, was as presented below :

Factor	Crop	1972-73	1975-76
Nitrogen	Sugarcane	2·67	2·92
	Paddy-HYV	1·48	12·42
Man labour	Sugarcane	2·54	6·14
Phosphate and potash*	Paddy-HYV	2·54	1·25

*The weighted mean price has been considered. They were Rs. 1·89 per kg. in 1972-73 and Rs .4·20 per kg. in 1975-76.

The return to nitrogen was highest in 1975-76 than in 1972-73, thus indicating that the increase in the input of nitrogen was rational. Similarly, the increase in labour was also justified. What is even more interesting is that the return to phosphate and potash had decreased which justified the reduction in their input by the farmers. It was observed that all of these factors received sufficient return. The return to nitrogen was especially high in paddy in 1975-76, thus indicating that there is scope for further increasing its input.

IMPACT OF INCREASE IN INPUT PRICES ON PRODUCTION AND PROFITABILITY OF MAJOR CROPS IN TARAI

D. K. Marothia*

With the adoption of new farm technology, the role of purchased inputs such as fertilizers, pesticides and insecticides and farm equipments/machinery manufactured in the non-agricultural sector has become more significant in Indian farming than those of labour, bullocks and organic manure which originate in the agricultural sector. The use of these purchased inputs in agriculture has brought about considerable changes in farm output and income. The available empirical evidence about the impact of increase in the purchased input prices on production and profitability of crop enterprises is far from clear. The present study makes an attempt to examine (1) the changes in the prices of purchased and non-purchased inputs, (2) the changing levels of inputs use and their (inputs) importance in the cost structure of the crops, and (3) the impact of the above two factors on the production and profitability to the farmer.

METHODOLOGY

To fulfil the objectives of this study 40 progressive farmers were randomly selected from four blocks (Rudrapur, Bilaspur, Bazpur and Kashipur) of Nainital district in the Tarai region of Uttar Pradesh. Since the majority of the Tarai farmers keep proper records, reliable data were obtained by using the survey method regarding the investments on inputs, prices of inputs, yield and farm returns over a period of four years (1967-68 to 1970-71). Inputs were grouped into two categories, namely, purchased and non-purchased inputs. Purchased inputs include seeds, fertilizers, insecticides and pesticides and equipments/machineries. Since the sample farmers purchased seeds from the seed agencies, it was considered as purchased input. Non-purchased in-

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