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9. ABSTRACT
This paper suggests policy measures for generating additional employment in the farming sector by inducing certain changes in the cropping pattern. A starting point is the proposition that different crops require different amounts of labor and it is possible to grow alternative crops under almost all conditions. In situations where the labor requirement of alternative crops vary widely, cropping pattern is, perhaps, the most important determinant of the level of rural employment.

It is suggested that policies to induce changes in the cropping pattern have a relatively short gestation period, particularly because certain changes seem possible even without creation of additional infrastructure; in some situations investible surpluses in the rural areas could be mobilized to establish industries which would change the cropping pattern in favor of labor intensive crops; the increment in employment is of an on-going nature; wage income generated would always exceed the amount of expenditure incurred; and finally, these policies would contribute simultaneously to the twin objectives of growth and raising income of the poor.

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GENERATING EMPLOYMENT IN RURAL AREAS

Gunvant M. Desai*
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Cropping Pattern and Employment on Farm

The Planning Commission, in its approach to the Fifth Five Year Plan, considers that there is 'a very conspicuous element of historic inevitability' in the main thrust of the Plan becoming a direct attack on reducing poverty.¹ It is estimated that over 220 million people are below the minimum consumption level. Three main causes of this abject poverty are identified as open unemployment, underemployment, and low resource base of a very large number of producers in the agriculture and service sectors. The urban poor are mainly an overflow of the rural poor. Great emphasis is, therefore, laid on generating employment in the rural areas in the strategy outlined by the Planning Commission.

The primary objective of this paper is to demonstrate that there is a significant possibility of generating additional employment in the farming sector by inducing certain changes in the cropping pattern. This is not proposed as a complete or the only solution to the problem of generating rural employment, but, clearly, dimensions of the problem demand something beyond creating more off-farm jobs.

Our starting point is the proposition that different crops require different amount of labour. It is possible to grow alternative crops under almost all conditions. In situations where the labour requirements of alternative crops vary widely, cropping pattern is, perhaps, the most important determinant of the level of rural employment.

So far, policy measures for changing the cropping pattern have been used to obtain the desired pattern of growth in output. However, we contend that these policies could also be used deliberately to generate additional employment in the farming sector. Non-foodgrain crops like sugarcane and groundnut will be shown to be relatively labour-intensive. Under conditions of unchanging technology, the

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¹Planning Commission, Towards an Approach to the Fifth Plan, (New Delhi), 1972.

most formidable constraint on policies aimed at encouraging the cultivation of non-foodgrain crops is that the output of foodgrains might decline as a consequence. However, yield-increasing technologies have been successfully evolved for some foodgrains and there are prospects of repeating this for other foodgrains. The above constraint, therefore, could be removed. The trend in acreage under certain non-foodgrain crops is declining since 1964-65. On the other hand, demand for non-foodgrain crops will continue to rise along with incomes because of high income-elasticities for the products dependent on these crops. All these factors indicate that manipulation of the cropping pattern in favour of certain labour-intensive crops is a feasible policy instrument to achieve the employment objective.

To illustrate that there is a substantial possibility of increasing employment in the farming sector, in both irrigated and unirrigated areas, we have analysed the impact of expansion of sugarcane and groundnut acreage on the demand for labour in Surat district of Gujarat. Some observations on policies required to induce changes in cropping pattern in favour of labour intensive crops are presented in the concluding section.

The Impact of Sugarcane Cultivation on Employment

Since the mid-1950's, there has been a vast expansion in the sugarcane acreage of Surat district. Acreage under sugarcane increased to 9,000 acres in 1961-62, and 17,500 in 1968-69 from less than 2,500 in 1954-55.² This growth was due to the development of the sugar industry in the district. The first sugar factory was erected at Bardoli in 1955 with a crushing capacity of 800 tons per day. This had almost doubled to 1,500 tons per day by 1967-68, when a second factory at Madhi began crushing sugarcane with a capacity of 1,250 tons per day. A third factory of a similar size became operational in 1971-72 at Chalthan. It is estimated that the crushing capacity in the district will rise to 7,000 tons per day by 1973-74. According to the estimates made by the sugar factories, this would require about 39,000 acres under sugarcane in the district.

²Despite substantial expansion in the acreage under sugarcane, it still accounted for less than two percent of the cultivated area, and 16 percent of the total irrigated area of the district in 1968-69.

Sugarcane is grown on irrigated land in a four-year cycle. It is planted first between October and December after a paddy crop in the kharif season, and harvested 14 months later. The first ratoon crop which immediately follows is out after 14 months. This is followed by the second ratoon crop, again to be cut 14 months later. The land then remains fallow for a few weeks before the paddy-sugarcane cycle begins again. The four alternative crop combinations to this cycle are: (i) banana - wheat (two year cycle), (ii) banana - val (two year cycle), (iii) paddy - wheat (annual cycle), and (iv) paddy - val (annual cycle).³

Table 1 shows labour requirements per acre under different crops. These estimates are made from data collected in a cross-section survey of 120 farmers for 1971-72.⁴ As part of a questionnaire, canvassed three times between December 1971 and May 1972, farmers were asked for the number of times each operation was performed, the number of days or hours taken each time, and the number of hired and family workers employed per day. Data were also collected by crop for all other inputs and output. The labour coefficients for each crop shown in Table 1 are derived from weighted averages for different operations performed by the sample of cultivators, the weights being individual cultivator's area under the crop. It was observed that except for planting, labour required for all other operations in the case of ratoon sugarcane was only marginally lower than that in the first year. Therefore, coefficient from all the other operations for sugarcane were obtained by taking the weighted average for sugarcane grown during the four-year cycle. Data from other sources are consistent with the labour requirements we have estimated, although data for Surat district itself are only available for a single crop, paddy in 1966.⁵

³ Val is a pulse crop which provides a considerable amount of fodder. Banana is generally planted as a kharif crop, and harvested over a three month period between 13 and 16 months later. It is followed by either wheat or val in rabi to complete a two year cycle.

⁴ The survey was carried out as a part of doctoral thesis research on raising incomes of small farmers. A stratified random sample was used. The 120 farmers selected were in five villages: 40 in two high income irrigated villages, 40 in two partially irrigated middle income villages, and 40 in an unirrigated tribal village. About 50 percent of the rural population in the district is tribal.

⁵ Studies in the Economics of Farm Management in the IADP Region of Surat and Bulsar (Gujarat State), P. 153.

Table 1: Use of Human Labour per acre by Operation on Irrigated Acreage among Sample Farmers in Surat District for 1971-72

| Crop | No. of cultivators | Ploughing | Planting | Weeding | Man-days for inter-cultivation | Harvesting and Threshing | Harrowing | Fertiliser application | Irrigation | Total |
|--------------------|--------------------|-----------|-----------------|---------|--------------------------------|--------------------------|-----------|------------------------|------------|-------|
| Sugarcane | 39 | 1 | 21 ^a | 38 | 3 | 105 ^b | - | 6 | 28 | 202 |
| Paddy ^c | 87 | 2 | 21 | 34 | - | 29 | 1 | 2 | 4 | 93 |
| Wheat ^c | 41 | 3 | 2 | 10 | - | 18 | - | 1 | 4 | 38 |
| Val | 38 | 1 | 4 | 8 | - | 13 | - | - | - | 26 |
| Banana | 6 | 1 | 13 | 78 | - | 59 | - | 6 | 36 | 199 |

a Only in the first year

b Estimated on the basis of information collected from the sugar factor at Bardoli. Harvesting of sugarcane is undertaken by the factory, which deducts the cost of harvesting from the value of farmers' output. To cut one ton of sugarcane and transport it to the factory in a day, three adults (usually two men and a woman) are required. The average yield of sugarcane in the region is 35 tons per acre. Thus, 105 man-days are required to harvest one acre of sugarcane. This coefficient is consistent with the labour force engaged for harvesting and the amount of sugarcane crushed by the factory.

c Both improved and high yielding varieties. The HYV of paddy grown by 41 of the 87 cultivators was Masuri, while the HYV of wheat grown by 13 of the 41 cultivators was Sonalika.

Putting together estimates of the use of labour per acre for different crops, total labour used per acre over a four-year period in cultivating the five alternatives are shown in Table 2. The table also shows average annual requirements of labour for the five alternatives.

Table 2: Labour Requirements Per Acre for Sugarcane and Alternative Crop Combinations

| Alternative | Crop Combinations | Labour required over four years (Man-days) | Labour required per year (Man-days) |
|-------------|-------------------|--|-------------------------------------|
| 1 | Paddy-Sugarcane | 657 | 164 |
| 2 | Banana-Wheat | 462 | 116 |
| 3 | Banana-Val | 438 | 110 |
| 4 | Paddy-Wheat | 524 | 131 |
| 5 | Paddy-Val | 476 | 119 |

From Table 2 it is clear that sugarcane generates additional employment per acre of cultivation of at least 33 man-days per year, even when it is compared with the most labour intensive alternative, paddy wheat.

In 1968-69, there were over 17,000 acres of sugarcane in the district. Therefore, sugarcane cultivation must have generated additional employment of at least 561,000 man-days in the farming sector of the district.

The increase in acreage under sugarcane, and the consequent increase in on-farm employment, was brought about by the installation of sugar factories in Surat district as mentioned earlier. A sugar factory such as the one just established at Chalthan, with a crushing capacity of 1,250 tons per day requires 7,000 acres of sugarcane. Thus, additional employment generated by only one such factory would be at least 231,000 man-days per year. The total crushing capacity will have risen to 7,000 tons per day by 1973-74. This will require over 39,000 acres under sugarcane. Thus, the sugar factories would have generated additional employment of at least 1.29 million man-days per year in the farming sector.

The impact of a sugar factory in creating additional employment is far greater in the farming sector than in the non-farming sector. For example, the Bardoli factory, with a crushing capacity of 1,600 tons per day in 1971-72, employed 350 casual labourers for 200 days, not including the labour for harvesting, with only a few of permanent members of staff in the factory. Thus, 70,000 man-days of employment were created within the factory against 231,000 man-days on the farms. This underlines the employment potential of establishing agro-based industries in the farming sector vis-a-vis the non-farming sector of rural areas.

Further, since labour for sugarcane is employed almost entirely in the off-peak period, a sugar factory has an important influence on spreading employment more evenly throughout the year. This is because weeding, harvesting, and most of the irrigation for sugarcane take place in the relatively slack period, between December and June.

The Impact of Groundnut Cultivation on Employment

Using the same procedure as above, we examined first the acreage under groundnut and labour requirements per acre for groundnut vis-a-vis alternative crops, and then estimated the impact of groundnut cultivation on employment in the district.

Groundnut was first introduced into this area in 1947. There was a rapid increase in its acreage; by 1961-62, 41,000 acres and by 1967-68, 92,500 acres were under groundnut. The crop is grown almost entirely on unirrigated land in the kharif season. On all unirrigated land in the district, only a single crop is possible in 12 months. The alternative crops are jowar, tur and cotton (Deshi and Digvijay).

Labour requirements for these crops, again drawn from the cross-section survey carried out for 1971-72, are shown in Table 3. Labour required for fertiliser application is negligible because these crops are not commonly fertilised, and even those cultivators who apply fertilisers do so at very low rates.

Groundnut cultivation is relatively labour-intensive, primarily due to the large amount of labour required for harvesting. Labour requirements for cotton estimated in a farm management study are of an order of magnitude similar to ours.⁶ They also refer to Deshi and

⁶ Studies in the Economics of Farm Management in the IADP Region of Surat and Bulsar (Gujarat State), P. 195.

Table 3: Use of Human Labour Per Acre by Operation on Unirrigated Acreage among Sample Farmers in Surat District for 1971-72

| Crop | No. of cultivators | Man-days for | | | | | | Total |
|-----------|--------------------|--------------|----------|---------|-------------------|--------------------------|-----------|-------|
| | | Ploughing | Planting | Weeding | Inter-cultivation | Harvesting and threshing | Harrowing | |
| Groundnut | 34 | 1 | 4 | 24 | 3 | 25 | 3 | 60 |
| Cotton | 46 | 2 | 3 | 19 | 3 | 9 | 1 | 37 |
| Jowar | 23 | 1 | 2 | 16 | 3 | 5 | 2 | 29 |
| Tur | 6 | 1 | 2 | 10 | 1 | 6 | 0 | 20 |

Digvijay varieties grown mainly under unirrigated conditions. A study of dry land agriculture, in panchmahal district of Gujarat and Bellary district of Mysore, also confirms the observation that groundnut is more labour intensive than any competing crop.⁷

Harvesting accounts for a proportionately larger part of the total labour requirements for groundnut than it does for cotton or jowar. Since 1971-72 was considered "bad" for groundnut and "mediocre" for jowar and cotton by the cultivators in this region, the differences of 23 man-days per year between the labour requirements of groundnut and cotton, and of 31 man-days per year between groundnut and jowar, are likely to be even greater in other years.

In 1967-68 total area under groundnut in the district was 92,500 acres. If we assume that cotton would have been planted on this land in the absence of groundnut, groundnut cultivation could be said to have generated additional employment of over 2.1 million man-days per year. If we consider the alternative crop as jowar, the estimate of additional employment would rise to almost 2.9 million man-days per year. For a crop which accounted for only eight percent of the total cultivated land, and which is cultivated almost entirely on unirrigated land, this increase in employment, is indeed, substantial.

⁷M. S. Krishnaswamy and K. V. Patel, Status of Dry Land Agriculture Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, 1973.

The seasonal distribution of the labour requirement for groundnut is rather more concentrated than it is for jowar, tur or cotton. However, a large part of the labour requirement still falls outside the peak-period in most parts of the district. The harvesting of groundnut takes place in October-November, after the harvesting of unirrigated varieties of paddy. It may coincide with the harvesting of irrigated paddy, but groundnut is grown mainly in the unirrigated parts of the district, and will therefore draw labour from this region. Thus, groundnut cultivation serves mainly to extend the peak period of demand for labour by four to six weeks. Jowar, tur, and cotton are harvested between January and March, in the middle of the non-peak period, but, as can be seen from Table 3, the labour required to harvest these crops is much less.

Labour required in processing groundnut is extremely little compared to the additional employment generated on farms. We estimate, on the basis of a typical oil mill in the region, that for every 10,000 acres under groundnut, 10,000 man-days of employment are generated by the mill.⁸ This is less than five percent of the additional employment created on farms.

Implications for Policy

Four points emerge clearly from the above empirical analysis. First, even marginal changes in cropping pattern could generate substantial amounts of additional employment in the farming sector. Second, the impact of cropping pattern changes on the employment situation is not only the additional employment generated but also the extension of employment to lean months. Third, cropping pattern changes which make a favourable impact on employment are possible in both irrigated and unirrigated areas. Fourth, the main impact of agro-processing industries on employment is in the farming sector through changes in the cropping pattern.

Empirical findings for Surat district highlight the possibilities of generating additional employment in rural areas through changes in the cropping pattern, insofar as labour requirements for some

⁸ A typical oil mill in the region crushes 40,000 quintals of groundnut a year, employing 100 men per day for 200 days. Average yield between 1964-65 and 1970-71 was two quintals per acre. Thus, we estimate that 20,000 acres are required to supply groundnut to the mill.

The labour required for pressing and ginning of cotton is still lower. We estimate that for every 10,000 acres under cotton in this region, only 1,700 man days are required for ginning and pressing. Thus, even if groundnut cultivation is at the expense of cotton cultivation, there are also no adverse employment effects in the processing sector.

crops are significantly higher than those for others, and these labour-intensive crops produce commodities with high income elasticities of demand. Demand for crops such as sugarcane, potato, onions, fresh vegetables, chillies, groundnut, and tobacco will continue to increase rapidly with rising incomes and growing population. The nature of these crops, and some empirical evidence, suggest that most of these crops have higher labour requirements than do the competing crops. Thus, there is a vast scope for generating additional employment through changes in the cropping pattern.

To estimate the amount of additional employment which could be generated through such changes in the cropping pattern, and to evolve an integrated policy for this purpose, one needs: (i) Data on labour requirements for different crops at the prevailing stage of farm mechanisation, (ii) a reasonably detailed exercise in regional crop planning with creation of additional employment as one of the objectives, and (iii) a critical evaluation of the results of such an exercise, particularly in terms of the opportunity cost of changing pattern. Obviously, most of the empirical data needed for this purpose are not available, nor can such an exercise be undertaken by an individual research worker. However, there is an urgent need to make a systematic beginning in this direction for the purpose of rational land-use planning, both for getting the desired mix of output, as well as for generating additional employment in the agricultural sector.

In the absence of such a comprehensive analysis of the problem, we would like to make some broad observations on major policy issues which have a bearing on changes in the cropping pattern.

It is now generally agreed that changes in relative prices affect the cropping pattern. This indicates that it is possible to increase areas under labour-intensive crops by evolving a positive price policy towards them. In this respect, the minimisation of price fluctuations is particularly important. It will avoid fluctuations in the acreage under such crops, and hence in the demand for labour. It will also induce the spread of such crops to relatively small farms.

Desirable changes in the cropping pattern could also be induced through the evolution of yield-increasing technologies for labour intensive crops. The most important determinant of the cropping pattern is cultivators' returns from different crops. It depends on yields of the crops as well as their prices. We recognise that new technologies cannot be evolved overnight. However, giving relatively high priority to research aimed at evolving yield-increasing technologies for labour-intensive crops would be consistent with the emphasis on achieving the employment objectives.

Existence of certain agro-industries can substantially alter the cropping pattern of a region in favour of some labour-intensive crops.

This has been demonstrated clearly by the impact of sugar factories in different parts of Gujarat and Maharashtra on the acreage under sugarcane. Installation of cold storage plants in areas where potato and other such crops could be grown will have similar effects on their acreage.⁹ This is emphasised because the labour requirements of potato are very high, while the amount of capital needed for the installation of a cold storage plant is relatively small.

Establishment of agro-processing industries to change the cropping pattern in favour of labour intensive crops has certain advantages. First, it would create additional on-going employment in both farming and non-farming sectors of the rural areas. Second, by raising incomes of medium and large landowners, it offers prospects of making them contribute towards the initial capital cost. Thus this strategy can become an effective mechanism for mobilising investible surpluses in rural areas for developmental objectives. Third, to the extent it raises incomes of small farmers, it contributes towards realisation of one of the plan objectives. Finally, the establishment of agro-processing industries would increase the supply of commodities which are scarce at present, and demand for which will continue to rise in the future.

A fourth means of changing the cropping pattern in favour of labour intensive crops would be an improvement of marketing facilities. Some perishable crops, such as fresh vegetables, are very labour-intensive, and face a rapidly increasing demand with rising income and urbanisation. An improvement in the marketing facilities for these crops would probably be effective in enlarging areas under these crops.

We do not suggest that the problem of generating employment in rural areas could be solved just through establishment of agro-industries or changes in cropping pattern. Measures such as minor irrigation, dairying and animal husbandry, and soil conservation, which are enumerated as "employment-intensive heads of development" in the Approach Paper to the Fifth Plan, are also necessary to generate additional employment. However, some of these activities would generate sizeable employment at one point of time. Further, some of the schemes would generate far more employment if they were undertaken along with measures to induce suitable changes in the cropping pattern. For instance, when minor irrigation schemes are undertaken in a region, they would increase the employment to a much greater extent if they are coupled with the establishment of agro-processing industries or cold storage plants. Thus, careful planning and execution of schemes is required, so as to exploit all possibilities of increasing employment with the farming sector.

⁹ N. Bandopadhyay, Economics of Potato Cultivation in West Bengal, Agro-Economic Research Centre, Visva Bharati, Santiniketan, 1968.

Our emphasis on non-foodgrain crops is not meant to belittle the importance of the foodgrain sector for creating additional employment. Quite the contrary. Rapid growth in the production of foodgrains through yield-increasing technologies is critical, if additional employment is to be generated successfully. The most obvious reason for this is the inflationary potential of employment-oriented schemes. By generating a growth in production through increase in yields, the HYV's have removed, to a considerable extent, the main constraint on shifting areas from foodgrain to non-foodgrain crops. Also, when high yielding varieties of food-grains replace local varieties, the demand for labour may increase substantially, as indicated in a large number of studies.

Clearly, the effectiveness of generating employment through changes in the cropping pattern in favour of labour-intensive crops depends on the pace of farm mechanisation and the extent to which it displaces human labour. Indiscriminate mechanisation could defeat the approach suggested here. Therefore, it is particularly important to ensure that the cost of mechanisation reflects the underlying factor endowments of the economy.

To conclude, given the magnitude of the problem, we argue that creation of additional employment in rural areas through policies to induce changes in the cropping pattern should be considered seriously for the following reasons. First, such policies have a relatively short gestation period, particularly because certain changes seem possible, both in irrigated and unirrigated areas, even without creation of additional infrastructure. Second, as pointed out above, in some situations investible surpluses in the rural areas could be mobilised to establish industries which are needed to change the cropping pattern in favour of labour intensive crops. Third, the resulting increment in employment is of an on-going nature. Fourth, in this approach there are no leakages, in the sense that the amount of wage income generated would always exceed the amount of expenditure incurred. Finally, these policies would contribute simultaneously to the twin objectives of growth and raising income of the poor, or in other words, they would increase the area of congruence in the interests of different economic classes.