

ABSTRACT

FARM MECHANIZATION AND AGRICULTURAL DEVELOPMENT: A CASE STUDY OF THE PAKISTAN PUNJAB

By

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This study investigated the economic and social implications of tractor mechanization in the Punjab province of Pakistan. It analyzed the influence of mechanization upon cropping intensities, yields per acre, cropping patterns, and the rate of return on investment in tractor and equipment. The social aspects include the influence of mechanization on employment of labor, tenurial relationships, and structure of farming. The method of study included (1) an analysis of the existing situation based on a field survey of a cross-section of tractor and bullock farms and (2) predictions based on a linear programming model developed for the wheat-cotton area in the Punjab. The study encompassed two systems of irrigation, canal irrigation only and canal plus tubewell irrigation. The canal plus tubewell irrigation included two cropping patterns, wheat-cotton and wheat-rice.

The results of the field survey and the programming model indicated that, on the whole, tractor as compared to bullock cultivation led to a cropping pattern relatively dominated by high value crops but had no significant influence on the yields per acre. The lack of influence on yields was because tractor farmers lacked the necessary auxiliary equipment and had made no significant change in the use of improved inputs and practices as compared to the bullock farmers.

The most important influence of the tractor mechanization had been on cropping intensity. There were, however, important differences due to the system of irrigation and cropping patterns. Without a tubewell, irrigation water remained a constraint, and therefore, tractor cultivation had no influence on cropping intensity. As expected, the rate of return on tractor mechanization on a 50-acre farm in this area was only 3 per cent. Where tubewell water supplemented canal irrigation, tractor cultivation led to substantially higher cropping intensities as compared to bullock cultivation. The difference was greater under the wheat-cotton compared to the wheat-rice cropping system. In the wheat-cotton area the rate of return on mechanization reached 46 per cent. The rate fell to 32 per cent when major inputs and outputs were priced at the world market level. The results of the programming model indicated that the thresher with bullock in the "without" tubewell area and the tractor with thresher in the tubewell were the most profitable forms of mechanization.

The tractor farms had relatively less family labor but used more hired labor per cultivated acre compared to the bullock farms. The structure of the hired labor on the tractor farms had changed, however, with less permanent and more casual labor being used.

Tractor mechanization led to large scale tenant ejection. The tractor farmers resumed land for self-cultivation; they also purchased and rented land to increase the operational size of their holding. The effects of tubewell mechanization on tenants and the farm size of the owner operator were very similar to those of tractor mechanization. It is hypothesized that not only the tractor but anything that increases the productivity of land and/or increases the land handling capacity of the landlord leads to the ejection of tenants.

Implications of this research for agricultural development policy in Pakistan are numerous. It was recommended that under the existing situation steps should be taken to encourage thresher instead of the tractor mechanization in areas without a tubewell. In the tubewell area where the adoption of the thresher instead of the tractor results in a smaller increase in productivity, the loss or gain needs to be considered against the likely benefits in the form of foreign exchange savings, improved off-farm linkages and, possibly, less tenant displacement. The agricultural extension service should place more emphasis on persuading the farmers to use a broader package of inputs and improved practices required to obtain optimum results from technological changes. Agricultural research can make very important contributions by shortening the growing seasons for wheat and especially for cotton, thus offsetting, at least partially, the speed advantage of the tractor in achieving higher cropping intensity. To reduce imbalanced growth between the tubewell and non-tubewell areas, diversion of some canal water from the former to the latter needs consideration.

Finally, several areas for further research have been identified. These are (1) to study ejected tenants and determine the process by which they have or have not been readjusted into the labor force; (2) to study whether there is a shortage of permanent hired labor and, if so, for what reasons; (3) to study the economic profitability of the tractor equipment and other improved inputs and practices; and (4) research towards developing short season, disease-resistant cotton varieties.