Vol XXXI
No. 3

ISSN 0019-5014

CONFERENCE
NUMBER

JULY-
SEPTEMBER
1976

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

The above findings reveal that human and bullock labour as source of power are being increasingly replaced by mechanical power. This has finally paved the way for large-scale mechanization on the capital intensive farms of Tarai.[3] The cost of irrigation has also increased remarkably.

3. *Yields, Prices and Returns*

Table III indicates that the average yield of wheat, paddy and maize on the sample farms increased by about 73, 55 and 54 per cent in 1970-71 as compared to 1967-68. The gross returns to the farmer have increased in 1970-71 over 1967-68 for all the three crops. This increase was to the tune of 71, 42 and 39 per cent for wheat, paddy and maize, respectively, although the prices of these commodities declined during the same period. Further, the higher yields and returns observed in the major crops revealed the profitable use of growth promoting inputs on the same farms. The substantial increase in the prices of different purchased and non-purchased inputs was offset by the high productivity of land, capital and other growth promoting inputs,[4] more investment on land development and irrigation facilities[5] and rapid adoption of high-yielding varieties and farm mechanization on Tarai farms.[6] Another important factor which compensated the increase in the prices of input was the most effective and sound technical know-how provided to the farmers by the research and extension workers of G. B. Pant University of Agriculture and Technology, Pantnagar for optimum allocation of the resources in crop production. Due to the efficient allocation of the resources and sufficient availablity of capital, the Tarai farms operated in the second stage of production functions.[7]

INPUT PRICES, PRODUCTION AND PROFITABILITY IN HARYANA

D. S. Nandal and D. K. Grover*

With the diffusion of improved agricultural technology, the farmers have moved into the market economy and thereby the importance of market incentives, particularly price incentive has assumed added importance in the production programme of the farmers. In the present study, an attempt has been made to examine the impact of increased input prices on production and profitability in Haryana. Specifically, the main objectives of the study are

3. D. K. Marothia, *op. cit.*
4. D. K. Marothia, "The Effects of New Technology on Factor Intensities and Farm Returns in Tarai," *Financing Agriculture*, Annual Number, 1975, pp. 43-46.
5. S. L. Shah and L. R. Singh, "Capital Formation in Agriculture of Tarai Region of Uttar Pradesh," *Indian Journal of Agricultural Economics*, Vol. XXIV, No. 4, October-December, 1969, pp. 88-92.
6. D. K. Marothia, "Farm Mechanization, Labour Use, and Farm Size in Developing Economy" (forthcoming article in the *Bangladesh Development Studies*).
7. D. K. Marothia, "Economics of Scale and Farm Size in Tarai," *The Economic Times*, Vol. XIV, No. 137, July 29, 1974.

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(*i*) to study the changes in inputs use and their relative share in the cost structure, (*ii*) to examine the changing input-output price relationships and (*iii*) to see the impact of these changes on the productivity and income of the farmer.

METHODOLOGY

The study covers all the agro-climatic zones of Haryana State. Multi-stage stratified random sampling with village as the primary unit and farm holding as the ultimate unit was adopted to select 100 farmers representing each region in proportion to the number of holdings and size of holdings. The data on cropping pattern, farm inventory, inputs used, outputs obtained, etc., were collected for the year 1974-75 and 1975-76 by survey method. In order to compare the pattern of inputs used and input-output price structure, the data for the year 1968-69 and 1969-70 were taken from the studies on the economics of farming in Haryana.[1] Though the data from the two sources are not strictly comparable due to differences in the method of collection of data, yet they jointly provide a fairly good picture of the general trend in inputs use and their share in cost structure over time. Time-series data on the harvest prices of agricultural products and prices of inputs were collected from the farmers as well as from secondary sources like Statistical Abstract of Haryana and Package of Practices, Haryana Agricultural University, Hissar to work out the relative input-output price relationship.

RESULTS AND DISCUSSION

Share of Inputs in Cost Structure

The use of inputs varied considerably from crop to crop, from region to region, from farmer to farmer and from irrigated field to unirrigated field. The variation between the irrigated and unirrigated fields was the most spectacular. Therefore, an effort has been made to work out the average cost of cultivation per cropped hectare for the irrigated and unirrigated areas separately. The results for the irrigated areas are given in Table I and for the unirrigated areas in Table II.

It is apparent from Table I that the pattern of inputs use has been changing considerably from year to year. The share of agricultural inputs supplied by the agricultural sector such as human labour, bullock labour, manure and farm seeds declined year after year. However, a marginal increase in the share of farmyard manure was observed in 1974-75 when the prices of fertilizers were almost doubled over the previous year. On the whole, the share of inputs supplied by the agricultural sector showed a declining trend, yet it accounted for the major share of the total cultivation cost. Their share in 1968-69, 1969-70, 1974-75 and 1975-76 in the total cultivation cost was 54.98 per cent, 48.50 per cent, 41.35 per cent and 36.55 per cent respectively.

1. Economics of Farming in Haryana, 1968-69 and 1969-70, Economic and Statistical Organisation, Planning Department, Government of Haryana.

TABLE I—COST PER IRRIGATED HECTARE OF VARIOUS ITEMS OF FARM EXPENDITURE
(LAND TAKEN ON RENT, LABOUR HIRED AND CAPITAL BORROWED)

Sr. No.	Items of expenditure	1968-69		1969-70		1974-75		1975-76	
		Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A.	*Inputs from farm sector*	1,056.98	54.98	829.00	48.50	852.64	41.35	762.21	36.55
	(*i*) Human Labour	639.38	33.05	513.13	30.01	523.63	25.39	465.81	22.34
	(*ii*) Bullock labour	309.48	16.10	234.44	13.72	227.98	11.06	215.18	10.32
	(*iii*) Farmyard and manure	34.92	1.82	27.47	1.61	60.74	2.94	45.92	2.20
	(*iv*) Farm seed	73.20	3.81	53.96	3.16	40.29	1.96	35.30	1.69
B.	*Inputs from non-farm sector*	287.11	14.94	289.12	16.91	634.20	30.75	718.76	34.49
	(*v*) Purchased seed	73.20	3.81	53.96	3.16	75.25	3.65	100.79	4.84
	(*vi*) Chemical fertilizers	52.39	2.73	67.03	3.92	240.30	11.65	272.21	13.06
	(*vii*) Pesticides	1.69	0.08	2.50	0.15	12.92	0.63	20.21	0.97
	(*viii*) Irrigation charges	101.44	5.28	98.74	5.77	125.76	6.10	137.16	6.58
	(*ix*) Implements and machinery ..	49.95	2.60	56.87	3.32	165.70	8.03	170.97	8.20
	(*x*) Electricity	8.44	0.44	10.02	0.59	14.27	0.69	17.42	0.84
C.	*Other items*	578.00	30.08	591.35	34.59	575.33	27.90	603.62	28.96
	(*xi*) Interest	66.76	3.47	63.89	3.74	52.01	2.52	51.83	2.49
	(*xii*) Land revenue	6.34	0.33	5.33	0.31	6.06	0.29	6.22	0.30
	(*xiii*) Rental value	500.55	26.02	519.62	30.40	500.00	24.26	525.30	25.20
	(*xiv*) Miscellaneous	4.35	0.24	2.51	0.14	17.26	0.83	20.27	0.97
	Total	1,922.09	100.00	1,709.47	100.00	2,062.17	100.00	2,084.59	100.00

TABLE II—COST PER UNIRRIGATED HECTARE OF VARIOUS ITEMS OF FARM EXPENDITURE
(LAND TAKEN ON RENT, LABOUR HIRED AND CAPITAL BORROWED)

Sr. No.	Items of expenditure	1968-69		1969-70		1974-75		1975-76	
		Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total	Expenditure (Rs.)	Percentage to total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A.	*Inputs from farm sector*	409.00	64.49	350.04	53.11	353.52	50.43	346.19	47.75
	(*i*) Human labour	208.86	32.93	189.40	28.74	185.69	26.49	179.76	24.79
	(*ii*) Bullock labour	148.73	23.45	108.29	16.43	95.28	13.59	98.16	13.54
	(*iii*) Farmyard manure	11.72	1.85	8.48	1.29	16.77	2.39	18.27	2.52
	(*iv*) Farm seed	39.69	6.26	43.87	6.65	55.78	7.96	50.00	6.90
B.	*Inputs from non-farm sector*	27.21	4.29	22.40	3.40	69.54	9.93	96.04	13.26
	(*v*) Purchased seed	—	0.00	—	0.00	15.23	2.18	25.60	3.54
	(*vi*) Fertilizers	7.81	1.23	4.57	0.70	17.25	2.46	20.97	2.90
	(*vii*) Pesticides	—	0.00	—	0.00	1.73	0.25	2.50	0.35
	(*viii*) Irrigation changes	—	0.00	—	0.00	—	0.00	—	0.00
	(*ix*) Implements and machinery ..	19.40	3.06	14.51	2.20	30.22	4.31	40.72	5.61
	(*x*) Electricity	—	0.00	3.32	0.50	5.11	0.73	6.25	0.86
C.	*Other items*	197.96	31.22	286.60	43.49	277.81	39.64	282.69	38.99
	(*xi*) Interest	12.02	1.90	13.55	2.06	14.80	2.11	15.47	2.13
	(*xii*) Land revenue	5.32	0.84	3.68	0.56	5.76	0.82	5.76	0.80
	(*xiii*) Rental value	174.08	27.45	262.73	39.86	250.00	35.68	255.21	35.20
	(*xiv*) Miscellaneous	6.54	1.03	6.64	1.01	7.25	1.03	6.25	0.86
	Total	634.17	100.00	659.04	100.00	700.87	100.00	724.92	100.00

The declining share of human and bullock labour showed that they were being replaced by mechanical power persistently.

On the other hand, the share of inputs supplied by the non-farm sector continuously increased over time. Among them the most spectacular increase was observed in the use of fertilizers and machinery and implements which transform the traditional agriculture. The share of chemical fertilizers increased from 2.73 per cent in 1968-69 to 13.06 per cent in 1975.76 while that of machinery and implements increased from 2.60 per cent to 8.20 per cent during this period. However, the importance of purchased seed, pesticides, irrigation charges and electricity also increased marginally with some improvement in their relative shares. On the whole, all inputs from the non-farm sector increased from 14.94 per cent in 1968-69 to 16.91 per cent in 1969-70, to 30.75 per cent in 1974-75 and to 34.49 per cent in 1975-76. This increase was mainly due to the large increase in the prices of these factors and partly owing to an increase in their use. Individually, rent was the major constituent of expenditure which accounted for about one-fourth of the cultivation cost in the irrigated areas.

The relative importance of inputs produced in the non-farm sector in the cost structure increased in recent years but their share in the total cultivation cost remained quite low in the unirrigated areas (Table II). Their share increased from 4.29 per cent in 1968-69 to 13.26 per cent in 1975-76. Land rent, manual labour, bullock labour were the three major constituents of expenditure which accounted for 83.83 per cent of the total cultivation cost in 1968-69 and 73.53 per cent in 1975-76. Thus, the cost of cultivation per hectare in the irrigated areas was approximately three times the cost in the unirrigated areas.

Input-Output Price Relationship

The prices of both inputs and outputs have been increasing till late 1975. The prices of selected inputs like tractors and fertilizers and harvest prices of two of the most important crops of the State, namely, wheat and paddy are given in Table III to see the change over the years.

It can be seen from Table III that the prices paid by the farmers for modern inputs and productive services increased faster than the increase in the output prices. Between 1971-72 and May, 1976 the prices increased by 100, 85.54, 126.93 to 185.97, 110.34 and 221.99 and 90.94 per cent in the case of nitrogen, phosphorous based on SSP and complex fertilizer, potash, Hindustan tractor and Zetor tractor respectively. The corresponding increase in the harvest prices of paddy and wheat was only 39.62 and 30.38 per cent.

TABLE III—PRICES OF SELECTED INPUTS AND OUTPUTS

Sr. No.	Input/output	Price per unit (Rs.) during						Percentage increase in May, 1976 over 1971-72
		1971-72	1972-73	1973-74	1974-75	December, 1975	May, 1976	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Inputs								
1.	Nitrogen (based on urea)(kg.)	2·01	2·09	2·28	4·35	4·02	4·02	100·00
2.	Phosphorous							
	(*a*) Based on SSP (kg.) ..	2·56	2·56	2·64	5·00	6·09	4·75	85·54
	(*b*) Based on complex fertilizer (kg.)	2·71	3·02	3·02 to 4·72	5·83 to 8·34	7·33 to 9·74	6·15 to 7·75	126·93 to 185·97
3.	Potash (based on MOP) (kg.)	0·87	0·91	1·12	2·03	1·95	1·83	110·34
4.	Tractor							
	(*a*) Hindustan 50 H.P. (one)	18,099	18,648	30,475	44,288	58,277	58,277	221·99
	(*b*) Zetor 2011 and 2511 (one)	18,640	21,518	28,412	32,410	35,591	35,591	90·94
Outputs								
1.	Paddy (kg.)	0·53	0·58	0·74	0·92	0·76	0·76	39·62
2.	Wheat (kg.)	0·79	0·79	1·20	1·26	1·14	1·03	30·38

In terms of real price of fertilizers, the best year for paddy growers was 1973-74 when they had to give 3.08 kg. of paddy for one kg. of nitrogen (Table IV). In May, 1976 it increased to 5.43 kg. implying an erosion of more than two-fifths in trading gains compared to the best year 1973-74. Similarly in respect of wheat, the best year was also 1973-74 when the farmer could purchase one kg. of nitrogen by selling 1.90 kg. of wheat. In May, 1976 the farmer had to sacrifice 3.90 kg. of wheat in exchange for one kg. of nitrogen indicating more than 50 per cent erosion in trading gains in relation to the best year 1973-74. Similar results but slightly different figures apply to phosphorous, potash and tractors.

TABLE IV—REAL PRICE OF SELECTED INPUTS IN DIFFERENT YEARS

Sr. No.	Inputs	1971-72	1972-73	1973-74	1974-75	December, 1975	May, 1976
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Wheat (kg.)			
1.	Nitrogen (based on urea) ..	2·54	2·64	1·90	3·45	3·53	3·90
2.	Phosphorous						
	(a) Based on SSP	3·24	3·24	2·20	3·97	5·34	4·61
	(b) Based on complex fertilizer	3·43	3·82	2·52 to 3·93	4·62 to 6·62	6·43 to 8·54	5·97 to 7·52
3.	Potash (based on MOP) ..	1·10	1·15	0·93	1·61	1·71	1·78
4.	Tractor						
	(a) Hindustan 50 H.P. ..	22,910	23,605	25,396	35,149	51,120	56,580
	(b) Zetor 2011 and 2511 ..	23,595	27,238	23,677	25,722	31,220	34,554
				Paddy (kg.)			
1.	Nitrogen (based on urea) ..	3·77	3·60	3·08	4·73	5·28	5·43
2.	Phosphorous						
	(a) Based on SSP	4·83	4·41	3·57	5·43	8·01	6·42
	(b) Based on complex fertilizer	5·11	5·21	4·08 to 6·37	6·33 to 9·06	9·64 to 12·82	8·31 to 10·47
3.	Potash (based on MOP) ..	1·64	1·57	1·52	2·21	2·56	2·47
4.	Tractor						
	(a) Hindustan 50 H.P. ..	34,149	32,152	41,182	48,139	76,680	78,752
	(b) Zetor 2011 and 2511 ..	35,170	37,100	38,395	35,228	46,830	48,095

Profitability

Agriculture like any other business must earn profit which can be put to economic use, after production costs have been covered by returns. The profits and losses per hectare under the irrigated and unirrigated conditions have been worked out separately in Table V.

TABLE V—GROSS INCOME AND EXPENDITURE PER HECTARE

(*Rupees*)

Years	Irrigated			Unirrigated		
	Gross income	Expenditure	Profit or loss	Gross income	Expenditure	Profit or loss
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1968-69	1,623·00	1,922·09	—299·09	330·64	634·17	—303·53
1969-70	2,022·93	1,709·47	+313·46	831·80	659·04	+172·76
1974-75	2,077·25	2,062·17	+ 15·08	387·92	700·87	—312·95
1975-76	2,164·11	2,084·59	+ 79·52	779·85	724·92	+ 54·93

Table V shows that the farmers earn profit in some years and suffer loss in others. The frequency and degree of loss is relatively higher in the unirrigated areas. In 1968-69 the farmers suffered loss in the irrigated as well as unirrigated areas due to relatively drought conditions in that year. However, the farmers earned profit in a good agricultural year in 1969-70 from both the irrigated and unirrigated areas. The year 1974-75 was again a bad agricultural year in Haryana but the farmers having irrigated area could more than cover the cost of production by the adoption of improved production technology but they suffered heavy losses in the unirrigated areas. The year 1975-76 was an exceptionally good agricultural year but they were deprived of an opportunity to earn profits for enhancing their investment and production capacity by the significant decline in the prices of agricultural products.

In fact the rate of adoption of modern inputs like fertilizers, improved seeds, mechanical power, etc., will depend upon the favourable cost-benefit ratio of these inputs in the production process. Since fertilizers contribute the maximum towards increasing productivity, an attempt has been made to work out the incremental cost-benefit ratio (ICBR) of their use in All-India Co-ordinated Fertilizer Trial on Wheat Crop. The price of wheat has been taken as Rs. 105 per quintal and market rates of fertilizers have been considered. The results are given in Table VI.

TABLE VI—FERTILIZER RESPONSE AND ICBR IN WHEAT IN LOW PHOSPHOROUS FIXING SOILS IN 1974-75

Sr. No.	Experimental Station	No. of experiments	Average yield of control (kg./ha.)	Average response (kg./ha.)		Returns (Rs./ha.)		Net ICBR	
				N120 P60 K60	N80 P60 K60	N120 P60 K60	N80 P60 K60	N120 P60 K60	N80 P60 K60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Champaran ..	316	2,120	1,681	1,269	820	551	1:0·87	1:0·70
2.	Delhi	153	2,192	1,717	1,607	858	906	1:0·91	1:1·16
3.	Kangra	164	1,172	1,174	644	288	209	1:0·30	1:0·23
4.	Rohtak	219	2,038	2,134	1,651	1,296	952	1:1·37	1:1·22
5.	Jammu	72	1,592	2,565	2,180	1,748	1,507	1:1·65	1:1·93
6.	Bilaspur	209	1,310	1,768	1,422	911	711	1:0·96	1:0·91
7.	Sangrur	282	2,665	1,747	1,394	889	671	1:0·94	1:0·86
8.	Tonk	269	1,794	1,246	884	353	146	1:0·37	1:0·19
9.	Bulandshahar ..	191	1,797	2,447	1,825	1,624	1,132	1:1·72	1:1·45
10.	Fatepur	172	1,433	2,290	1,850	1,460	1,761	1:1·54	1:1·49
	Average ..	2,047	1,711	1,876	1,501	1,025	794	1:1·03	1:1·02

Source : Quarterly Economic Report, January, 1976, p. 33.

The general opinion in view of other risks is that net ICBR should be recommended higher than 2.50 for the adoption of improved agricultural practices. But the average ICBR having value a little more than one indicated that the response to fertilizer was a little more than twice the cost of fertilizer. The general conclusion which emerges from this analysis is that the level of profitability is enough to attract the farmers to adopt the full package of fertilizer in wheat cultivation even in established wheat revolution areas at the current price structure. Under the prevailing price structure the outlook of sustaining fertilizer use appears to be bleak.

With the steep falling trend in the prices of agricultural products a further set-back in the use of improved inputs whose demand has been already sluggish is not ruled out. The use of modern inputs is essentially a business proposition and will be resorted to only if it is profitable to the farmer. The mere need for higher agricultural production in the country has hardly any relevance to the farmers in taking a decision on the use of non-conventional inputs. The adverse terms of trade in the use of modern inputs will have adverse effect on the rural economy. The future scope of increasing agricultural production in India lies only in increasing agricultural productivity per unit with the use of modern inputs. Thus the prevailing adverse terms of trade in the use of purchased inputs have to be made favourable to the farmer for the adoption of improved technology for rapid agricultural development with stability.

CONCLUSION

The faster increase in the prices of modern inputs has shifted the competitive advantage from capital intensive agriculture to traditional agriculture. A decline in output prices witnessed since late 1975 will make intensive agriculture uneconomical posing a serious policy dilemma for agricultural development. It requires a set of policies designed to enhance resource efficiency in the agricultural sector in the long run. Till then substantial subsidies for using modern inputs and/or higher output prices seem to be the only alternative.

IMPACT OF INPUT PRICES ON PRODUCTION AND PROFITABILITY OF WHEAT AND PADDY IN THE PUNJAB

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In subsistence type of farming, the role of purchased inputs is very insignificant. The major inputs are the human and bullock labour. However, as agriculture undergoes a change with the adoption of new technology the role of monetized inputs assumes importance. During the last one decade, the

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