INTRODUCTION OF HIGH YIELDING

RICE VARIETIES: IMPLICATIONS FOR

THE HIRED AGRICULTURAL LABOUR MARKET IN BURMA

by

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A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
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ABSTRACT

With the dramatic increases in rice production following the use of high yielding varieties, interest has focused on factors affecting the supply of and demand for hired labour. Adopting the new rice technology results in increased use of total labour with much of this coming from unpaid family labour. The relative contribution of hired labour is declining.

This thesis examines the available data in order to determine the factors that affect the supply of and demand for hired labour in Burmese rice production. Knowledge of these supply and demand structural relationships could be of use to policy makers in developing measures that will help to solve the problems stemming from labour shortages during crop establishment. In this study structural supply and demand equations for hired labour are developed and the simultaneous equation method is used for estimating purposes.

The results from the study suggest that institutional arrangements and composite paddy prices should be of interest to policy makers in solving the labour shortages problem stemming from intensive cultivation. One policy option is for institutional programs to increase incentives for agricultural labour. Another is to narrow the gap between the official price and open market price of rice.

ACKNOWLEDGEMENTS

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INTRODUCTION

1.1 PROBLEM STATEMENT

Agriculture is the mainspring of the economy of Burma with over 65 percent of foreign exchange earnings derived from this sector. Accordingly, future economic development will also be based upon agriculture and agriculturally related industries. Rice, which constitutes more than half of the total sown area, is grown throughout the country under varying climatic conditions where sufficient water is available. Out of the total area sown to rice about 80 percent is in the rainfed area, 16 percent in the irrigation area and 4 percent in the upland area. Rice is not only the staple food of the entire populace of the country but is also the major export earning crop of Burma. More than half of its cultivated area was devoted to the production of rice, and of the annual production of about 4.9 million tons before the war about 2.9 million tons was exported. Historically, Burma was the world's leading exporter of rice for many years. The trend in rice exports was relatively stable up to the mid-1960's, but declined sharply in 1967 and reached a low point with a drastic situation in 1973, 1974 and 1975 (Table 1). The main reasons for this situation were the increase in domestic consumption and dampening in the growth of rice production.

The growth rate of paddy production in Burma over the 25 years before 1977 was sluggish, mainly because of the poor characteristics of local traditional varieties and inappropriate crop production techniques. The sown area did not change very much in the subsequent years. The yield per hectare grew slowly between 1950 and 1976 (1360 kg/ha to 1867 kg/ha) but an appreciable increase took place between 1977 and the mid-1980's (up to 3072 kg/ha in 1984). It is notable that short lived high yielding varieties had been developed to replace the local varieties at a rapid rate; a special high yielding paddy program was established in areas where conditions were favourable. In 1977 the first special high yielding paddy program was launched in two entire townships. The whole

Table 1

TOTAL AREA OF RICE, AREA OF H.Y.V., AVERAGE YIELD,
NATIONAL PRODUCTION, AND EXPORTS OF RICE (1950-84)

Year	Total Sown Area ('000) ha	Harvested Area ('000) ha	Average Yield (kg/ha)	National Production ('000) ton	H.Y.V. Sown ('000) ha	% Sown Area of H.Y.V.	Exports ('000) ton
1950	na.	3831	1360	5612	–	–	1530
1955	na.	3968	1480	5873	–	–	1728
1960	na.	4197	1620	6789	–	–	1749
1961	na.	4282	1570	6729	–	–	1591
1962	na.	4654	1650	7665	–	–	1715
1963	na.	4877	1600	7783	–	–	1686
1964	na.	4976	1710	8508	–	–	1456
1965	na.	4848	1660	8055	–	–	1342
1966	4989	4516	1470	6636	–	–	1128
1967	4936	4706	1650	7769	3.4	.07	546
1968	5021	4763	1680	8023	167	3.33	352
1969	4957	4671	1710	7985	134	2.70	561
1970	4977	4809	1700	8162	183	3.67	678
1971	4980	4764	1716	8175	178	3.57	811
1972	4864	4528	1626	7361	192	3.95	524
1973	5091	4911	1743	8559	238	4.67	133
1974	5179	4884	1757	8583	316	6.10	214
1975	5205	5069	1819	9221	433	8.32	288
1976	5079	4913	1867	9172	463	9.12	636
1977	5137	4864	1945	9462	522	10.16	690
1978	5245	5011	2095	10500	823	15.69	375
1979	5028	4442	2355	10448	1342	26.69	590
1980	5128	5040	2601	13107	2210	43.10	653
1981	5105	4809	2942	14147	2316	45.37	674
1982	4884	4662	3166	14758	2218	45.41	701
1983	4833	4661	3017	14062	2219	45.91	858
1984	4914	4674	3072	14357	2128	43.31	721

na. = data not available

Sources:

1. Harvested area, yield, and production; from F.A.O. Production Year Book (annual).
2. Total sown area after 1966 from report to Phithu Hluttaw (1985/86), Union of Burma.
3. H.Y.V. sown area for 1967 to 1981 from Alternative Method in Moving Cropping System Technology to Farmers by U Tin Hlaing, (1981), (p.6).
4. H.Y.V. sown area for 1982 to 1984 from Report to Phithu Hluttaw (1985/86), Union of Burma.
5. All data after 1983 from Report to Phithu Hluttaw, Union of Burma, (1986/87).

township program was extended to 82 townships in 1984. The area sown to H.Y.V. continued to increase rapidly from 9.1 percent in 1976 to 45.9 percent in 1983.

Storage and distribution of fertilizers and pesticides are under the control of Government agencies. Fertilizers are ideally distributed at the recommended rates for the rice crop. However, priority is given to the high yielding varieties growing in the area under the new rice technology program. The amount of fertilizer distributed does not reach the total requirement in some years.

New H.Y.V. technology required precise timing of ploughing, harrowing and transplanting. The recommended plant population of 320,000 hills per hectare was doublethat normally used by farmers. Transplanting of 25 to 30 day-old seedlings at the recommended high density required more transplanters than traditionally employed. Community organization provided added transplanters by reviving the age-old Burmese practice of helping each other through voluntary labour. High labour requirements for all aspects of rice cultivation were also met by increasing the remuneration of the village workers and recruiting transplanters from the urban area. Many nonfarm workers and police and army personnel originally from rural area came and assisted farmers in transplanting and harvesting.

It is noticeable that introduction of H.Y.V. and operation of the special high yielding rice program had brought some changes in traditional cropping practices and consequently changes in the intensity of labour use. Data assembled by Barker and Cordova (1978) showed that labour input per hectare for rice production was higher for H.Y.V. than for traditional varieties on the order of 10 to 50 percent.[1]

An increase in the index number of labour used in rice production from 331 in 1963 to 400 in 1983[2] indicates that the demand for labour in rice production has risen

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[1]Hayami, T. and M. Kikuchi, Asian Village Economy at the Crossroads: An Economic Approach to Institutional Change. (Tokyo: University of Tokyo Press, 1981), p.57.

[2]F.A.O. Production Year Book (annual).

Table 2

LABOUR UTILIZATION IN RICE PRODUCTION FOR SELECTED YEARS

Year	Operator and Unpaid Family Labour	Hired Farm Labour	Total Labour Used	Relative Contribution of Hired Labour to Total Labour Used
	-- '000 man-day equivalents --			(%)
1960	100401	178490	278891	64.00
1964	119036	211619	330655	63.99
1968	117304	205213	322517	63.63
1972	112185	195616	307801	63.55
1976	133241	227647	360888	63.08
1980	159359	239272	398631	60.02
1983	156191	233461	389652	59.51

Source:

Data generated from Table 1 and Table 5.

sharply in recent years. From Table 2 it can be observed that the cultural practices associated with the new technology and its higher yields have resulted in an increase in total labour used with greater fluctuations in the use of hired labour relative to operator and unpaid family labour. Table 2 also shows that the relative contribution of hired labour to total labour used in rice production has declined from 64 percent in 1960 to 59.5 percent in 1983. Although benefits arising from high yielding varieties are a net addition to Burmese rice production, problems also arise regarding the increased demand for labour during the crop establishment and harvesting period. Even though State and Party Organizations have provided additional manpower by means of organizing people to participate in critical phases of rice productionas voluntary labour when labour shortages occurred[3], the problem of insufficient labour is of major concern if the longer term benefits of H.Y.V. technology are to be captured for the Burmese economy.

The problem to be studied in this thesis is the insufficient supply of hired labour available from the labour market to cope with the dramatic increase in rice production following the use of high yielding rice varieties.

1.2 OBJECTIVES OF THE STUDY

Given the shortage of hired agricultural labour to meet the increased demand for labour resulting from the introduction of high yielding rice varieties, this study will attempt to extend the knowledge of the agricultural labour market in Burma and to identify ways of dealing with labour shortages for rice production.

The specific objectives are:

1.   to obtain statistical estimates of the demand and supply functions for hired agricultural labour in rice production, and

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[3]Khin Win, and Nyi Nyi. "The Special High Yielding Varieties Rice Program", Paper presented at the International Symposium on Cropping Systems at the International Rice Research Institute, Philippines in March 1980.

2.   to utilize the information gained from the statistical analysis to derive policy implications for dealing with labour shortages.

1.3   GENERAL PROCEDURES

This study attempts to estimate the structural demand and supply relations for hired labour used in rice production using time series data for the period 1960-1983. The analysis is aggregative in that demand and supply relations are estimated for the total hired labour force rather than for individual farms. The research concerns itself with the man-day equivalents of hired labour employed in rice production and the wages they earn. It does not consider the changes in quality of the labour resource, nor changes in the hours worked by the individual.

The price of hired farm labour and the quantity employed are assumed to be mutually determined. Hence, in estimating the structural equations, a simultaneous equations method is necessary in order to avoid inconsistency bias. Two-stage least square estimating procedures are therefore applied. Long-run elasticities are estimated in this study, using the concept of a distributed lag hypothesis. The parameter estimate of this variable implies a coefficient of adjustment which expresses the relationship between short-run and long-run elasticities.

1.4   ORGANIZATION OF THE REMAINDER OF THE THESIS

In order to develop a better understanding of the labour market in agriculture, the background of the problem in terms of rice production practices and labour utilization, is introduced in chapter two. In the third chapter the theoretical background for the economic model formulated for the relationship between supply of and demand for hired labour is developed. Statistical results are discussed in the fourth chapter. In the final chapter general economic implications of the statistical results and implications of the structural elasticities are discussed, followed by policy implications. Suggestions for future research are also presented to extend the investigation of the Burmese agricultural labour market.

Chapter 2

BACKGROUND OF THE PROBLEM

In this chapter the general characteristics of the agricultural labour force and the changing economic forces in the agricultural labour market are summarized. This information will be helpful as a basis for developing the economic model and understanding the results from the statistical analysis.

2.1   GENERAL CHARACTERISTICS OF THE AGRICULTURAL LABOUR FORCE

This section considers the agricultural labour force from two perspectives. First are the demographic characteristics of the total labour force as measured by available data sources. Second are the changes that are taking place in the hired agricultural labour force following the introduction of the high yielding varieties of rice.

2.1.1 ACTIVE LABOUR FORCE IN AGRICULTURE

A reasonable analysis of the agricultural labour force should reflect: (a) the rate of participation by individuals in the economic labour force of the community; (b) the age, sex, and skill structure of the labour force and (c) the apportionment of labour inputs between strictly defined agricultural activities and other activities that are not directly related to agricultural production.

Table 3 presents data on the total population, population in agriculture, economically active population and economically active population in agriculture for the period 1960-1983. These data indicate that although there were increases in total agricultural population, participation of economically active population in agriculture decreased considerably during the ten year period 1960-1970 and increased slightly thereafter in absolute terms. In relative terms, economically active population in agriculture has declined steadily from 73 percent in 1960 to 50 percent in 1983.

It can be expected that non-agricultural jobs are either more attractive from the standpoint of cash earnings and/or have greater security of employment. Although

Table 3

TOTAL POPULATION, AGRICULTURAL POPULATION AND ECONOMICALLY ACTIVE POPULATION IN AGRICULTURE

Year	Population		Economically Active Population		% in Agriculture
	Total	Agriculture	Total	Agriculture	
		- '000 ---			
1960	20662	15178	10571	7745	73.3
1965	24732	15815	11181	7144	63.9
1970	27000	16529	11898	7088	59.6
1975	29800	17351	12880	7154	55.5
1980	33313	18276	14084	7294	51.8
1983	37949	18860	14936	7417	49.7

Source:

F.A.O. Production Year Book (annual).

supporting data are not available, it is very likely that landless labourers and unpaid family labourers are the most important departures from the agricultural labour force, while most of the land holding farmers are unlikely to give up the right of farm ownership resulting from the Land Nationalization Act (1950).

Although the agricultural population has increased over time, the economically active population in agriculture decreased for the period 1960-1970, and increased slightly during the period 1970-1983, but at a much slower rate than total population or agricultural population. It is clear that the declining participation of the rural labour force in agriculture is in considerable measure responsible for the declining hired labour available to agriculture.

Changes in the age, sex and skill structure of the labour force are also important in determining the potential labour force in agriculture. Unfortunately, supporting data to analyze these factors were not available.

2.1.2 CHANGES IN THE HIRED AGRICULTURAL LABOUR FORCE

In this section, the discussion deals with the changes in the hired agricultural labour force in rice production. Data for hired labour in rice production are analyzed from the perspective of factor payments and the contribution of the High Yielding Rice Varieties to total sown area of rice.

For a better understanding of changes in the farm labour force, it is necessary to describe the characteristics of farming practices in Burma. Size distribution of farms in agriculture can be seen in Table 4. A significant characteristic of farming practices in Burma is small farm size. Farms under 20 acres account for over 97 percent of all farms and 85 percent of total farm area in Burma. This size of farm is still small and is kept from growing by the Land Nationalization Act (1950) which provided for government ownership of all lands. Average land holding per farm family is 5.65 acres. For holders of small farms the following considerations are relevant to decisions on input of labour. Given the anticipated amount of labour input required for a particular agricultural

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Table 4

SIZE DISTRIBUTION OF FARMS, 1980/81

| Size of Holding | Number | | Percentage | |
	Peasant Families	Acres	Peasant Families	Acres
Under 5 acres	2621785	6074310	61.1	25.07
5 to 10 acres	1053768	7506839	24.59	30.99
10 to 20 acres	498153	7090891	11.62	29.29
20 to 50 acres	109127	3014992	2.55	12.45
50 to 100 acres	1929	127934	0.05	0.53
100 acres and above	610	410186	0.01	1.69

Note: 1 hectare = 2.47 acres

Source:

Burma, Ministry of Planning and Finance. Report to Phithu Hluttaw (Rangoon), 1982/83, pp. 50.

enterprise, a farmer may choose (1) to work at it himself, (2) to have available family members do some of thework, (3) to have hired workers take over a part of the work, and/or (4) to make use of a labour pool arrangement in the community whereby labour is exchanged among farm families according to individual needs of the proprietors. The third choice entail payment of wages, whereas the others do not.

Table 2 (Chapter 1) shows that the man-day equivalents of total farm labour, farm operator and unpaid family labour, and hired labour used in rice production increased by 40, 56, and 31 percent respectively during the 1960-83 period. This increase is consistent with the increased labour requirements for the cultural practices associated with the new technology and its higher yields. Although in absolute terms the increase has been about the same in both groups of labour, the percentage contribution of the hired labour component has been decreasing relative to the operator and unpaid family labour component.

2.2 CHANGING ECONOMIC FORCES IN THE AGRICULTURAL LABOUR MARKET

In this section the discussion centres around technological change in the Burmese rice industry and the economics of new technology.

2.2.1 TECHNOLOGICAL CHANGE IN THE BURMESE RICE INDUSTRY

The term technical change is used to refer to changes in techniques of production at the firm or industry level that result both from research and development and from learning by doing. The term technological change is used to refer to the result of the application of new knowledge of scientific, engineering, or agronomic principles to techniques of production across a broad spectrum of economic activity.

Before new technology can be applied in agriculture this new technology has to be developed and made available to farmers. There have been many attempts directed towards the development of agricultural technology. For example, in 1967, high yielding rice varieties released by the International Rice Research Institute (IRRI) were first introduced

to Burma and research efforts were intensified to develop new technologies suitable for the Burmese environment. Closer links were established with IRRI for both collaborative research and training of research scientists. In 1975/76 a pilot rice production program known as the Whole Township Rice Production Program was launched in lower Burma, based on a package of new rice technology[4]. Essentially the new technology package consisted of the planting of modern varieties, increased use of fertilizer, improved transplanting methods with a high plant density, and better weed control practices.

Efforts to encourage farmers to adopt new technology have also been increased through agricultural extension and training in vocational agriculture. Production camps were established to serve as distribution centres for seed and fertilizer and meeting places and training camps for farmers[5]. Although the increase in technology cannot be expressed explicitly, the dramatic increase in rice production that is almost totally attributable to yield increases with little or no change in planted area is a significant result of adopting new technology.

2.2.2 ECONOMICS OF THE NEW TECHNOLOGY

During the initial period of the Special High Yielding (S.H.Y.) Rice Program, there appears to have been considerable pressure on farmers in the program area to adopt the new technology. However, in subsequent years, adoption seems to have been largely voluntary, often enthusiastically so. Certainly, the new technology was economically attractive to farmers.

Table 5 shows that even if output was entirely valued at official paddy prices, the gross margin from using H.Y.V. is more than twice that of local varieties. It is evident

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[4]For more detail, see "The Impact of a Special high yielding Rice Program", IRRI Research Paper Series No. 58, Los Banos: IRRI, 1981.

[5]Hlaing, Tin. "Alternative Methods of Moving Cropping System Technology to Farmers", Rangoon: Agricultural Corp., 1981.

Table 5

COSTS AND RETURNS OF H.Y.V. AND TRADITIONAL TECHNOLOGY, 1980-81

Items	Units	Local		H.Y.V.	
Material Costs: Kyats (percent)					
Seeds	Kyats	30	(3.7)	44	(3.8)
Fertilizer	Kyats	20	(2.5)	76	(6.6)
Manure	Kyats	26	(3.2)	67	(5.8)
Pesticides	Kyats	1	(0.1)	7	(0.6)
Total Material Costs	Kyats	77	(9.5)	194	(16.8)
Labour Costs:					
Land preparation	Kyats	218	(27.1)	273	(23.7)
Pulling seedlings and transplant	Kyats	150	(18.6)	183	(15.9)
Weeding	Kyats	16	(2.0)	30	(2.6)
Crop maintenance	Kyats	32	(4.0)	89	(7.7)
Harvesting and threshing	Kyats	167	(20.7)	201	(17.4)
Total Labour Costs	Kyats	582	(72.4)	776	(67.4)
Cost of Cattle	Kyats	145	(18.0)	182	(15.8)
Total Costs	Kyats	804	(100.0)	1152	(100.0)
Average Yields	kg/ha	2200		3556	
Gross Returns	Kyats	946		1529	
Gross Margin	Kyats	142		377	

Note: Figures within parenthesis are percent of total costs.
Cost means money value in terms of Kyats, (Burmese currency).
Canadian $1 = 5.5 Kyats (approximate) in 1983.
Costs of cattle means the cost of hiring the cattle used in land preparation and threshing.

Source:

S.K. Jayasuriya, "Technical Change and Revival of the Burmese Rice Industry", The Developing Economies, Vol. 22. 1984, pp. 148.

that the new technology is more profitable than local technology. The cultural practices associated with the new technology and its higher yields require higher labour use. Data assembled by Barker and Cordova (1978) showed that labour input per hectare for rice production was higher for H.Y.V. varieties than for traditional varieties on the order of 10 to 50 percent[6]. In a paper by Khin Win and Nyi Nyi the point was made that more labour was demanded as a result of adopting the new rice technology. More specifically,

> The new technology needed more labour in such processes as transplanting, weeding, fertilizer application and harvesting. The most labour consuming process in the whole rice cropping system was transplanting. The plant population had increased more than two fold from 60,000 to 130,000 planting hills per acre so that the work required about double the number of transplanters.[7]

There is substantial increase in labour use (about 35 percent), but much of this has come from the farm family. The rise in labour demand has led to reports of labour shortages, particularly during crop establishment and harvesting periods. While the income of both farm families and hired labourers has increased with the new technology, the farm family obtained a greater share. It can be seen from Table 6 that most of the additional benefits from new technology adoption have accrued to the farm families.

It can also be noted that the increase in income to farm families arising from the adoption of the new technology also increased the labour demand for both hired and unpaid family labour.

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[6]Hayami, and M. Kikuchi. Asian Village Economy at the Crossroad: an Economic Approach to Institutional Change, (Tokyo: University of Tokyo Press, 1981) p. 57.

[7]Khin Win and Nyi Nyi. "Factors Contributing to Increased Rice Production in Burma", Agriculture Corporation, Burma, 1980, pp. 7.