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AGRICULTURAL MECHANIZATION AND INCOME DISTRIBUTION IN FAIZABAD DISTRICT, EAST UTTAR PRADESH

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I. Introduction

The introduction of high-yielding varieties, of wheat and rice in particular, has resulted in important changes in Indian agriculture. This "Green Revolution" has brought Indian foodgrain production to levels of self-sufficiency in 1972, from near famine conditions in the late 'sixties. This increase in production has been accompanied by increasing use of non-traditional inputs : fertilizers, irrigation and mechanized sources of power. The basic structure of the village economy is being altered from a self-contained mode to a market-oriented use of inputs and production (Saith and Tankha 1972). These changes have given rise to many problems, which include uneven distribution of gains in income within and between regions and among farms, susceptibility of new varieties to pests and diseases, long run environmental and ecological costs, greater migration to urban areas, break-down of traditional social stability and security, greater unemployment, and greater under-employment due to accentuation of seasonality of unemployment (Cleaver 1972; Wharton 1969; Falcon 1970; Frankel 1971). The present study is an attempt to evaluate the impact of the introduction of tractors—a labour substituting technology—on production and income distribution within a region of India. The report covers only a small part of a much more comprehensive study that is currently in progress and at the present stage it has not taken into consideration many important aspects of agricultural policies such as those dealing with taxes, land reform and credit, and the assumptions are highly restrictive. It should therefore not be taken as a definitive analysis but rather as indicative and speculative. It also illustrates a meaningful approach in a study of the problems of income distribution that are associated with economic growth.

II. The Model

The data were collected by interviewing 81 farmers in the Faizabad district of East Uttar Pradesh in early 1972. A regional linear programming

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model was constructed with a representative farm approach. The model consists of five sectors—landless labourers and four sizes of farms. Regional resource limitations and behavioural constraints were imposed, and the model maximizes regional net income (the sum of the net incomes to the five sectors). The model allows for the transfer of labour between sectors. In addition to the assumptions necessary for linear programming, the model assumes: uniform technology for the four different sizes of farms; no urban employment possibilities; fixed prices or infinitely elastic demand for foodgrains; instantaneous adjustments; fixed wage rates and prices of other inputs; unlimited availability of fertilizers and irrigation; and no constraints on increased multiple cropping. Some of these assumptions are due to the data limitations, others will be relaxed in later phases of the study. It has been contended that tractors are mechanical inputs and are labour displacing, unlike fertilizers and irrigation which are biological inputs that are complementary with labour (Fatemi 1972). However, due to the seasonal nature of agriculture, it is possible that tractors may relieve the bottleneck of one or more of the crop culture operations, and thus allow for fuller production potential of a high-yielding variety to be realized and consequently increase the indirect employment of labour (Gayoso 1971). This study allows both for the direct substitution and the possible indirect increased employment of labour in order to evaluate the total impact of tractorisation.

III. Results

One way of ascertaining the validity of the model, within the highly restrictive assumptions, is to compare its predictions of the cropping pattern with the actual cropping pattern. These results are presented in Table I. The model predicted fairly well with the maximum deviation from the actual, being 8.73 per cent in the case of wheat, while the total crop intensity deviation was only 4.59 per cent from the actual.

TABLE I—COMPARISON OF PREDICTED CROPPING PATTERN WITH ACTUAL CROPPING PATTERN

(per cent)

Crop	Wheat	Paddy	Gram	Sugarcane	Pulses	Total
Predicted	37.82	42.31	5.71	16.25	0.00	102.09
Actual*	29.09	46.06	11.62	8.55	2.18	97.50
Deviation	+8.73	—3.75	—5.91	+7.70	—2.18	+4.59

* *Source:* District Statistical Officer, Faizabad.

To analyse the impact of tractors, they were introduced into the model in stages at increasing levels. Only the large farmers (owning more than 15

acres of land) were allowed to buy tractors. This assumption is in accordance with the existing situation in the area, *i.e.*, in the sample, farmers with less than 15 acres did not own tractors. In this phase of the study, tractor hiring by small farmers was not permitted. It was assumed that the farmers could borrow the required capital at an interest rate of 12 per cent. The results obtained under this set of assumptions are presented in Table II. The production on the tractorised farms increased by 135 per cent, while the production on the non-tractorised farms *decreased* by 23 per cent. The regional income was maximized by more labour being employed on the tractorised farms (an increase of 47 per cent), and less labour being employed on the non-tractorised farms (a decrease of 56 per cent). The total employment of landless labourers increased by 22 per cent. The seasonal pattern of the labour hiring activity of the landless labourers is shown in Figure 1. As a result of tractorisation, the pattern shifted from the months of *Baisakh* and *Jeth* to the months of *Bhadon* through *Poos*. These results do not clearly indicate whether or not the seasonal unemployment is being accentuated—while employment opportunities were eliminated in two months, *Baisakh* and *Jeth*, new opportunities were created in two months, *Bhadon* and *Poos*.

TABLE II—EFFECT OF TRACTORS ON TOTAL AGRICULTURAL PRODUCTION* AND EMPLOYMENT

Number of tractors	0	1,000	2,000	3,000	3,569	Per cent change 0 to 3,569 tractors
			(*million rupees*)			
1. Production on non-tractorised farms ..	521	470	444	439	398	—23.61
2. Production on tractorised farms ..	254	335	374	384	597	+135.04
3. Total production	775	805	818	823	995	+28.39
			(*million man-days*)			
4. Labour hired out by						
(*a*) Landless labourers	25.7	29.7	31.2	30.0	31.4	+22.17
(*b*) Less than 1-acre farmers ..	6.0	6.0	6.0	6.0	6.0	0.00
(*c*) 1- to 2.5-acre farmers	5.0	5.0	4.6	3.8	3.8	—24.00
5. Labour hired in by						
(*a*) 2.5-to 15-acre farmers	12.3	9.4	8.0	10.8	5.3	—56.91
(*b*) Tractorised farmers	24.4	31.3	33.8	28.9	35.9	+47.13
6. Total labour hiring	36.8	40.7	41.8	39.8	41.2	+11.95

* Valued at 12-month wholesale average price for 1970-71 in Faizabad market, as reported by the District Agricultural Marketing Officer, Faizabad: wheat 33.40 Rs./md.; paddy 26.18 Rs./md.; sugarcane 3.73 Rs./md. and pulses (*arhar*) 28.10 Rs./md.

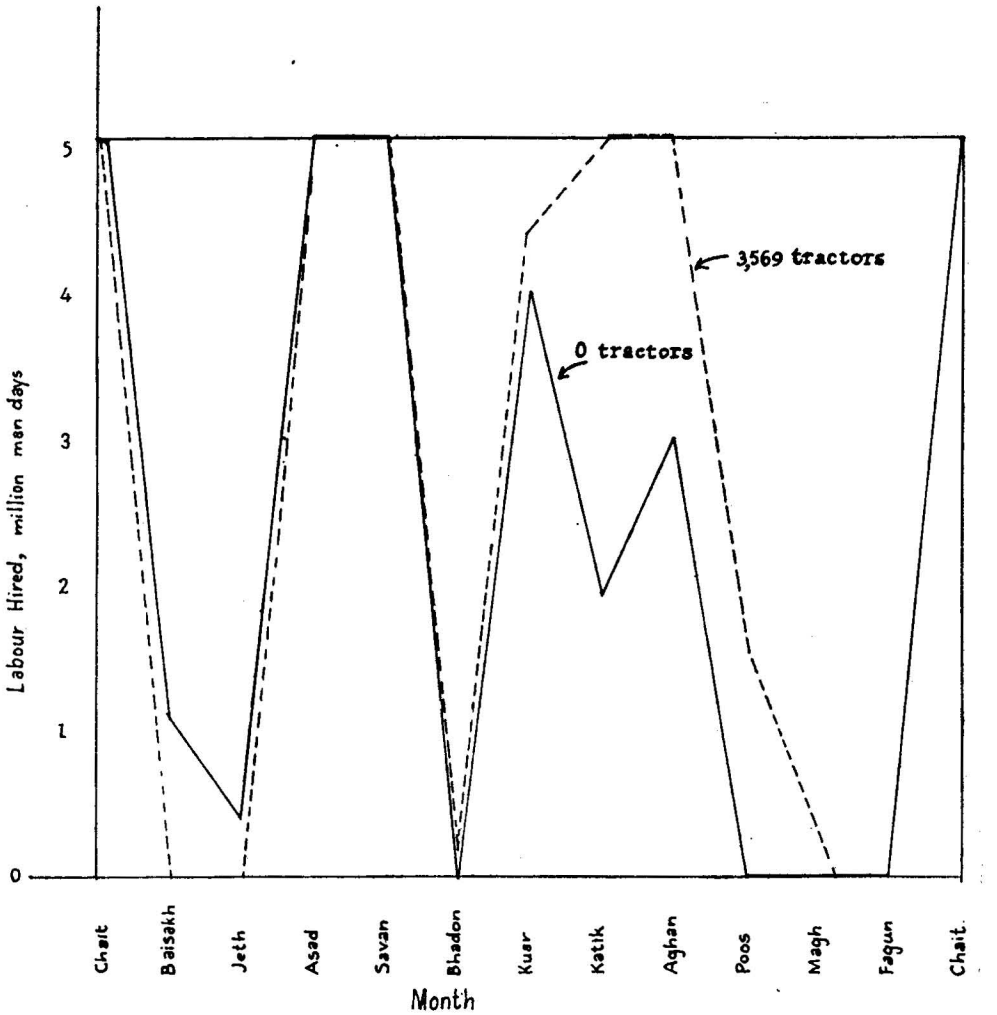

Figure 1—Seasonal Nature of Labour Hired out by Landless Labourers

The effect of tractors on the income per agricultural worker in different groups is shown in Table III. Compared to an overall increase of 3.61 per cent, the income of the tractorised farmer increased by about 131 per cent. The non-tractorised farmer in the 2.5-to 15-acre size lost income; he was no longer able to obtain the necessary labour as the labour was more productive on the tractorised farm where it added more to the regional net income. There was also an increase of 18 per cent in the income of the landless labourer as a result of increased employment.

TABLE III—EFFECT OF TRACTORS ON INCOME PER AGRICULTURAL WORKER FOR DIFFERENT GROUPS

(*Rs. per agricultural worker*)

Number of tractors	0	1,000	2,000	3,000	3,569	Per cent change 0 to 3,569 tractors
1. Landless labourers ..	387	427	456	439	457	+18.08
2. Less than 1 acre	556	556	556	556	556	0.00
3. 1 to 2.5 acres	754	754	766	935	935	+24.00
4. 2.5 to 15 acres	2,559	2,385	2,169	2,108	1,597	—38.29
5. More than 15 acres ..	5,687	7,136	8,955	9,322	13,177	+131.70
Weighted average	1,411	1,429	1,446	1,460	1,462	+3.61

The relative shares of the incomes of the five groups are shown in Table IV. The landless labourers and the small farmers gained slightly, while the medium farmers lost income, and the tractorised farmers gained substantially. These figures were used to plot the Lorenz curves for different levels of tractorisation (Figure 2). It may be seen that the more important changes occurred between the medium and the large farmers. The small farmers generally maintained their relative shares, and the bulk of the gains due to tractorisation accrued to the large farmers.

TABLE IV—EFFECT OF TRACTORS ON SHARE OF INCOME ACCRUING TO DIFFERENT GROUPS

(*per cent*)

Number of tractors	0	1,000	2,000	3,000	3,569	Per cent change 0 to 3,569 tractors
1. Landless labourers ..	8.85	9.65	10.19	9.70	10.09	+1.24
2. Less than 1 acre	6.46	6.38	6.31	6.25	6.24	—0.22
3. 1 to 2.5 acres	7.48	7.39	7.42	8.97	8.85	+1.47
4. 2.5 to 15 acres	59.96	55.19	49.57	47.75	36.14	+23.82
5. More than 15 acres ..	17.25	21.38	26.51	27.33	38.58	+21.33
Gini index	.506	.458	.471	.473	.511	
Equality index*	.494	.542	.529	.527	.489	

* 1—Gini index.

These figures were used also to develop the Gini index of inequality for different levels of tractorisation (Table IV). It may be seen that the initial introduction of 1,000 tractors shows a trend towards equality—the Gini index declines from .506 to .458. However, further introductions created a more unequal distribution—the Gini index increases gradually from .458 to .511. An equality index was developed by substracting the Gini index from 1. The equality index was plotted against production to give the trade off curve

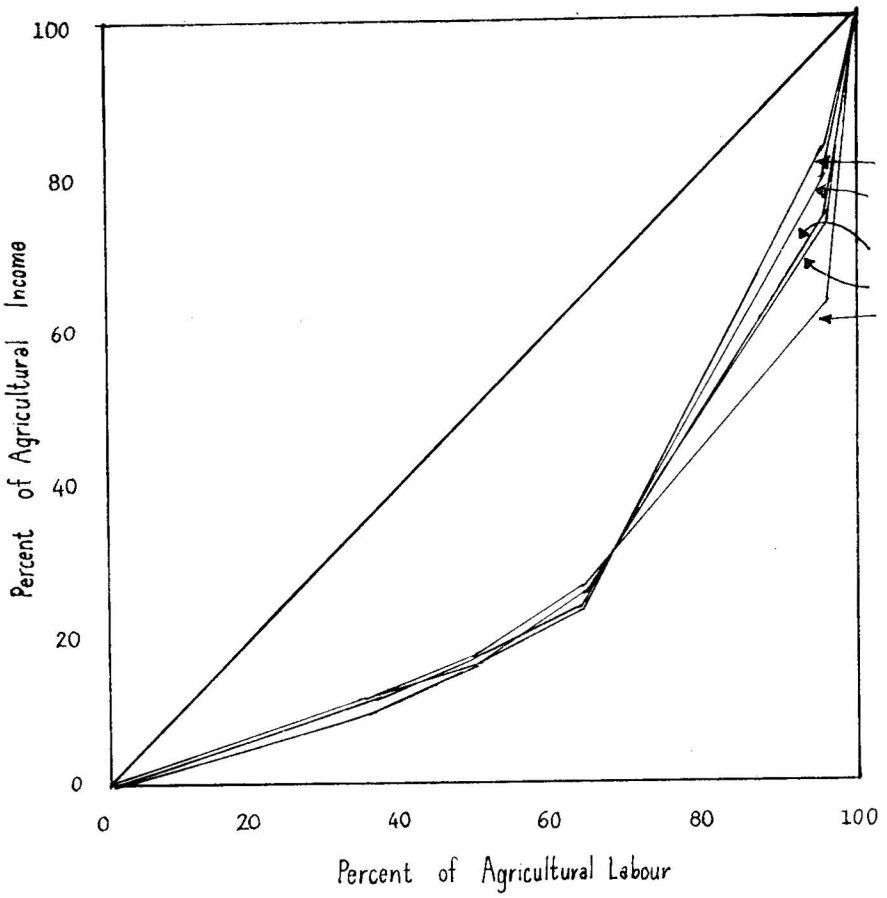

Figure 2—Effect of Tractors on Income Distribution

between equality and production (Figure 3). After the initial 1,000 tractors, the curve has a negative slope, showing that a trade off does exist.

A word of caution is in order here. These results are tentative. They have been obtained under highly restrictive assumptions. Particularly relevant is the assumption that land on the tractorised farms lends itself to increasing multiple cultivation. If this is not the case, then tractors, instead of creating employment, may displace labour. Another assumption that may be too restrictive is that of not permitting smaller farms to hire tractors.

IV. Implications

The first implication is that the dual objectives of growth (production) and social justice (redirection in the level of inequality) as professed by the Planning Commission (1972) may not be compatible. The planners therefore need an explicit social welfare function in order to be able to choose between the two.

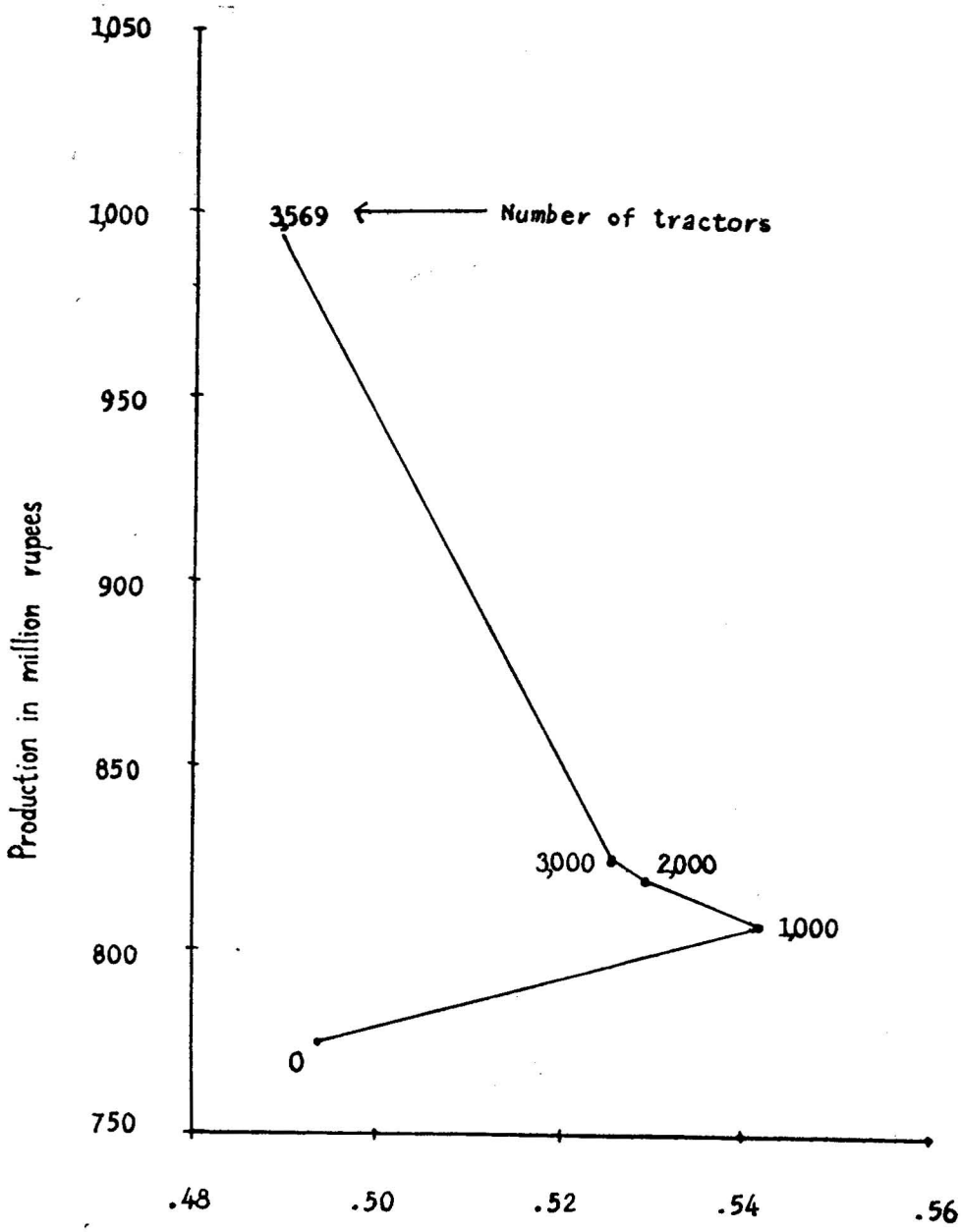

Figure 3—Trade off between Production and Equality

The second implication is that the relevant choice may not be between tractorisation and non-tractorisation, but between the different levels of tractorisation. Tractorisation may lead to both — growth and social justice with certain ranges, and may be detrimental beyond these levels.

The third implication is with respect to the increasing Gini index, or the declining equality index. The Uttar Pradesh Government is planning to introduce a large number of tractors within the next few years (Joshi 1972). This is likely to skew the rural income distribution, giving rise to considerable social and political costs (Frankel 1971). Peasants' agitations are a reality.

The fourth implication is often not recognized. Gurley (1971) emphasized that one fundamental characteristic of capitalistic development is, what he calls, "building on the best"—those who are best, or most efficient already, have the best opportunity and facilities to progress further, while those lagging behind initially may have neither. Tractorisation as presently occurring is an event of this nature. The incomes of the large farmers increase substantially, leaving the rest either unchanged or worse off. It is yet to be seen if some capitalist modification may be able to change the situation in this respect. (Note that tax and credit policies have not been analysed.) However, the need for positive government programmes to aid in reconciling conflicts of interest and in assisting those affected adversely is among the most important implications.

The fifth implication is incidental: that the tractors tend to hurt the middle peasants most tends to support Marx's thesis of the proletization of petty bourgeoisie. Class distinctions may become more distinct as a result of the modern technology unless public actions to counteract the adverse effects are taken.

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