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# RAPPORTEUR'S REPORT

## ON

### IMPACT OF INCREASE IN INPUT PRICES ON PROFITABILITY AND PRODUCTION

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Thirty-four papers have been accepted for discussion on the subject. A very large majority of the papers deal mainly with empirical aspects of the subject. Consequently, analysis and findings of various papers have been largely governed by the nature of empirical data on which they are based. About five papers are based on time-series data, and the rest on cross-section data or findings. Over 20 papers are based on cross-sections of two or more points in time for the same locations, and in many cases for the same samples of cultivators. The time period covered by all papers taken together is from early 1950s to mid-1970s. The geographical coverage is various locations in about 15 States. Thus, despite some limitations of the data pointed out at appropriate places below, the papers throw useful light on many empirical aspects of the subject.

Various findings available in the papers are summarised under different headings as follow: (i) Changes in the Prices of Inputs, (ii) Changes in the Prices of Output, (iii) Changes in the Real Prices of Inputs, (iv) Changes in the Levels of Use of Inputs, (v) Factors behind the Changes in the Levels of Input Use, (vi) Changes in the Cost of Cultivation, (vii) Relative Importance of Different Inputs in the Cost Structure, (viii) Impact of the Changes in the Levels of Input Use on Production, (ix) Changes in the Returns over Cost of Cultivation, (x) Factors behind Changes in the Returns over Cost, (xi) Findings on Farms of Different Sizes and (xii) Policy Issues. The report ends with some suggestions on issues for discussion in the Conference.

#### CHANGES IN THE PRICES OF INPUTS

About 15 papers have given empirical evidence on the changes in the prices of inputs. Bulk of this evidence is in the form of prices paid by the cultivators at two or three points in time. In many cases the comparison is between prices in some year(s) before 1974-75 and in 1974-75 or 1975-76. B. Krishna Rao has given index numbers of wage rate, and prices of bullocks and fertilizers in Tamil Nadu from 1954-55 to 1973-74.

Taken together, the papers dealing with this aspect have covered almost all inputs. While fertilizer prices are given in all papers, about seven to eight papers have also given wage rates and prices of pesticides. The prices of remaining inputs have been covered in two to four papers.

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During 1974-75 there was a tremendous rise in the prices of fertilizers and pesticides. The prices of different fertilizers went up by 50 to 150 per cent while those of various pesticides increased by 90 to 350 per cent (S. S. Grewal and P. S. Rangi, R. I. Singh and his colleagues, T. R. Singh and his colleagues)\*. Grewal and Rangi have shown that during 1974-75 the prices of labour and diesel also went up by 12 and 18 per cent respectively.

A number of papers have compared the prices of various inputs besides fertilizers and pesticides between late 1960s/early 1970s and 1974-75/1975-76. They clearly indicate a substantial increase in the prices of inputs. B. S. Rathore and his colleagues have shown that between 1970-71 and 1974-75 the prices of various inputs increased as follows: human labour 85 per cent, bullock labour 74 per cent, tractor and thresher power 83 per cent, electricity 70 per cent, diesel 148 per cent, manure 34 per cent and fertilizer 109 per cent. A similar pattern is also reported by S. S. Acharya and N. L. Agarwal, D. S. Nandal and D. K. Grover, N. S. P. Rebello and his colleagues, J. S. Garg and his colleagues, K. Thiruvengkatachari, J. P. Misra and his colleagues, and K. B. Malkhede and D. G. Pawaskar.

The analysis in some papers also reveals that the prices of various inputs were going up even before mid-1970s. Acharya and Agarwal have shown that between 1965-66 and 1971-72 the prices of various seeds increased by 8 to 73 per cent, that of human labour by 157 per cent, those of bullock labour and machine repairs by 50 per cent, that of DDT by 28 per cent, those of farmyard manure and fertilizers by 11 per cent, and that of credit by 25 per cent in Jaipur district of Rajasthan. The findings of D. K. Marothia for Tarai, R. I. Singh and his colleagues for Jaunpur district of Uttar Pradesh, and Krishna Rao for Tamil Nadu also confirm that even before mid-1970s the prices of various inputs were rising. However, by and large, the rate of increase in the prices of different inputs during the period up to 1970 was lower than during the period after 1970-71.

Though it is difficult to say anything conclusively on the basis of fragmentary evidence from scattered locations, on the whole it appears that till 1974-75 the prices of inputs supplied by the agricultural sector and of those supplied by the non-agricultural sector were rising at roughly comparable rates. However, the impact of the Oil Crisis on the prices of inputs supplied by the non-agricultural sector after June, 1974 changed the situation. This is clearly indicated by the comparison of the changes in the prices of various inputs in the post-June, 1974 period with those before 1974-75.

There is very little discussion in the papers on the factors responsible for the rise in the input prices. This is unfortunate because, from the scanty information available in a few papers, it appears that inadequate availability

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\*The names in brackets relate to authors of the relevant papers.

of certain inputs (particularly fertilizers during 1972-73 and 1973-74) and some imperfections of the factor markets were also responsible for the rise in the prices of inputs. Such imperfections are indicated by varying magnitudes of the rise in the price of the same input in various locations during roughly comparable periods.

#### CHANGES IN THE PRICES OF OUTPUT

About ten papers have given information on the changes in the prices of output received by samples of cultivators for certain crops at two or more points in time during late 1960s to mid-1970s. These papers cover wheat, paddy, bajra, maize, and sugarcane. Wheat and paddy have the largest coverage. In addition to the papers based on comparable cross-sections, Krishna Rao has given time-series of farm harvest prices of paddy in Tamil Nadu between 1954-55 and 1973-74.

Barring a few exceptions, most of the papers report increase in the prices received by the cultivators over time. To cite a few examples, between 1961-64 and 1969-72 the price of local wheat increased by a little over 100 per cent (A. C. Gangwar and S. P. Singh). Dayanatha Jha and Praduman Kumar report an increase of about 5 per cent between 1968-70 and 1972-74, 67 per cent between 1972-74 and 1974-75, but a decline of 29 per cent between 1974-75 and 1975-76 for Mexican wheat, R. I. Singh and his colleagues report a decline of 10 per cent between 1967-68 and 1970-71, and an increase of about 17 per cent between 1970-71 and 1973-74 for HYV wheat. Similarly, for paddy (both local and HYV), Rebello and his colleagues report an increase of about 27 per cent between 1972-73 and 1975-76. On the other hand, R. I. Singh and his colleagues report a decline of 10 per cent between 1967-68 and 1970-71, and an increase of 20 per cent between 1970-71 and 1973-74. For sugarcane, P. B. Parthasarathy and K. S. Suryanarayana report an increase of about 40 per cent between 1964-65 and 1970-71, and Rebello and his colleagues report an increase of about 11 per cent between 1972-73 and 1975-76. For hybrid bajra, Jha and Kumar report an increase of 39 per cent between 1968-69 and 1972-74, of 76 per cent between 1972-74 and 1974-75 and a decline of 44 per cent between 1974-75 and 1975-76. Krishna Rao reports that between 1952-53 and 1970-71, farm harvest prices for paddy in Tamil Nadu increased at an annual rate of 3.93 per cent.

#### CHANGES IN THE REAL PRICES OF INPUTS

In the absence of time-series data on prices paid by the cultivators for various inputs and those received by them for different crops, it is difficult to comment conclusively on the changes in the real prices of inputs over time. The available evidence, however, indicates that, on the whole, the prices of inputs were rising at faster rates than those of crops. Also, while there were some cases of decline in the prices of crops received by the cultivators, there was hardly any evidence of fall in the prices of inputs over the past decade or so.

Thus, it appears that the real prices of inputs were going up. This impression is confirmed by the three papers which have examined the changes in the prices of inputs in real terms, *i.e.*, in terms of the amount of crop output required to buy one unit of input (Jha and Kumar, Gangwar and Singh, and Nandal and Grover). Each of these papers has estimated the real price of fertilizers in terms of a few crops between late 1960s and mid-1970s. Nandal and Grover have also estimated the real price of tractors in terms of wheat and paddy. While Jha and Kumar have used lagged output prices, the other authors have used current output prices to estimate the real prices of inputs.

According to Nandal and Grover, between 1972-73 and May, 1975, the real prices of fertilizers in terms of wheat increased as follows: N about 54 per cent, P about 74 per cent, and K about 62 per cent. In terms of paddy, however, the increase in the real price of fertilizer was a little less. During the same period, the real price of a 50 HP Hindustan tractor increased by 147 per cent in terms of wheat and 131 per cent in terms of paddy. In money terms, the prices of these inputs had increased as follows: N 100 per cent, P 127 per cent, K 110 per cent, and tractor 222 per cent. Gangwar and Singh's findings, which relate to 1971-72 to 1972-75, confirm the pattern shown by Nandal and Grover. According to Jha and Kumar the real price of fertilizer in terms of wheat increased by 62 per cent between 1969-70 and 1974-75. In 1975-76, however, it declined, and hence, was 35 per cent higher than in 1969-70. According to the same authors, the real price of fertilizers in terms of bajra increased by 20 per cent between 1969-70 and 1970-71, but continuously declined thereafter. Consequently, in 1975-76 it was 13 per cent lower than in 1969-70.

#### CHANGES IN THE LEVELS OF USE OF INPUTS

It is possible to examine the changes in the levels of use of different inputs in *physical* terms, with the help of the findings of about 16 papers. Among various inputs, fertilizer has received the maximum coverage. Findings on seed, human and bullock labour, and irrigation are available in about 8 to 10 papers, and on other inputs in about five papers each. In a majority of the papers, the findings relate to a unit of land under a specific crop. Among different crops, wheat and paddy have received the maximum attention in 6 to 7 papers each. Other crops, covered in one to two papers each, are bajra, maize, barley, sugarcane and potato. In 5 to 6 papers, the findings are given for a unit of farm land, and not for specific crops. Taken together, the time frame of the papers is early 1960s to mid-1970s.

In most of the papers, the findings on the changes in the levels of use of different inputs are available in the form of comparable cross-sections at two to four points in time. There are, however, four papers which have presented the findings in the form of time-series (Grewal and Rangi, A. C. Broadway and his colleagues, Garg and his colleagues, and Rathore and his colleagues). The following picture emerges from these papers.

Till 1972-73, there was a substantial increase in the rates of fertilizer application (Grewal and Rangi, Gangwar and Singh, R. I. Singh and his colleagues, Jha and Kumar, Acharya and Agarwal, Garg and his colleagues, and Marothia). This was true not only for HYVs but also for local varieties. For instance, Gangwar and Singh have shown that between early 1960s and early 1970s the rate of fertilizer application on local wheat in Punjab increased by about five times. Nor was it confined to irrigated crops alone as shown by Nandal and Grover and Acharya and Agarwal.

The evidence on changes in the rates of fertilizer application after 1972-73 is mixed. Some papers have shown that there was a decline in the rates of application (Grewal and Rangi, T. R. Singh and his colleagues, Misra and his colleagues, Prakash Bakshi and Prakash Naidu). Crops covered in these papers include both local and HYVs of paddy and wheat, bajra, barley, maize, and potato. On the other hand, a number of papers report an increase in the rates of application (Rebello and his colleagues, Garg and his colleagues, Nandal and Grover, Malkhede and Pawaskar, and R. I. Singh and his colleagues). These papers also cover a variety of crops, both high-yielding and local varieties, and irrigated as well as unirrigated conditions. Some of these papers, however, report a decline or stoppage in the use of phosphatic and/or potassic fertilizers. For the same sample of cultivators, Jha and Kumar report an increase in the rate on Mexican wheat but a substantial decline on hybrid bajra after 1973-74.

As for the changes in the level of use of human labour per unit of land, a large number of papers have shown a decline (Gangwar and Singh, R. I. Singh and his colleagues, Marothia, Bakshi and Naidu, Rebello and his colleagues, Acharya and Agarwal, and Nandal and Grover). The time frame of these papers covers the entire period from early 1960s to mid-1970s, and the findings apply to varied crop enterprises and situations. On the other hand, R. I. Singh and his colleagues, S. K. Chakravorty, and Garg and his colleagues have reported an increase in the use of human labour over time. In this context, the findings of Jha and Kumar and Rebello and his colleagues are worth noting. These authors show that for the same sample of cultivators there was a decline in human labour use in the case of Mexican wheat, HYV paddy and sugarcane, but an increase in the case of hybrid bajra and local paddy.

The evidence on the changes in the level of use of bullock labour per unit of land is quite similar to that on human labour except that Garg and his colleagues and Acharya and Agarwal have reported a more or less constant level.

The evidence on the changes in the level of use of farm machinery and implements per unit of land is available only in a few papers. All of them indicate an increase over time (Jha and Kumar, Marothia, Nandal and Gro-

ver, and Gangwar and Singh). Garg and his colleagues have shown that between 1966-67 and 1972-73 there was a continuous increase in the per hectare investment in farm machinery and implements. Similarly, Malkhede and Pawaskar have shown that there was a substantial increase in the number of sprayers, dusters, iron ploughs and other implements owned by their sample of cultivators between 1973-74 and 1975-76.

As for the changes in the level of irrigation per unit of land, the evidence is quite mixed. The papers by Nandal and Grover, Malkhede and Pawaskar, and Baskshi and Naidu show an increase over time. On the other hand, the papers by Misra and his colleagues, and Acharaya and Agarwal show a decline, and those by R. I. Singh and his colleagues, and Garg and his colleagues indicate fluctuations over time. The findings of Jha and Kumar reveal that while the number of irrigations on Mexican wheat remained constant between 1968-70 and 1975-76, on hybrid bajra irrigation was stopped in 1975-76 after a constant level up to that year.

Most of the papers which have reported changes in the level of pesticide use per unit of land, indicate an increase over time (Acharya and Agarwal, Malkhede and Pawaskar, Nandal and Grover, and Marothia). The papers by Misra and his colleagues, and R. I. Singh and his colleagues, however, indicate a decline.

As for seed and farmyard manure, the evidence is mixed with a majority of the papers indicating increase in the rates over time (Rebello and his colleagues, Jha and Kumar, Nandal and Grover, Gangwar and Singh, Marothia, R. I. Singh and his colleagues, Acharya and Agarwal, and Chakravorty).

#### FACTORS BEHIND THE CHANGES IN THE LEVELS OF INPUT USE

The above discussion clearly shows that between early 1960s and mid-1970s, and more particularly after mid-1960s, the prices of inputs paid by the cultivators were rising more rapidly than the prices of output received by them. Thus, the prices of inputs were going up not only in money terms but also in real terms. And yet, the per hectare levels of use of inputs purchased from the non-agricultural sector were continuously rising. This was true even after the price hike of 1974-75 for most of the inputs, though the evidence is mixed for fertilizers after 1972-73. For the inputs supplied by the agricultural sector also, the evidence on the changes in the levels of use is mixed despite continuous increase in their prices. Therefore, it would be incorrect to say that the changes over time in the levels of use of various inputs were primarily governed by movements in their prices, either in money or in real terms. To what extent this conclusion for the overall scene is supported by the analysis in the individual papers? It would also be pertinent to see which other factors have been identified by various authors as forces governing the changes in the levels of input use.



Unfortunately, this aspect has not received adequate attention. This is not to say there are no comments, or even assertions, on the "why" of the observed changes in the levels of use of inputs. Systematic analysis to identify the factors governing the observed changes in input use is, however, available only in a few papers. Therefore, in the following paragraphs, we have made an attempt to summarise the discussion on this aspect in various papers irrespective of the degree of rigour with which the 'conclusions' have been reached.

Broadly, the papers dealing with the factors behind the changes in the levels of use of inputs could be divided into two categories. There are some papers which have attributed the observed changes in input use mainly to changes in the prices of inputs (Grewal and Rangi, Rathore and his colleagues, Misra and his colleagues, and Bakshi and Naidu). In all these papers, the decline in the levels of input use (mainly fertilizer) between early and mid-1970s has been attributed to the rise in the prices of inputs. Bakshi and Naidu have argued that the rise in the prices of inputs caused inadequacy of credit with small cultivators, and this in turn led them to cut down fertilizer use. Rathore and his colleagues have pointed out that the rise in the price of diesel induced the sample cultivators to substitute diesel power by electric power. It may, however, be noted that Grewal and Rangi as well as Rathore and his colleagues have also attributed the decline in fertilizer use to scarcity of fertilizers and other complementary inputs such as irrigation and various shortcomings of the distribution system.

On the other hand, there are some papers which have shown that the changes in levels of use of inputs were not governed by the changes in their prices either in money or in real terms (Jha and Kumar, Rebello and his colleagues, Malkhede and Pawaskar, Broadway and his colleagues, and Chakravorty). Together the reference period of these papers cover the period between mid-1950s and mid-1970s, and the analysis covers several inputs supplied by both the agricultural and non-agricultural sectors.

Jha and Kumar have estimated factor demand functions for human labour and fertilizers relating the changes in their levels of use on Mexican wheat and hybrid bajra to real prices of these inputs and to the other variables. Their analysis shows that human labour use on wheat was significantly influenced by real wage rates, lagged labour use, degree of mechanization and area under the crop. In the case of bajra, however, it was significantly influenced only by the degree of mechanization and area under the crop. The level of fertilizer use in the case of both the crops was significantly influenced only by area under the crop and lagged fertilizer use, and the real price of fertilizer did not have any significant influence.

Rebello and his colleagues have explained the rise in the rates of nitrogen use on sugarcane, HYV paddy and local paddy, despite substantial rise in the price of nitrogen, by pointing out the marginal value productivity of this input

estimated from production functions. They, however, also state that the rates of nitrogen application were governed more by the cultivators' judgments about the requirements of the crops than precise calculations of profitability.

Malkhede and Pawaskar have attributed the increase in the levels of use of various inputs, despite a rise in their prices, to an increase in the area under HYVs, changes in cropping pattern and the influence of the Cotton Monopoly Purchase Scheme. They have also indicated that the levels of use of pesticides were governed more by the cultivator's perception about adulteration of pesticides than their prices. Broadway and his colleagues have attributed the increase in fertilizer use to the spread of HYVs and increase in the levels of irrigation.

From the above discussion it is clear that even at the micro level a number of authors have identified the role of the changes in cropping pattern, spread of HYVs, increase in irrigation and the efficacy of the input distributing agencies in influencing the changes in the levels of use of certain inputs. This is not surprising because, besides the prices of inputs and output, all these factors affect profitability, and hence, the cultivators' effective demand for inputs. What has, however, not received adequate attention is the analysis of the cultivators' behaviour in factor substitutions either in response to the relative price structure of different inputs or as a consequence of the investment in certain types of fixed capital.

#### CHANGES IN THE COST OF CULTIVATION

About half the papers have examined the changes in the per hectare cost of cultivation between two or more points in time for the same locations, and in some cases for the same samples of cultivators. In some papers the analysis relates to individual crops, *viz.*, wheat, paddy, bajra, maize, barley and sugarcane. Among different crops, wheat and paddy have received more attention than the others. About six papers have examined the changes in the per hectare cost of cultivation for all crop enterprises taken together. The time frame of all these papers taken together covers the period from mid-1950s to mid-1970s.

While the information on cost of cultivation available in various papers is very valuable, it also suffers from certain limitations. The term "Cost of Cultivation" connotes different things in different papers. While in some papers it means cost concept  $A_2$  or B or C of the Farm Management Studies, in others, it does not correspond to any of these concepts. In a majority of the papers it means cost C minus rent (or land revenue) and interest on fixed capital. In a couple of papers, only purchased inputs are considered. Similarly, some papers are based on the data generated through the cost accounting method while others are based on the data collected by the survey method.

These limitations make quantitative findings of different papers incomparable. On the other hand, inasmuch as each paper has consistently used the same concept of cost at different points in time and, by and large, employed the same method for data collection, they do provide a fairly good opportunity to study the broad order of magnitudes in the changes in the per hectare cost of cultivation. The following overall picture emerges from the various papers which have examined this aspect.

The papers give unambiguous evidence that the per hectare cost of cultivation has been increasing over time in current money terms. This is true not only for such cases where only inputs purchased from the non-agricultural sector are considered but also where the cost C concept has been used. Similarly, it is true not only for studies based on data for 1970s but also for the earlier period. Nor is the phenomenon confined to some particular crops, or to HYVs or to large or to progressive farms.

On the basis of Farm Management Studies conducted in Hooghly and 24 Parganas districts of West Bengal, Chakravorty has shown that between mid-1950s and early 1970s, the per hectare cost of cultivation (cost B) increased by nearly eight times in current money terms. The magnitude of rise was as high as 11 times for farms of 3 to 4 hectares, but even for farms upto 0.5 hectare, there was a seven-fold increase. Similarly, Gangwar and Singh have shown, with the help of Farm Management Studies conducted in Punjab, that between early 1950s and early 1970s, the per hectare cost of cultivation (cost C) of *desi* wheat increased by about 150 per cent. Acharya and Agarwal have also shown that between 1965-66 and 1971-72 there was a substantial increase in the per hectare cost of cultivation (cost C minus rent) of wheat, bajra and barley on both the bullock and pump operated farms in Jaipur district of Rajasthan. For barley it increased by 36 to 42 per cent, for wheat by 58 to 68 per cent, and for bajra by 116 to 133 per cent. In the case of each crop, the cost was higher on the bullock operated farms. Also, it increased by a higher percentage on these farms.

More than ten papers have examined the per hectare cost of cultivation for two or more years in the period between late 1960s and mid-1970s. Because of the trends in the prices of inputs during this period, there is a general impression that the per hectare cost of cultivation increased at higher rates during the later part of this period, particularly during 1972-73 to 1974-75. On the whole, this impression is confirmed (Grewal and Rangi, Nandal and Grover Rathore and his colleagues, Rebello and his colleagues, Jha and Kumar, R. I. Singh and his colleagues, Broadway and his colleagues, and Marothia). This is quite consistent with the overall impression one gathers about the trends in the levels of use of inputs. As stated above, despite very rapid rise in the prices of inputs, there is no widespread evidence of substantial decline in the levels of use of several inputs. And, inasmuch as there were many cases where the levels of input use had gone up, the cost of cultivation was bound to increase at higher rates than during the earlier years.

Only a couple of papers have examined the changes in the average cost of producing a unit of output. All of them show an increase over time (Jha and Kumar, Acharya and Agarwal, and Parthasarathy and Suryanarayana).

#### RELATIVE IMPORTANCE OF DIFFERENT INPUTS IN THE COST STRUCTURE

Over 15 papers contain the findings on the relative importance of different inputs in the cost structure. Such findings are available for individual crops such as wheat, paddy, bajra, maize, barley, sugarcane and cotton as well as for the farm business as a whole. For wheat, paddy and bajra they are available for both local and HYVs. For cotton, the information is available for both *desi* and American cotton. Comparable findings are also available for farms with different characteristics with respect to size, source of farm power, degree of progressiveness and irrigation. About ten papers also throw some light on how the relative importance of different inputs in the cost structure was changing over time in the same locations, and in some cases for the same samples of cultivators. Thus, despite lack of uniformity in the cost concepts used by different authors, as pointed out in the previous section, these papers do provide an opportunity to study, at least in an indicative manner, the directions of change in the relative importance of different inputs in the cost structure.

Even a cursory examination of the available findings reveals tremendous variation in the relative importance of the same input in the cost structure of the same enterprise. To illustrate, as percentage of per hectare operating cost of HYV wheat (defined uniformly by some authors), the share of human labour varies from less than 25 per cent to over 40 per cent, that of bullock labour from less than 10 per cent to over 35 per cent, that of seed from around 5 per cent to about 15 per cent, that of farmyard manure from less than 3 per cent to about 15 per cent, that of fertilizers from less than 10 per cent to over 25 per cent, that of farm machinery charges from nil to over 20 per cent, that of irrigation cost from around 5 to nearly 15 per cent, and that of pesticides from nil to about 3 per cent (Jha and Kumar, Marothia, Rathore and his colleagues, and Raj Vir Singh and R. K. Patel). Though comparable findings for other crops are not available to the same extent as HYV wheat, they do indicate a similar pattern of variation. The findings of Rathore and his colleagues show that in the cost structure of both local and HYVs of wheat and bajra, and in that of barley, the inputs purchased from the non-agricultural sector account for a much higher proportion of the cost of cultivation on the pump operated farms as compared to the bullock operated farms. J. S. Chawla and R. P. Singh's findings show that there was not much difference in the relative importance of different inputs in the cost of cultivation of *desi* and American cotton, but the per hectare variable cost for American cotton was 25 to 40 per cent higher than for *desi* cotton on farms of different sizes.

As a consequence of the tremendous variation in the relative importance of different inputs in the cost structure of the same crop enterprise, there was

wide variation in the relative importance of inputs supplied by agriculture vis-a-vis the non-agricultural sector. For instance, for roughly comparable period, the share of inputs supplied by the non-agricultural sector in the per hectare operating cost of HYV of wheat varied from less than 20 to over 70 per cent (Acharya and Agarwal, Marothia, Jha and Kumar, R. K. Singh and his colleagues, and Singh and Patel). Similar variation, though less pronounced, is also found for other crop enterprises. All available evidence, however, indicates that over time the share of inputs supplied by the non-agricultural sector was increasing. This was true for a number of crop enterprises, both local and HYVs, and for varied situations with respect to the characteristics of farms.

#### IMPACT OF THE CHANGES IN THE LEVELS OF INPUT USE ON PRODUCTION

The findings on per hectare levels of input use and yield are available in more than half of the papers. They relate to different time periods and diverse situations with respect to crop enterprises and characteristics of farms. Excepting a few papers, such findings are available for two or more points in time for the same location/sample of farms. The most important limitation of these findings is that in some papers they are available only in monetary terms. In such cases, they present obvious difficulties of interpretation in judging the changes in the levels of input use and yield in *physical* terms.

Not all papers which have reported the findings on levels of inputs use and yield have analysed them to examine different aspects of the relationship between these variables. In fact, excepting the attempt by T. K. Jayaraman and V. B. Savdasia such analysis is available mainly in the form of estimation of production functions from cross-sectional data or in the form of fertilizer response functions. And hence, the papers do not contribute much to our understanding of the extent to which the production trends over time could be explained by the variations in the levels of use of different inputs.

In this context, the findings of Jayaraman and Savdasia are worth noting. They have made an attempt to explain the trends in the total agricultural production in Gujarat between 1961-62 and 1973-74 with five explanatory variables, *viz.*, capital, fertilizers, energy, rainfall and trend. The results of their log-linear aggregate model indicate that these five variables together explained nearly 96 per cent of the variation in agricultural production. The three explanatory variables which were significant at 5 per cent level were rainfall, fertilizers and energy. However, the last variable had a negative sign.

A number of authors have estimated production functions from cross-sectional data (Rebello and his colleagues, Singh and Patel, Chawla and Singh, R. K. Singh and his colleagues, S. P. Sinha and his colleagues and S. S. Pal). Despite various limitations, their analysis clearly indicate three things. First, in many situations, a fairly high proportion of the cross-sectional

variation in production could be explained by the variations in the levels of use of different inputs. The analysis of Bhanudeb Bagchi and K. Sain also confirm this. Second, more often than not there is a wide variation in the ratios of marginal productivities and input prices of different inputs. This indicates the scope for cost reduction through factor substitution to obtain the same yield. Third, in a number of cases, the marginal value productivities of inputs are higher than their unit prices. In a way, this explains why the increase in input prices did not result in a widespread decline in their levels of use.

Three papers have analysed the impact of price changes on the levels of input use and yield by estimating fertilizer response functions on the basis of data available from simple fertilizer trials on the cultivators' fields, sample surveys for assessment of HYVP, and experiment stations (D. Singh and B. B. P. S. Goel, S. C. Tewari and his colleagues, and S. D. Patil). These papers confirm that the optimum rates are sensitive to changes in fertilizer and output prices, and that an increase in the real prices of fertilizers adversely affects yield as well as profitability of fertilizer use. Singh and Goel have also given estimates of adverse impact on yield when fertilizer prices go up and the total expenditure on fertilizers remains fixed as a result of capital rationing.

As stated above, the findings on changes over time in the levels of use of different inputs and yields are available in a number of papers (Grewal and Rangi, Rebello and his colleagues, Pal, Garg and his colleagues, Marothia, Bakshi and Naidu, and P. C. Shukla). In general, these findings indicate a positive and strong association between increase in yield and increase in the levels of use of certain inputs, particularly fertilizers, irrigation, and in some cases, farm machinery. The findings of some of these papers also indicate that year to year fluctuations in yields are not due to the fluctuations in the levels of use of inputs. Finally, the evidence on a decline in yield due to a decline in the levels of input use, particularly during 1973-74 and 1974-75 is mixed.

#### CHANGES IN THE RETURNS OVER COST OF CULTIVATION

Almost all papers which have examined the changes in the cost of cultivation have also examined the changes in the returns over cost of cultivation. Thus the findings on the impact of input price changes on the profitability of cultivation are available for a number of different situations between mid-1950s and mid-1970s. The most important limitation of these findings, however, is that the "returns over cost of cultivation" means a number of different things. This is so because of the variation in the cost concepts used by different authors. The term "returns over cost of cultivation" means anything from returns over cost of inputs purchased from the non-agricultural sector to returns over cost C. In a majority of the papers, however, it means returns

over "operating cost," the latter being defined as cost C minus rent (or land revenue) and interest on fixed capital.

Notwithstanding the above limitation which makes the findings of many papers incomparable, the papers taken together throw some useful light on the subject because of two reasons. First, the findings on the returns over cost of cultivation for two or more time periods in each paper are comparable because of the consistency in the use of cost concepts, and they apply to the same locations, and often to the same samples of cultivators. Second, they are based on prices actually received and paid by the cultivators.

While the findings on per hectare cost of cultivation consistently show increase over time, the overall picture which emerges from the findings on the returns over cost of cultivation is not as clear. There are a number of cases in which, despite significant increase in cost, the returns increased over time. Against this, there are significant number of other cases where returns declined over time. Such an inconclusive picture emerges for all crop enterprises covered in the papers. It also emerges for cases where the analysis is for the farm business as a whole. Nor are the findings on the two-way movements in the returns confined to any particular time period. It is also clear from some papers that often there were year to year changes in the directions of movements in the returns. The following paragraphs highlight some of the findings which lead us to this conclusion about the overall scene.

According to Jha and Kumar the per hectare net returns, based on cost C, on Mexican wheat declined from Rs. 1,776 in 1968-70 to Rs. 1,437 in 1972-74. In 1974-75, despite a 55 per cent increase in the cost of cultivation, the per hectare net returns went up by about 150 per cent to Rs. 3,604. Then in 1975-76 the net returns dropped to Rs. 891 per hectare. This happened, not because of an increase in the cost of cultivation, but because of a 25 to 30 per cent decline in both yield and price of output.

Such two-way changes in the returns over cost are reported by a number of papers [Broadway and his colleagues, R. I. Singh and his colleagues, Rathore and his colleagues (for traditional farms), Grewal and Rangji (for paddy), and Nandal and Grover]. On the other hand, Rathore and his colleagues have shown that for four successive years after 1970-71, the per hectare returns over operating cost were increasing in the case of progressive farms. Similarly, Grewal and Rangji have reported continuous increase in the returns over  $A_2$  cost for wheat during 1971-72 to 1974-75. A couple of papers, based on two-point data between late 1960s and early or mid-1970s, have also reported increase in the returns over cost particularly for paddy and wheat (Marothia, Acharya and Agarwal, and Rebello and his colleagues).

In this context, the findings of two papers based on Farm Management Studies are worth noting. Using the data from the studies conducted in

Hooghly and 24 Parganas districts of West Bengal, Chakravorty has shown that between mid-1950s and early 1970s, there was nearly eight-fold increase in the per hectare cost of cultivation (cost B). And yet, the returns over cost B increased by over three times. On the other hand, Gangwar and Singh have shown that between early 1960s and early 1970s the per hectare returns on *desi* wheat in Punjab declined by 36 per cent on cost B basis, and by 69 per cent on cost C basis. On cost A<sub>1</sub> and A<sub>2</sub> basis, however, they increased by about 40 per cent.

#### FACTORS BEHIND CHANGES IN THE RETURNS OVER COST

Per hectare returns over cost on a particular crop enterprise would change due to the changes in one or more of the following factors: level of yield, price of output, cost of cultivation. As stated above, almost all papers have reported an increase in the per hectare cost of cultivation over time. On the other hand, the evidence on returns is mixed. Therefore, to see the relative importance of the above three factors in influencing the changes in the returns, an attempt is made here to answer two questions with the help of the findings of various papers. These questions are: (1) What was the relative importance of increase in yield vis-a-vis rise in output prices in raising the returns in the face of an increase in the cost of cultivation? (2) Whenever the returns over cost fell over time, was it mainly due to an increase in the cost of cultivation or was it also due to a decline in yield and/or output prices? Given the nature of the evidence available from various papers, it is obvious that the answers to these questions could be only in qualitative terms.

A scrutiny of the findings of some papers, where the information on yield, price of output and cost of cultivation is available, indicates that in some cases the increase in per hectare returns over cost was only due to an increase in yield. This is clearly indicated by the findings of Marothia for paddy, wheat and maize, and those of R. I. Singh and his colleagues for paddy and wheat. In all these cases, the returns over cost increased over time, despite substantial increase in the cost of cultivation, because of increase in yield alone. In fact, in all these cases, the prices of crops received by the cultivators went down during the periods of comparison. On the other hand, the findings of Jha and Kumar for Mexican wheat and hybrid bajra for 1974-75, and those of Rebello and his colleagues for both local and high-yielding varieties of paddy show that the increase in the returns was due to both increase in yield and prices of crops.

As for cases where the returns over cost declined between different years, a scrutiny of available information indicates that only in a few cases this was due to an increase in the cost of cultivation (Gangwar and Singh for *desi* wheat, and Rebello and his colleagues for sugarcane). In a number of cases, the decline in per hectare returns was associated not only with the increase in the cost of cultivation but also with the decline in yield, and in some cases



with both decline in yield and a fall in the prices received by the cultivators for output (Jha and Kumar for Mexican wheat and hybrid bajra in 1972-74 and 1975-76, and R. I. Singh and his colleagues for wheat and paddy in 1973-74).

In the papers where the per hectare returns over cost have been examined by taking all farm enterprises together, the changes in the returns over cost could be due to the changes in cropping patterns, yields, prices of output and cost of cultivation. For want of analysis of these aspects, it is not possible to say which of these factors were mainly responsible for the observed changes in the returns over time.

#### FINDINGS ON FARMS OF DIFFERENT SIZES

About ten papers have examined some issues related to the subject under discussion for farms of different sizes. Some of the papers are based on data for one point in time while others are based on data for two or more points in time. The issues which have been examined are such as levels of use of different inputs, changes in the levels of use of inputs, yields and returns over cost, and the incidence of the imperfections of distribution system on farms of different sizes. An attempt has also been made in some papers to explain why farms of different sizes behave differently.

Chawla and Singh have shown that the per hectare variable cost for both local and American cotton increased with the increase in the farm size. Their findings also show that with the increase in the farm size, the percentage of inputs purchased from the non-agricultural sector increased only marginally. Yet another thing revealed by their findings is that the relative share of each purchased input in the total variable expenditure did not change much among the farms of different sizes either for local or for American cotton. Against this, the findings of Singh and Patel reveal that the percentage share of inputs supplied by the non-agricultural sector in the total expenditure increased significantly with the increase in the farm size both for sugarcane and wheat.

As for the changes in the levels of use of certain inputs over time, the evidence is mixed. The papers by T. R. Singh and his colleagues, and R. I. Singh and his colleagues show that the small and marginal farmers either increased their levels of fertilizer use more than the medium and big farmers or reduced their rates the least. Shukla's findings also show that farms of less than one hectare maintained their pace of input use in order to increase gross output during 1969-70 to 1971-72. Thiruvengkatachari shows that between 1970-71 and 1975-76 farms of all sizes increased their per hectare expenditure on paddy cultivation by about the same rate. On the other hand, Chakravorty's analysis based on Farm Management Studies conducted in Hooghly and 24 Parganas districts of West Bengal during the mid-1950s and early 1970s shows that though the per hectare expenditure on seeds, manure

and fertilizers, and human and bullock labour had gone up on farms of all sizes, the rate of increase was relatively less on farms below one hectare than in the case of those above one hectare. Bakshi and Naidu have shown that between 1971-72 and 1975-76, farms of the smallest size-group in their sample reduced fertilizer use more than the other groups. They have attributed this to the lack of credit with the small farms.

The evidence on the returns over cost is also mixed. Chakravorty's findings show that between mid-1950s and early 1970s, in general, the percentage increase in per hectare income (gross revenue minus cost B) was higher on farms below two hectares than on farms above that size. Thiruvankatachari's findings also show that the rate of increase in the per hectare returns over cost was inversely related to the size of farms. On the other hand, Singh and Patel's findings reveal that the per hectare gross returns, net returns, returns over purchased inputs and the gross returns per rupee of purchased inputs increased with the farm size in the case of sugarcane. In the case of wheat, while the per hectare net returns increased with the farm size, the returns over purchased inputs and gross returns per rupee of purchased inputs declined. Bakshi and Naidu have shown that due to the decline in fertilizer use between 1971-72 and 1975-76, the yield and returns over prime cost were most adversely affected on farms upto two hectares.

As for the impact of the imperfections of the input supply systems on farms of different sizes, R. I. Singh and his colleagues state that the small and marginal farmers had to pay higher prices for fertilizers in Kanpur district of Uttar Pradesh. This was true in the case of all agencies—co-operatives, agro-industries corporation and private dealers. Similarly, Thiruvankatachari has stated that the marginal farmers had to pay higher rate of interest on loans.

#### POLICY ISSUES

Though about 15 papers contain some policy suggestions with respect to inputs, perhaps, it would not be incorrect to say that, on the whole, there is very little rigorous discussion of policy issues in the papers.

As for the prices of inputs, different suggestions made by various authors are such as bringing down the prices of inputs, regulating and stabilising the prices of inputs, and protecting the small farmers from the rise in input prices (V. V. Desai, R. I. Singh and his colleagues, Tewari and his colleagues, Malkhede and Pawaskar, Grewal and Rang). Bagchi and Sain have argued that in view of the importance of human labour in the input cost structure, minimum wages should not be fixed without considering its impact on the cost of cultivation and on the price of output. They have also argued that the small farmers should be exempted from paying the minimum wages.

As for the prices of output, Parthasarathy and Suryanarayana have argued that there is a case to increase the minimum price for sugarcane because the

cultivators are not getting adequate returns. They fear that in the absence of raising the minimum price of sugarcane, the cultivators would divert land to other crops. Broadway and his colleagues have also argued, on the basis of observed evidence, that the relative prices of inputs and outputs induce changes in the cropping pattern towards those crops which do not require high level of such purchased inputs as fertilizers. Grewal and Rangi also state that because of the rise in the prices of inputs, the farmers have to make higher initial investment to get the same margin of profit, and this may distort the cropping pattern, and also have an adverse impact on capital formation in the agricultural sector. Thiruvengkatachari has suggested that the Agricultural Prices Commission should take into account the regional variations in the cost of cultivation while fixing the prices.

Among other policy suggestions, those made by Malkhede and Pawaskar, and R. I. Singh and his colleagues deserve special mention. These authors have suggested a number of improvements in the input distribution system. Some of their suggestions are such as establishing a Credit Guarantee Corporation to improve the fertilizer distribution system, easing of credit limits for short-term loans, increasing the number of retail outlets, ensuring the quality of inputs and giving concessions for providing electricity connections.

#### ISSUES FOR DISCUSSION

Different aspects of the subject, and the nature and scope of discussion in various papers suggest a number of issues for discussion in the Conference. These issues could broadly be divided into three categories as factual issues, analytical issues, and policy issues. Some of the major issues under each head are indicated below.

##### *Factual Issues*

It is obvious from the papers that the empirical evidence on every aspect of the subject is not clear-cut. Therefore, it would be useful to discuss if various conclusions on different factual aspects of the subject presented in this report are reasonable. This is particularly necessary for an appreciation of the relevance of different analytical issues, and a meaningful discussion of the policy issues. It will also help in avoiding needless confusion and controversy.

The following specific aspects are suggested for this purpose: (i) Changes in the prices of inputs, (ii) Changes in the prices of output, (iii) Changes in the real prices of inputs, (iv) Changes in the levels of use of different inputs, (v) Importance of the phenomenon of substitution among factors, (vi) Changes in the cost of cultivation, (vii) Relative importance of different inputs in the cost structure and changes in this over time, (ix) Changes in the returns over cost.

While covering the above issues it would be useful to discuss how the conclusions would change as the level of observation changes from the micro to the macro level, and also for different categories of farmers.

*Analytical Issues*

The analytical issues suggested for discussion relate to the "why" of the "observed" realities. The following questions illustrate the approach suggested for the discussion of analytical issues.

1. What were the factors behind the rise in the prices of inputs?

While discussing this question it may be useful to distinguish between the inputs supplied by the agricultural and non-agricultural sector. It may also be useful to examine if factors responsible for the rise in prices of inputs have changed over time. Finally, we may also discuss the extent to which the rise in input prices was due to the shortcomings of the input supply systems and some characteristics of the factor markets as distinguished from the increase in the cost of production of the inputs themselves.

2. Which factors have governed the cross-sectional variation and changes over time in the levels of use of different inputs?

It is suggested that this question may be discussed in three stages for analytical convenience and clarity.

Stage I: To what extent has the observed pattern of changes in the levels of use of different inputs been governed by the availability of inputs to the cultivators? Which factors influenced the availability of inputs to the cultivators?

Stage II : To what extent were the past changes in the levels of input use governed by the profitability of using inputs? In influencing the cultivators' decisions on the levels of input use, what was the relative importance of (a) productivity of inputs, (b) prices of output, (c) cost of using inputs, (d) the levels of use of other inputs, (e) the past levels of use of inputs, (f) relative price structure of different inputs, and (g) availability and interest rates of credit?

Stage III: Which factors have influenced the phenomenon of substitution among factors?

3. Which factors account for increase in the per hectare cost of cultivation over time? What was the relative importance of (a) increase in prices of inputs, (b) increase in the levels of use of different inputs, and (c) substitution among factors in the changes in the per hectare cost of cultivation over time?

While discussing this question we may also want to discuss the cross-sectional variation in the per hectare cost of cultivation, and factors behind such variation.

4. Which factors were responsible for increasing the share of the inputs supplied by the non-agricultural sector in the total cost of cultivation per hectare?

5. To what extent could the trends of agricultural production be explained by changes in the levels of use of various inputs?
6. To what extent do the fertilizer response functions estimated from fertilizer trials data and from data of experiments reflect the productivity of fertilizers in actual farm conditions?
7. To what extent do the ratios of marginal productivities and prices of different inputs, derived from production functions based on cross-sectional data, indicate the scope for reduction in the cost of cultivation through factor substitution?
8. What has been the impact of increase in the prices of inputs on agricultural production through the changes in the cropping patterns?
9. In which way have the returns over cost of cultivation, defined in terms of the alternative concepts of Farm Management Studies, changed over time? What was the relative importance of the changes in (a) yields, (b) prices of crops, (c) prices of inputs, and (d) cropping pattern in changing the returns over cost of cultivation?
10. How did the changes in the returns over cost of cultivation affect different categories of farmers?

#### *Policy Issues*

Among several policy issues which may be discussed, the following are suggested either because they have been suggested in the papers or because they have received negligible attention.

1. Does the present structure of input-output prices pose a "threat to the viability of new cereal production technology"?
2. What public policy measures are required to reduce the prices of agricultural inputs?
3. Is there scope to reduce the cost of cultivation through more effective extension work? What would be the pay-off through this method of reducing cost of cultivation vis-a-vis subsidies on inputs?
4. Should the distribution of subsidised inputs be linked up with compulsory procurement of agricultural commodities at less than market prices? What would be the impact of such a policy on agricultural production and equity within the agricultural sector?
5. Which public policy measures are required in the realm of prices of agricultural output to encourage the use of modern inputs?
6. Which special measures are required to promote the use of modern inputs on the small and marginal farms?