

Rural Women and High Yielding Variety Rice Technology

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The absence of gender analysis in the vast body of literature on the socio-economic implications of the new agricultural strategy reflects uncritical acceptance of the assumption that the household is a unit of converging (perhaps even homogenous) interests, wherein the benefits or burdens of technological change will be shared equally by all members. This paper questions this assumption, and focuses attention on some of the implications of HYV rice technology on women of different socio-economic classes. Consideration of the impact on women of the poorest households in particular is seen as important, because many of these women are the primary or sole income-earners in their families and their access to employment and income is crucial for their own and their families' survival.

The primary thrust of the paper is on a quantitative assessment of the impact of HYV rice on the nature and extent of involvement in field-related work of women and men belonging to different classes of households, in three principal rice-growing states, viz. Andhra Pradesh, Tamil Nadu and Orissa. The paper is divided into four sections. Section II contains an empirical analysis of the impact of HYV rice on female labour use in field-related agricultural work. The impact is disaggregated by different categories of labour (family, permanent and casual) and by different farm size groups. Section III brings together illustrative material which throws light on the noted or expected implications of HYV rice technology on women's overall work burden (including the burden of non-field related agricultural and other work) and on their income and consumption. A brief summary and concluding comments are presented in Section IV.

I

Introduction

THERE is today a vast body of literature on the socio-economic implications of the new agricultural technology (high yielding variety (HYV) seeds, mechanical equipment, etc) in India.¹ However, the focus of the bulk of this literature is on inter-household differences (by socio-economic class) in the impact of the new technology, while possible gender differences have received little attention. The absence of a gender analysis in such studies reflects an uncritical acceptance of the assumption that the household is a unit of converging (perhaps even homogeneous) interests, wherein the benefits or burdens of technological change will be shared equally by all members.

The present paper questions this assumption. It focuses on some of the implications of the HYV rice technology on women of different socio-economic classes. Underlying the focus on women rather than on the household alone as the unit of analysis is the recognition that male and female members of a given class of household can be affected differentially by technological change. Underlying the separation by socio-economic class is the further recognition that the effect of a given change on women of different classes is likely to differ. In particular, a consideration of the

impact on women of the poorest households is seen as important, because many of these women are the primary or sole income earners in their families and their access to employment and income may be crucial for their own and their families' survival.

Gender differences in the impact of technological change in agriculture, within each socio-economic class, may be expected to stem from initial differences between women and men in:

- (a) the extent and nature of their involvement in agricultural field work;
- (b) the extent and nature of their involvement in non-field work, including cattle rearing, domestic work and child care, etc; and
- (c) the extent of their control over and pattern of distribution of household earnings and of consumption items.

These initial differences would themselves stem from historical, social and cultural factors which, in addition to the economic, govern the norms *vis-a-vis* the existing sexual division of labour, both within the home and outside, in any community. These norms are manifest within the home in women's primary and often sole responsibility for housework and child care, and outside the home in women being confined to certain agricultural

tasks and being barred from others. Technological change impinging on such initial differences in labour use are likely to lead to different implications for women and men in their access to employment in agricultural and non-agricultural work, and in their overall work burden. Further, to the extent that there are inequities in the control over and distribution of household earnings and household expenditure between women and men, any income/consumption impact of technological change may be expected to vary by gender.

In the available literature for India, all three aspects of the gender implications of technological change in rice cultivation, namely for women's field-related work, their non-field work, and their access to income or consumption items, have largely been neglected. Among the rare exceptions are the studies of Harriss (1977a), Chinnappa and Silva (1977), and Mencher and Saradamoni (1982). Both Harriss, and Chinnappa and Silva provide some quantitative information on the effect of HYV rice on female labour use in two districts in the State of Tamil Nadu. Mencher and Saradamoni's analysis is still ongoing. So far their work provides some qualitative information on women's work in rice cultivation, and some useful quantification of the relative contributions of women and men to household income in Kerala.

TABLE 1: NUMBER AND PERCENTAGE OF FARMS BY FARM SIZE GROUPS AND BY ADOPTION OF HYV RICE

Farm Size (ha)	No and Percentage of Farms		
	AP (1974-75)	TN (1976-77)	Orissa (1977-78)
LE 1.00	14 (14.1)	23 (26.4)	24 (14.3)
GT 1.00 — LE 2.00	14 (14.1)	23 (26.4)	61 (36.3)
GT 2.00 — LE 4.00	26 (26.3)	26 (29.9)	59 (35.1)
GT 4.00	45 (45.4)	15 (17.2)	24 (14.3)
All farms	99 (100.0)	87 (100.0)	168 (100.0)
Farms with some area under HYV rice	62 (62.6)	69 (79.3)	73 (43.4)

Note: Figures in brackets give the percentages to total farms in the sample.

TABLE 2: LABOUR USE BY TYPE OF LABOUR: ANDHRA PRADESH, TAMIL NADU AND ORISSA

Type of Labour	Mean Labour Time			Percentage Labour Time		
	(hrs per sown hectare)			AP	TN	Orissa
	AP	TN	Orissa			
Female family labour	37.7	87.8	13.7	2.1	4.5	0.9
Female casual labour	811.8	968.9	266.4	45.9	49.5	17.1
Male family labour	314.0	294.9	600.0	17.8	15.1	38.5
Male casual labour	447.4	464.3	504.0	25.3	23.7	32.4
Male permanent labour	140.7	125.5	151.9	8.0	6.4	9.8
Exchange labour*	—	14.2	18.4	—	0.7	1.2
Gift labour	—	—	1.1	—	—	0.1
Child labour	16.5	2.9	1.1	0.9	0.1	0.1
All labour	1768.1	1958.5	1556.6	100.0	100.0	100.0

Note: *This includes both male and female exchange labour.

Tamil Nadu and West Bengal, but specific information on the impact of HYV rice has yet to emerge from their analysis.

In the present paper, I seek to fill some of the existing lacunae in research. My primary thrust is on a quantitative assessment of the impact of HYV rice on the nature and extent of involvement in field-related work, of women and men belonging to different classes of households, in three of the principal rice-growing States of India, viz, Andhra Pradesh, Tamil Nadu and Orissa. Unfortunately, my data do not enable me to quantify the impact on women's non-field related work or on their income or consumption. At the same time these aspects cannot be ignored if we are to gain a more comprehensive understanding of the gender implications of the new rice technology. A consideration of their non-field related work in conjunction with their work in the fields, for instance, is important because the two together determine the impact on women's total work burden. A consideration of the issue of income and consumption effects is important because an increase or decrease in work burden may not always be accompanied by a similar increase or decrease in women's access to the earnings from this work. Given this, I have sought to bring together related

literature to bear on these two aspects. In addition to studies relating to India, illustrative material from other Asian countries has also been used to provide pointers, along with *a priori* reasoning to suggest possible directions in which the effects may be expected to lie.

The paper is divided into four sections. Section II, which follows, contains an empirical analysis of the impact of HYV rice on female labour use in field-related agricultural work. The impact is disaggregated by different categories of labour (family, permanent and casual) and by different farm size groups. This section is divided further into four sub-sections: (1) gives a description of the data base; in sub-section (2) some hypotheses relating to the likely impact of HYV rice on labour use are spelt out; sub-section (3) indicates the procedure used for estimating this impact; and in sub-section (4) the empirical results are discussed. Section III brings together illustrative material which throws light on the noted or expected implications of the HYV rice technology on women's overall work burden (including the burden from non-field related agricultural and other work), and on their income and consumption. Section IV contains a brief summary and concluding comments.

II

Impact of HYV Rice on Labour Use in Fields: An Empirical Analysis

DATA BASE

The major rice-growing areas of India lie in the southern and eastern parts of the country. For the present analysis, as mentioned, sample farms from three of the main rice-growing States have been chosen, two of which — Andhra Pradesh and Tamil Nadu — all in the southern belt, and the third — Orissa — in the east.² Andhra Pradesh (AN) and Tamil Nadu (TN) represent the relatively more agriculturally advanced States: much of the rice cultivation here is under irrigated conditions; they are also among the principal adoptors of HYV rice in the country.³ Orissa provides an interesting contrast. It represents an agriculturally backward part of the country with a low adoption of HYV rice and with rice cultivation being undertaken primarily under rainfed conditions. Together, the three States would give a broad picture of the conditions under which rice is grown in the country and of the likely impact of HYV rice on labour use in general, and on female labour use in particular.

The data used for the analysis were collected under the "Comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops" by the Agricultural Universities of the three States respectively, for the Directorate of Economics and Statistics, New Delhi. The AP sample consists of 99 farms and relates to the crop-year 1974-75; the TN sample has 87 farms and relates to 1976-77, while the Orissa sample has 168 farms and relates to 1977-78.⁴

The average percentages of gross cropped area irrigated in the AP, TN and Orissa samples come to 67.4 per cent, 78.8 per cent and 27.6 per cent respectively. While in AP and TN, 89 per cent and 97 per cent of the farms have irrigation at least for some part of the year, in Orissa 64 per cent of the sample farms are totally un-irrigated. In all three States, irrigation is primarily through surface irrigation works: 81 per cent of the irrigated sample farms in AP, 68 per cent in TN and 80 per cent in Orissa are irrigated solely by canals and tanks.

SOME HYPOTHESES

On *a priori* grounds we would expect the adoption of HYV rice to increase

TABLE 3: PERCENTAGE USE OF FEMALE LABOUR AND TOTAL MALE LABOUR* BY OPERATIONS

Operation	Andhra Pradesh				Tamil Nadu			
	Female Labour			Male Labour Total	Female Labour			Male Labour Total†
	Family	Casual	Total		Family	Casual	Total†	
Ploughing**	1.3	1.2	1.2	15.0	0.1	0.0	n	30.6
Sowing/Transplanting	19.6	31.2	30.7	12.3	9.9	19.2	18.4	6.1
Manuring	9.8	0.4	0.8	8.8	4.3	2.3	2.4	4.4
Interculture	33.4	30.8	31.0	10.4	42.9	38.7	39.1	8.4
Irrigation	0.8	n	0.1	11.9	3.5	n	0.3	14.4
Plant protection	0.3	n	n	1.3	0.0	n	n	0.5
Harvesting	15.9	28.3	27.7	14.7	18.1	32.7	31.5	20.9
Threshing	17.0	7.9	8.3	23.3	21.0	6.8	8.0	14.0
Miscellaneous	1.9	0.1	0.2	2.3	0.1	0.3	0.3	0.6
All operations	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: * For details of the operation-wise use of male labour by type see Agarwal (1981b).

** 'Ploughing' also includes other subsidiary functions associated with seed-bed preparation.

† Does not include exchange labour.

n = negligible.

the overall requirements of labour in the field, relative to the traditional rice varieties, for a number of reasons. Firstly HYV cultivation is usually accompanied by a new 'package' of practices requiring greater care and a more intensive use of labour. For instance, HYVs are usually transplanted, while traditional varieties are often sown through the broadcast method;⁵ HYVs usually require more intensive weeding especially where there is a greater associated use of fertilisers and manure; and they would need greater care and time for irrigation and water management. Secondly, due to their positive crop-yield effects, relatively more labour would be needed with HYVs for harvesting and threshing. Thirdly, many (though not all) HYVs of rice are of shorter duration than the traditional varieties: this would enable the farmer to increase cropping intensity which would then increase labour requirements over the crop-year. (Of course, to the extent that weedicides and mechanical equipment accompany the introduction of HYV rice, some of the positive labour demand effects would tend to get negated.)

However, in what ways this overall increase in labour requirements will affect the demand for different types of labour is a more complex and largely neglected issue. As noted, labour has been divided broadly into three types: family, casual (*viz.* that hired for specific tasks on a seasonal or even a daily basis), and permanent (*viz.* that hired on a long term contract, usually extending over a year or more). Each type of labour has further been divided into male, female and child categories.

By and large, we would expect the introduction of HYV rice to increase the requirements of casually hired labour, because of the higher peak labour needs for transplanting, weeding and

harvesting. Insofar as these are also the operations in which female labour is primarily used, we would expect an increase with HYVs in the use of female casually hired labour, although whether or not this increase is equivalent to greater than, or less than that for male casual labour would depend on the degree to which women are preferred over men for these tasks, and on the supply of female casual labour in the region.

The impact of HYV rice on female family labour use is much more difficult to predict. This is because while HYV rice is likely to increase the overall requirements for labour on the farm, it is also likely to increase family income. On the one hand, the increase in labour needs would act as an inducement for the more intensive use of the labour of family women on the farm. On the other hand, there would be a tendency for the women to withdraw from manual work in the fields due to family prestige considerations, if the family can now afford to use hired help instead. (A negative association between the family's socio-economic status and the involvement of family women in manual field work has been noted, for instance, by Epstein [1962, 1973] in Karnataka, and by Vanamala [1982] in Andhra Pradesh.) The final outcome would be the net result of the two contradictory tendencies: the positive labour requirement effect and the negative effect of a rise in income on female family labour supply.

Finally, the demand for permanent labour may be expected to rise with the adoption of HYV rice for a number of reasons: (a) because of the higher peak requirements under HYV cultivation it would be important to ensure a certain minimum availability of labour on the farm to reduce the risk of labour not being available on

a casual basis, when required, during the peak season; (b) any increase in cropping intensity accompanying HYV cultivation would raise the overall demand for labour over the year, and make it more worthwhile to employ the services of permanent workers; and (c) there would be an increased need for close supervision and management, both in specific operations such as irrigation, and in general, for the larger numbers of casually hired labourers that would usually be employed under HYV cultivation.

However, in order to clearly identify these possible effects of HYV rice on the level and pattern of labour use on the farm, we need to separate out the effects of any additional factors which might also impinge on this aspect, such as farm size, the percentage of cropped area irrigated, the cropping pattern and the level of farm mechanisation. Among these, controlling for farm size is especially important since farm size has been noted to be (a) related negatively to total labour use in general and family labour use in particular; (b) related positively to hired labour use — casual and permanent (e.g. see Agarwal, 1983). In other words, many of the effects of farm size and HYV adoption would tend to lie in opposite directions, and if the farm size effects are not controlled for, they are likely to be confused with and may mask the HYV effects. Taking account of farm size is also of interest in the context of female family labour: in a social setting where women's participation in manual work outside the home is seen as lowering the family prestige, we would expect that in households that can economically afford it, women would not be engaged in such work, and farm size which serves as a broad proxy for the family's eco-

TABLE 4.1: ANDHRA PRADESH — MEAN USE OF LABOUR BY RICE VARIETY, FARM SIZE AND TYPE OF LABOUR

Farm size (ha)	No of Farms	Female Labour			Male Labour				Child Labour			Ex-change Labour	Total Labour	Bullock Pair	Tractor (hrs/ha)
		Family	Casual	Total	Family	Casual	Perma- nent	Total	Family	Casual	Total				
Labour Use on Area under Traditional Rice															
LE 1.00	10	121.6	600.4	721.4	422.1	329.3	0.0	751.4	4.2	0.0	4.2	—	1477.0	248.6	0.0
GT 1.00-LE 2.00	9	38.4	577.7	616.1	468.4	387.6	0.0	856.0	0.3	17.6	17.9	—	1490.0	273.1	0.9
GT 2.00-LE 4.00	19	59.1	658.2	717.3	401.2	300.1	41.0	742.3	1.3	14.0	15.3	—	1474.9	193.7	9.1
GT 4.00	29	28.7	589.6	618.3	271.1	273.3	184.4	728.8	3.0	24.5	27.5	—	1374.6	255.4	0.3
All	67	52.4	609.1	661.5	357.0	304.6	91.5	753.1	2.3	16.9	19.2	—	1433.8	239.3	0.3
Labour Use on Area under HYV Rice															
LE 1.00	7	20.3	486.8	507.1	365.3	264.2	2.1	631.8	0.0	2.5	2.5	—	1141.4	167.9	1.1
GT 1.00-LE 2.00	9	35.0	576.3	611.3	291.0	396.1	15.3	702.4	1.5	18.5	20.0	—	1333.7	144.8	1.2
GT 2.00-LE 4.00	16	26.2	675.2	701.4	254.9	310.4	129.6	694.9	0.4	2.8	3.2	—	1399.5	201.1	0.7
GT 4.00	30	11.0	805.0	816.0	120.9	295.8	230.9	647.6	0.0	14.7	14.7	—	1478.3	151.7	2.7
All	62	19.4	702.4	721.8	207.8	310.6	147.6	666.0	0.3	10.8	11.1	—	1398.9	165.3	1.8
Difference† (all farms)	—	-33.0*	+93.3	+60.3	-149.2**	+6.0	-56.1*	-87.1	-2.0	-6.1	-8.1	—	-34.9	-74.0*	+1.5*

Notes: LE = Less than or equal to; GT = greater than.

† Labour use under HYV rice minus labour use under traditional rice.

In accordance with the two-tailed test: *denotes significance at the 5 per cent level; **denotes significance at the 1 per cent level.

One female labour unit has been taken as equivalent to one male labour unit, and one child labour unit as equivalent to 1/2 a male labour unit.

TABLE 4.2: TAMIL NADU — MEAN USE OF LABOUR BY RICE VARIETY, FARM SIZE AND TYPE OF LABOUR

Farm size (ha)	No of Farms	Female Labour			Male Labour				Child Labour			Ex-change Labour	Total Labour	Bullock Pair	Tractor (hrs/ha)
		Family	Casual	Total	Family	Casual	Perma- nent	Total	Family	Casual	Total				
Labour Use on Area under Traditional Rice															
LE 1.00	12	63.0	786.4	849.4	320.0	360.6	12.8	693.4	0.0	0.0	0.0	50.0	1592.8	325.6	0.0
GT 1.00-LE 2.00	17	78.6	641.6	720.2	313.8	257.8	90.5	662.1	4.8	3.4	8.2	45.3	1435.8	253.3	0.2
GT 2.00-LE 4.00	22	50.8	644.5	695.3	244.6	275.7	130.9	651.2	0.8	0.0	0.8	0.9	1348.2	301.7	0.1
GT 4.00	8	1.3	501.0	502.3	21.4	308.2	247.7	577.3	0.0	0.0	0.0	0.0	1079.6	186.4	4.0
All	59	54.6	653.1	707.7	249.6	292.2	111.1	652.9	1.7	1.0	2.7	23.6	1386.9	277.0	0.6
Labour Use on Area under HYV Rice															
LE 1.00	20	95.1	754.1	849.2	270.3	390.0	0.0	660.3	0.5	0.0	0.5	1.8	1511.8	296.3	0.0
GT 1.00-LE 2.00	17	61.0	650.9	711.9	348.6	350.2	121.5	820.3	7.4	0.0	7.4	15.6	1555.2	286.2	0.1
GT 2.00-LE 4.00	20	73.7	666.6	740.3	282.6	343.8	133.9	760.3	1.2	0.5	1.7	3.5	1505.8	325.3	0.1
GT 4.00	12	0.8	552.4	553.2	51.2	354.4	241.3	646.9	0.0	0.0	0.0	1.1	1201.2	210.6	0.4
All	69	64.1	668.2	732.3	255.0	360.6	110.7	726.3	2.3	0.1	2.4	5.6	1466.6	287.3	0.1
Difference† (all farms)	—	+9.5	+15.1	+24.0	+5.4	+68.4	-0.4	73.4	+0.6	-0.9	-0.3	-18.0	+79.7	+10.3	-0.5

Notes: LE = Less than or equal to; GT = Greater than.

† Labour use under HYV rice minus labour use under traditional rice.

In accordance with the two-tailed test: *denotes significance at the 5 per cent level; **denotes significance at the 1 per cent level.

One female labour unit has been taken as equivalent to one male labour unit; and one child labour unit as equivalent to 1/2 male labour unit.

conomic position would thus be related inversely to female family labour use.

The impact of irrigation may usually be expected to lie in the same direction as that of HYVs insofar as it too would tend to increase the requirements for labour time, both at the crop-level and for the farm as a whole (the latter by enabling a higher cropping intensity).⁶ It is possible, however, that the impact of the irrigation variable, over and above the impact of HYV rice (which is usually grown under irrigated conditions), may be slight.

The effect of the cropping pattern on labour use would be important to consider where there are significant differences between farms in the crops grown over the year. This is because certain crops are (a) more labour intensive than others and (b) likely to use more of certain types of labour than others.⁷ The level of mechanisation on the farm, especially the use of tractors, is again a factor that can affect the level and pattern of labour use.⁸

In the analysis undertaken here, I have looked at the impact of HYV rice on the use of different types of labour after taking account of farm size and the percentage area irrigated. There were few noteworthy cropping pattern differences among the sample farms for any of the three States studied, rice being the predominant crop in all the farms, and on average accounting for 69.4 per cent of gross cropped area in AP, 67.6 per cent in TN and 76.1 per cent in Orissa. Also, the percentage area under *all* rice was found to be correlated rather highly with the percentage area under HYV rice in all three samples. Hence, this variable was not separately considered. The mechanisation variable again, is of limited importance in the present context, because of the low levels of machine use among the sample farms. The Orissa sample, for instance, has no tractor users, while in AP and TN only 25 per cent and 10 per cent of the sample farms, respectively, use tractors, usually solely for ploughing. Also, when tractor use was included as an explanatory variable, it was found to have insignificant explanatory power. Hence it was dropped from the final analysis. Irrigation pumpsets are the only other type of machine used, and again on very few farms.

Finally, it may be mentioned here that in the choice of the explanatory variables, the emphasis is on demand factors, on the assumption that a higher quantum of labour, especially

of hired labour, would generally be forthcoming if there were a higher demand for it. Also, information on factors such as caste, which may affect the supply of labour, is not available from my data source. One other limitation of the data is the absence of information on the number of hired labourers employed on the farms; hence the measurements have to be confined to labour time effects.

ESTIMATION PROCEDURE

A comparison has first been made of the mean use of labour time per ha, disaggregated by different types of labour, on the land under traditional varieties (TV) of rice and that under HYV rice, for farms divided into four different size groups (specified further on), and the statistical significance of observed differences in means (for all sizes of farms taken together) has been tested.

Subsequently, a multiple regression analysis has been undertaken. In this, a series of equations have been specified in the log-linear form, with each type of labour, measured in hours per ha of net sown area, in turn, being the dependent variable. By measuring labour use in this way, both the crop-yield effect and any cropping intensity effect of HYVs get taken into account. The explanatory variables for the equations relating to AP and TN are percentage of gross cropped area under HYV rice, farm size and the percentage of gross cropped area irrigated. For Orissa, irrigation has not been included as an explanatory variable because of the high correlation (0.70) found between this variable and the percentage area under HYV rice (see Appendix Table). As noted earlier, the overall availability of irrigation in this State is quite low. Hence, in the sample farms with some irrigation, often the only crop irrigated is HYV rice. In the case of AP and TN, however, a good deal of the traditional rice and some of the minor crops are also grown under irrigated conditions.

Farm size has been defined in terms of net operated area (namely, net sown area plus uncultivated area minus area under orchards or gardens). In the regression equations, farm size has been treated as a continuous variable. For the presentation of mean values, however, the farms in each state have been divided into four size groups. Farms in the first size group of less than or equal to (LE) 1.00 ha could be termed the marginal farms; most of these would be too small to adequately provide for the household's subsistence needs, and the household

members would have to work in the fields of others or to undertake some non-agricultural work to supplement farm income. Those in the next three size groups (*viz.*, greater than (GT) 1.00 ha and LE 2.00 ha; GT 2.00 ha and LE 4.00 ha; and GT 4.00 ha) may be termed the small, medium and large sized farms. From Table 1 it can be seen that in AP about a third, and in TN and Orissa about half of the sample farms respectively, would fall under the categories of marginal and small. In the Orissa and TN samples the largest farm is approximately 7 ha in size, while in the AP sample it is 24 ha in size. In all three States a fairly large percentage of the sample farms have at least some portion of their cropped area under HYV rice.

RESULTS AND INTERPRETATION

(i) Labour use by Operations

Table 2 gives an idea of the relative importance of different types of labour in the three States. We note that in all three States, casual labour (male plus female) provides the largest proportion of total labour time: 71.2 per cent in AP, 73.4 per cent in TN and 49.5 per cent in Orissa. It is also noteworthy that in AP and TN, female casual labour is the most important type of labour in use, providing close to half of total labour time on the farm.⁹ The lower proportionate use of female to male labour in Orissa relative to AP and TN would be due to a variety of economic and cultural differences between the States, such as difference in the availability of channels for non-agricultural employment for male/female labour, the social norms governing female seclusion and the sexual division of labour in the fields, etc. A further exploration of these dimensions would be fruitful but has not been attempted here.

However, in all three States, the involvement of women in cultivation is found to be distinctly task-specific, in the sense that women are found to be working primarily in certain operations. Some illustrative results of the operation-wise breakdown of labour use for AP and TN are presented in Table 3. From the table, it can be seen that female labour is concentrated in specific operations, while male labour is much more evenly spread across operations. In AP, on average, 30.7 per cent of total female labour time used over the year is in sowing (including transplanting); another 31.0 per cent is in interculture (mainly weeding) and 27.7 per cent in harvesting. In other words, these three ope-

TABLE 4.3: OBUSSA — MEAN USE OF LABOUR BY RICE VARIETY, FARM SIZE AND TYPE OF LABOUR

Farm size (ha)	No of Farms	(hrs/ha)											Total Labour	Bullock-Pair	Tractor	
		Female Labour			Male Labour				Child Labour		Exchange Labour	Gift Labour				
		Family	Casual	Total	Family	Casual	Perma- nent	Total	Family	Casual						
Labour Use on Area under Traditional Rice																
LE 1.00	24	10.8	186.2	197.0	810.6	202.4	0.0	1013.0	1.6	—	11.8	3.2	1226.6	294.6	—	
GT 1.00-LE 2.00	61	16.0	175.8	191.8	490.9	413.6	52.5	957.0	0.3	—	12.9	0.4	1162.4	276.8	—	
GT 2.00-LE 4.00	59	1.7	190.9	192.6	358.5	353.9	172.0	884.4	0.6	—	16.0	0.0	1093.6	246.2	—	
GT 4.00	24	0.2	135.4	135.6	275.4	402.5	203.0	880.9	0.0	—	4.2	0.0	1020.7	263.3	—	
All	168	8.0	176.8	184.8	459.3	360.8	108.5	928.6	0.6	—	12.6	0.6	1127.2	266.7	—	
Labour Use on Area under HYV Rice																
LE 1.00	6	66.7	119.2	185.9	1122.0	907.0	0.0	2029.0	0.0	—	0.0	8.7	2223.6	300.4	—	
GT 1.00-LE 2.00	28	26.3	351.9	378.2	596.2	706.3	58.9	1361.4	0.0	—	18.1	2.8	1760.5	275.8	—	
GT 2.00-LE 4.00	30	8.9	346.6	355.5	665.7	644.5	226.4	1536.6	3.1	—	5.3	0.0	1900.5	253.5	—	
GT 4.00	9	0.0	281.4	281.4	209.0	642.3	292.0	1143.3	0.0	—	0.0	0.0	1424.7	227.5	—	
All	73	19.2	321.9	341.1	620.2	689.5	151.7	1461.4	1.3	—	9.1	1.8	1814.7	267.6	—	
Difference† (all farms)		—	+11.2	+145.1**	+156.3**	+160.9	+328.7**	+43.2	+532.8**	+0.7	—	-3.5	+1.2	+687.5**	+0.9	—

Notes: LE—Less than or equal to; GT—Greater than.

† Labour use under HYV rice minus labour use under traditional rice.

In accordance with the two-tailed test: *denotes significance at the 5% level;

**denotes significance at the 1% level.

One female labour unit has been taken as equivalent to one male labour unit, and one child labour unit as equivalent to 1/2 male labour unit.

TABLE 5.1: ANDHRA PRADESH—HYV RICE AND LABOUR USE PER SOWN HECTARE (1974-75)

Equation No.	Dependent Variable	Constant Term	Regression Results			\bar{R}^2	'F' Ratios
			Explanatory Variables				
			Per Cent HYV Rice Area	Farm Size	Per Cent Area Irrigated		
1.1	Total labour	3.05	0.13** (5.53)	-0.10* (2.16)	0.03 (0.89)	0.25	11.62
1.2	Female family labour	1.76	-0.26** (2.90)	-0.88** (4.97)	-0.24 (1.70)	0.30	14.57
1.3	Female casual labour	2.72	0.12** (4.23)	-0.06 (1.07)	0.02 (0.40)	0.14	6.32
1.4	Total female labour	2.82	0.10** (3.80)	-0.08 (1.57)	-0.01 (0.22)	0.11	5.16
1.5	Male family labour	2.27	0.03 (0.69)	-0.75** (9.16)	0.23** (3.47)	0.48	31.28
1.6	Male casual labour	1.84	0.33** (4.02)	-0.22 (1.37)	0.17 (1.32)	0.14	6.69
1.7	Male permanent labour	0.42	0.22** (2.03)	1.69** (8.08)	-0.19 (1.12)	0.43	25.50

Notes: (1) Figures in brackets give the 't' values of the respective coefficients.
 (2) In accordance with the two tailed test: *denotes significance at the 5 per cent level; **denotes significance at the 1 per cent level.
 (3) All the 'F' ratios are significant at the 1 per cent level.

TABLE 5.2: TAMIL NADU—HYV RICE AND LABOUR USE PER SOWN HECTARE (1976-77)

Equation No.	Dependent Variable	Constant Term	Regression Results			\bar{R}^2	'F' Ratios
			Explanatory Variables				
			Per Cent HYV Rice Area	Farm Size	Per Cent Area Irrigated		
2.1	Total labour	2.81	0.06* (2.02)	-0.17** (3.64)	0.21** (3.44)	0.30	13.21
2.2	Female family labour	1.20	0.32* (2.08)	-0.82** (3.19)	-0.30 (0.87)	0.15	5.96
2.3	Female casual labour	2.21	0.03 (0.84)	-0.10 (1.54)	0.36** (4.23)	0.20	8.42
2.4	Total female labour	2.30	0.04 (1.03)	-0.13* (1.96)	0.33** (3.83)	0.20	8.20
2.5	Male family labour	2.98	0.17 (1.17)	-1.21** (4.94)	-0.63 (1.91)	0.24	10.21
2.6	Male casual labour	2.05	0.16** (3.22)	-0.03 (0.36)	0.16 (1.47)	0.13	5.31
2.7	Male permanent labour	-0.49	0.06 (0.38)	1.68** (6.76)	0.62 (1.86)	0.35	16.03

Notes: (1) Figures in brackets give the 't' values of the respective coefficients.
 (2) In accordance with the two-tailed test: *denotes significance at the 5 Per cent level; **denotes significance at the 1 per cent level.
 (3) All the 'F' ratios are significant at the 1 per cent level.

rations account for 89.4 per cent of total female labour time on the farm. Threshing is the only additional operation of any significance, using 8.3 per cent of female labour time. Further, 95.6 per cent of total female labour is accounted for by female casual labour. In TN, likewise, the percentage of total female labour time (*viz* casual + family) in these four operations is found to be 18.4 per cent, 39.1 per cent, 31.5 per cent and 8.0 per cent respectively, with female casual labour accounting for 91.7 per cent of total female labour. In Orissa too the pat-

tern of female labour use was found to be distinctly task-specific. Further, in all three States, women do not undertake ploughing (though they may be involved with marginal functions relating to seed-bed preparation), and no women were found to be employed as permanent labourers.

The task-specific nature of women's involvement in agricultural work means that women dependent on such work for their livelihood (as would be the women of agricultural labour households) are likely to be especially vulnerable to the introduction of techno-

logies such as rice transplanters, weedicides, power-operated paddy processing mills etc. which would decrease the total demand for female labour in such operations. In fact, this is already noted to be happening on a significant scale in many parts of the country with the introduction of modern rice mills which employ virtually no female labour (see eg. Harriss, 1977 b; Acharya and Patkar, 1981).

(ii) Labour use by Rice Varieties

Tables 4.1, 4.2 and 4.3 give the mean values of labour time for the different types of labour as used under TV and HYV rice, on farms of different size groups, in AP, TN and Orissa respectively.

In the Andhra Pradesh sample (Table 4.1) a comparison of the labour time per ha used for TV rice relative to HYV rice indicates that with HYVs, for all farm sizes taken together, there is a significantly lesser use of both female and male family labour and a higher use of male permanent labour. While a higher use of male and female casual labour is also noted (and much more so for female than male labour) these differences are not statistically significant. Other noteworthy features are the significantly lower use of bullock labour and the significantly higher use of tractor power with the adoption of HYV rice. Within size groups too this pattern broadly holds; for instance, the lower use of female family labour with HYVs is noted in all size groups.

In the case of Tamil Nadu (Table 4.2), for all farm sizes taken together, there is a higher use with HYVs of virtually all categories of labour (including female family labour) but none of these differences are statistically significant. Within size groups again, the pattern is broadly consistent, there being a greater use of almost all types of labour with HYV rice relative to TV rice.

Again, for Orissa (Table 4.3), the higher use of labour under HYV rice cultivation is noticeable for all categories of labour other than exchange labour. Further, the differences are statistically significant in the case of female and male casual labour as well as for all female, male and total labour. The increase is specially dramatic for male and female casual labour — the use of both being found to virtually double with HYVs. However, between these two types of labour the increase, both in absolute and in proportionate terms, is more for male than female labour.

TALBE 5.3 : ORISSA—HYV RICE AND LABOUR USE PER SOWN HECTARE (1977-78)
Regression Results

Equation No	Dependent Variable	Constant Term	Explanatory Variables		\bar{R}^2	'F' Ratios
			% HYV Rice Area	Farm Size		
3.1	Total labour	3.10	0.16** (11.60)	-0.09** (2.73)	0.45	69.94
3.2	Female family labour	0.33	-0.07 (1.05)	-0.14 (0.88)	0.01	9.98
3.3	Female casual labour	0.93	0.75** (6.14)	0.72* (2.55)	0.21	22.77
3.4	Total female labour	1.06	0.70** (5.71)	0.53 (1.87)	0.17	18.49
3.5	Male family labour	2.82	-0.16 (1.89)	-1.11** (5.51)	0.16	17.42
3.6	Male casual labour	1.76	0.48** (5.20)	0.94** (4.42)	0.22	24.21
3.7	Male permanent labour	0.21	0.08 (0.64)	1.95** (6.84)	0.21	23.83

Notes: 1) Figures in brackets give the 't' values of the respective coefficients.

2) In accordance with the two-tailed test: *denotes significance at the 5 per cent level **denotes significance at the 1 per cent level.

3) All the 'F' ratios are significant at the 1 per cent level, other than for equation 3.2 for which it is insignificant at the 5 per cent level.

Finally, in all three States, as farm size increases there is an overall decrease in the use of total labour and especially of family labour, and an increase in the use of permanent labour, for area under TV rice. These results (although with less consistency, and with the exception of total labour use in Andhra Pradesh) hold true too for area under HYV rice.

(ii) The Regression Results

The regression results help us to see to what extent there are statistically significant differences in the level and pattern of labour use with HYV rice, after allowing for differences due to farm size and irrigation. To begin with, the results pertaining to each State will be discussed in turn; subsequently, the broad conclusions for all three States taken together, will be highlighted.

Andhra Pradesh (refer to Table 5.1): As had been hypothesised, the adoption of HYV rice is found to have a significant positive association with total labour use and with female casual, male casual and male permanent labour use. Female family labour use, by contrast, is found to have a significant negative association with the percentage area under HYV rice. This suggests that any positive effect of HYVs on the requirement of female family labour has been offset by the negative effect of a rise in income on the supply of such labour. It is consistent with the view that family women tend to withdraw from manual work in the fields with a rise in the

economic status of the family. This is further supported by the significant negative association of female family labour use with farm size and with per cent area irrigated. A larger farm size, a higher percentage of area under irrigation and a higher percentage of area under HYV rice would all be indicative of the better economic status of the family.

Male permanent labour, as might be expected, is seen to have a strong positive association with farm size: large farms tend to employ more permanent labourers than small ones, not only because they can better afford to do so but also to ensure a certain minimum availability of labour during peak seasons; and to provide supervision labour to supplement or perhaps even substitute for family supervision. The irrigation variable, however, is found to have a neutral association with most types of labour, other than male family labour with which it has a positive association.

Tamil Nadu (refer to Table 5.2): As in AP, so in TN, the adoption of HYV rice is seen to have the expected significant positive association with the use of total labour and male casual labour; however, unlike AP, no significant relationship is found with female casual labour.

Also in contrast to AP is the positive association observed between female family labour and HYV adoption, which suggests that whatever may have been the negative labour supply effect of a rise in income with HYVs, the positive labour requirement effect has offset it.

This is perhaps not surprising given that a much larger proportion of the TN farms, relative to the AP sample, fall in the marginal and small size groups (viz. LE 2.00 ha) and would, therefore, be much less in a position to substitute hired labour for female labour. The expected negative association between female family labour and farm size is, however, found in the Tamil Nadu equations as well, in keeping with our hypothesis that women of better-off families tend not to work in the fields. Permanent labour is found once more, as hypothesised, to be related positively with farm size.

Further, in several of the equations in this sample the irrigation variable has the expected sign and is found to be associated positively with total labour and with female casual labour use.

Orissa (refer to Table 5.3): The Orissa results are consistent with the hypothesis that HYVs tend to increase the use of total labour and especially of casual labour --- female and male. However, female family labour has no significant association with HYV adoption in either set of equations.

In keeping with the results of AP and TN, farm size is positively associated with the use of male permanent labour. The negative association of male family labour and farm size is also consistent with the observations of AP and TN. However, one contrasting feature is that both male and female casual labour are positively associated with farm size, unlike AP and TN, where the association was found to be neutral.

Main conclusions, for all three States taken together: Taking the results of all three States together, the following broad conclusions emerge:

- The adoption of HYV rice tends to increase the use of total labour time per sown ha on the farms, in all three States.
- Most of this increase is accounted for by female and male casual labour time; and in the case of one State also by a higher use of male permanent labour time.
- The impact of HYV rice on the use of female family labour is not clearly predictable, being the net result of two diverging effects. Hence HYVs may decrease the use of female family labour, as found in AP; increase its use, as in TN, or leave it unchanged, as in Orissa.
- Farm size tends to be related

TABLE 6: AVERAGE DAILY WAGE EARNINGS IN AGRICULTURAL OPERATIONS FOR WOMEN AND MEN OF RURAL AGRICULTURAL LABOUR HOUSEHOLDS

	AP		TN		Orissa	
	Women	Men	Women	Men	Women	Men
Money wages (1964-65)	0.85	1.21	0.85	1.39	0.89	1.33
Money wages (1974-75)	1.96	2.65	2.32	3.64	1.83	2.64
Agricultural consumer price index (1964-65=100)*	258		293		278	
Real wages (1974-75)	0.76	1.03	0.79	1.24	0.65	0.95

Note: *Computed by the Labour Bureau on the basis of changes in the price level of a fixed basket of goods and services consumed by the agricultural labour households.

Sources: Government of India (1979): Rural Labour Enquiry 1974-75, Final Report on Wages and Earnings of Rural Labour Households, Labour Bureau, Ministry of Labour, Chandigarh, pp 102-3, 162.

negatively to the per ha use of total labour as well as to the per ha use of family labour -- female and male. It is positively associated with the per ha use of hired labour, especially of male labour hired on a permanent basis.

III

Wider Implications of HYV Rice Technology for Women

So far we have considered only the impact of HYV rice on women's involvement in field-related work. This is a step forward in filling one significant lacuna in existing India-related literature on this aspect. However, as mentioned earlier, for a more comprehensive understanding of the implications of HYV rice technology for women we also need to take into account the impact on their overall work burden (including their non-field related work), on their access to any increase in household earnings, on their consumption and on their health. Unfortunately there is no study in the Indian context that has gone into all these aspects. My own data do not cover these dimensions either. Nevertheless, some broad pointers can be provided and inferences drawn from more general information on the status of women in different socio-economic classes of rural households. In this Section, I shall attempt to pool together some of this information, from associated literature.

To pinpoint the issues, it is useful to divide the women into three socio-economic classes (classes admittedly drawn on very broad criteria but which would suffice for purposes of illustration) as below:

(a) Women of agricultural labour households who have to hire themselves out to work on the

fields of others. These would be women belonging either to landless households or to households with insufficient land to provide basic subsistence from self-cultivation alone. Most of the women working as casual labour in my sample of farms would fall under this category.

(b) Women of small cultivator households who would not usually have to hire themselves out to work as wage labour but who would usually need to put in some manual work on the family farm.¹⁰ Most of the women providing family labour on the farms of 1.5-2.00 ha in size in my samples, would fall under this category.¹¹

(c) Women of medium and large cultivator households who would not usually have to hire themselves out or to undertake manual work in the fields, but who might be doing supervision work in the fields or non-field related agricultural work.

Our primary concern here is for the women belonging to the agricultural labour and the small cultivator households, most of whom would be living at subsistence levels or below subsistence levels. Among these would also be women who are the sole or main income earners in their families. The backdrop against which the impact of technological change on any field-related work must be judged, for these classes of women, is a complex one, in which it is necessary to take into account several aspects such as those outlined below:

(1) In both these classes of households, women are found, in virtually all parts of the Third World, to work long hours, and usually longer hours than men. In addition to their work con-

tribution in the fields, the entire burden of childcare and a substantial burden of housework such as cooking, water fetching, fuel gathering, grain grinding, fodder collection and caring for animals (if any) tends to fall on the women. Although studies on the pattern of time-allocation by women and men among rural households in India are few, of the rare two I have come across, one (based in Rajasthan and West Bengal) indicates that rural women work longer hours than men (Jain and Chand, 1982), and the other (based in Karnataka) notes that women put in the same number of hours but expend more total energy in the tasks they do (Batiwala, 1983). Some studies that have examined women's work alone find that a 14-16 hour working day is common in certain areas even among pregnant women (e.g. see Khan *et al.*, 1983 for Uttar Pradesh). Carefully undertaken time-allocation studies in other Asian countries too support the view that women and female children usually work longer hours than men and male children (e.g. see Nag, *et al.*, (1978) for Nepal; White (1976) for Indonesia; Quizon and Evenson (1978), and King (1976) for the Phillipines).

(2) Among the landless or near-landless households, the woman's earnings are often crucial for the family's survival. This is true not merely in female-headed households (a point I shall take up further on) but also in households with both male and female adult earning members. Mencher and Saradamoni (1982) in their study relating to six villages (two each in Kerala, TN and West Bengal) found, for instance, that in households with no land, where both women and men were earners, the average of women's contribution to household earnings was more than the men's in five villages and equal to the men's in the sixth. Among marginal landowning households too, female earnings from outside work ranged from a little under half to well over half of the total household earnings from outside employment. Further, on average, the

minimum contribution by the women was higher than the minimum contribution by the men, in almost all the villages in both classes of households.

- (3) Undertaking a large, and often a disproportionately large share of the household's workload, or making a significant contribution to household income, does not necessarily give these women greater access to cash income or to food and other consumption items, or lead to their greater participation in the family's decision-making process. For instance, Chakravarty (c 1977) on the basis of her study of 5 villages in 3 Indian States observed that even where the wages were paid to the women, these were taken over and controlled by the household men. (That women often have little control over household earnings is noted too by Heyzer (1981) in the context of landless plantation labour in Malaysia; and by Palmer (1980) among rice cultivating small peasant households in South Korea.) Women's access to cash income is important to take into account because evidence indicates that where they have some discretion over cash expenditure, they usually spend the money on family needs, while men often spend a good deal of what they earn on their personal needs such as liquor, cigarettes, etc see Gulati (1978), and Mencher and Saradmoni (1982), for India; and Arens and Van Beurden (1977) for Bangladesh.
- (4) The sharing of consumption items, especially food, within the household generally tends to favour males over females, as does access to overall health care. This is apparent both in the direct assessments of food intakes relative to requirements, and in indirect indicators such as male/female differentials in malnutrition, morbidity and mortality. Balliwala (1983), for example, in a Karnataka-based study of a sample of village households, has sought to estimate the energy expended by women and men during the day and compare it with estimates of respective caloric intakes. She finds that on average the women have an intake deficit of 100

calories per day while the men have a surplus of 800 calories per day. Again, Gulati (1978) in her case-study of a typical agricultural labour household in Kerala notes that on working days the woman's caloric intake fell short of the recommendations made by the Indian Council of Medical Research by 20 per cent, while the man's fell short by 11 per cent; on unemployed days the respective shortfalls were 50 per cent for the woman and 26 per cent for the man. Both these studies are of course only indicative since neither are based on a systematic measurement of food intake levels. But more careful and detailed measurements undertaken in a recent Bangladesh study also bring out the sex bias (see Chen, *et al.* 1981); as does Schofield's (1979) extensive survey of several hundred village studies relating to Asia, Africa and Latin America.

Alternative indicators such as levels of malnourishment among male and female children provide strong supportive evidence. Sen and Sengupta (1983), for instance, on comparing the nutritional condition of male and female children below five years of age, in two West Bengal villages, find a systematic sex bias reflected in the higher prevalence of malnourishment and the lower growth dynamics among girls relative to boys. Again, a study for rural Punjab notes that female children are breast-fed for a shorter time and given less supplementary milk and solid food (Levinson, 1974). Sex bias in food distribution is not confined to poor households, although it appears to be sharper under poverty conditions (e.g. Sen and Sengupta, 1983). It is also noted to be higher in the northern States, especially in the northwest, relative to the South (Miller, 1981).

Morbidity again appears to be higher among women than men. This is found, for instance, in a recent study in rural Uttar Pradesh which also notes that women's ailments usually tend to be ignored in the initial stages and medical attention is made available only when the disease becomes chronic or serious

(Khan, *et al.* 1983). The same pattern of sex differentials is revealed in hospital admissions data (Kynch and Sen, 1983), in child mortality figures (Bardhan, 1974), and in overall sex ratios; and once again these differences are noted to be sharper in the northern States relative to the southern (Miller, 1981).¹²

- (5) In a large number of rural households women are the sole adult income earners. According to an estimate by Buvinic and Youssef (1978), about 18.7 per cent of households in India are *de facto* female-headed, and the incidence of poverty among female-headed households is observed to be higher than among male-headed households. Visaria and Visaria (1983) note that by the 1971 census, 9.6 per cent of all rural households were female-headed, but emphasise that there is likely to have been under-reporting. They further find, on the basis of the National Sample Survey Data, that the proportion of those unable to find work on any day when they have sought work or were available for work is much higher among female headed households. Also, Parthasarthy (1982), in a study based on a survey carried out in a district in Andhra Pradesh, found that a much larger proportion of female-headed households in the sample were below the poverty line relative to male-headed households.

All these aspects suggest that the implications of technological change for women are likely to be mediated not merely through class-related factors but also through gender-related factors. And these gender-related factors may offset some of the class-related benefits or aggravate some of the class-related adverse effects which a given technology may bring about.

Using the above discussion as a backdrop, let us now consider what the wider implications could be of the results relating to the effects of HYV rice on women's field-based work, that we noted in the last section.

For agricultural labour households we noted that HYV rice tends to increase the demand for both female and male casual labour time.¹³ However, whether or not the women benefit by this will depend on a number of complex factors. To begin with, we would need to know what the

APPENDIX TABLE: CORRELATION MATRICES

	Per Cent HYV Rice Area	Farm Size	Per Cent Area Irrigated	Per Cent Area Under Paddy
Andhra Pradesh				
Per cent HYV rice area	1.00	0.16	0.13	0.44
Farm size	0.16	1.00	0.04	-0.15
Per cent area irrigated	0.13	0.04	1.00	0.32
Per cent area under paddy	0.44	-0.15	0.32	1.00
Tamil Nadu				
Per cent HYV rice area	1.00	-0.22	0.17	0.43
Farm size	-0.22	1.00	-0.11	-0.31
Per cent area irrigated	0.17	-0.11	1.00	0.16
Per cent area under paddy	0.43	-0.31	0.16	1.00
Orissa				
Per cent HYV rice area	1.00	0.04	0.70	0.47
Farm size	0.04	1.00	0.02	-0.00
Per cent area irrigated	0.70	0.02	1.00	0.38
Per cent area under paddy	0.47	-0.00	0.38	1.00

change in real wages has been. Data taken from the Indian Rural Labour Enquiry Reports of 1964-65 and 1971-75 (and presented in Table 6) indicate that the daily money wage earnings from agricultural work have increased during this period (i.e. the period over which a major increase in area under HYV rice occurred) for both women and men, in all three States. However, when these figures are deflated by the consumer price index for these households to give the daily real wage earnings we find that there has, in fact, been a decline.¹¹ In other words, while the demand for casual labour may have increased with HYV rice, the real wages have not increased simultaneously.¹² For many of the households under consideration, the overall real earnings from agricultural wage work may well have declined.

To the extent that there has been a decline in female real earnings, the implications for women's well being are likely to be much more severe than for the men, both in male-headed households in the context of the observed unequal distribution, especially of food, in favour of male members, and in female-headed households, since women's wages even in the same agricultural operations are usually lower than men's. In short, the noted employment advantages which HYV rice offers cannot be assumed to necessarily benefit the women, where there is no simultaneous increase or even constancy in real wages, and when there is the noted unequal sharing of income, consumption and work burden between women and men.

For the cultivator households we found that in TN and Orissa family

women worked more than before in the fields with the introduction of HYV rice, and in AP they worked less. Where women are working more it is first of all likely to imply an overall increase in their workloads, since the women would continue to be responsible for non-field related work, including housework and child care.

Secondly, although the introduction of HYV rice may be assumed to increase the overall crop production and income of these households, this may not benefit the women insofar as the additional income is likely to be controlled by the men and, as noted, they are more likely to spend much of it on personal needs or perhaps on farm production items, rather than on the needs of the women. It is noteworthy that in the heart of the green revolution, viz. Punjab, while there have been considerable improvements in technology handled by men, in the form of tractors, threshers, combines, etc. there has been little improvement in the women's kitchen apparatus, even in the economically well-off households.¹⁶ In other words, the extra effort put in by family women in the field with the introduction of HYV rice, cannot automatically be assumed to bring in benefits to them in terms of improved standards of living.

Thirdly, working in the paddy fields, in operations such as transplanting, exposes the women to a number of health hazards such as increased susceptibility to intestinal, and parasitic infections, splitting heels, pain from leach bites, rheumatic joints and arthritis (seen Mencher and Saradmoni (1982) for documentation in the

Indians context). An UNDP report (1980) also notes that in Asia there appears to be an association between working in paddy fields and gynaecological infections. Thims is an additional cost which both the farm family women working in the fields and the women agricultural labourers employed on a casual basis, have to pay.

Where the family women are found to withdraw from work in the fields, as noted in AP, it may be seen as a benefit in that it saves them from the mentioned health hazards; but whether or not it reduces their overall burden of work would depend on the effect on their non-field related work. In certain areas, it has been noted that with the greater employment of casual labour with the green revolution, women, even of economically well-off families, have an additional work burden as they now have to put in long hours cooking for the hired labour, where providing at least one meal is customary, especially during the peak season (see e.g. Randhawa, 1975; and Mencher and Saradmoni, 1982). In other words, it is possible that while women withdraw from field-related work they are forced to spend more time on non-field related work. It is noteworthy that while women's labour in the field may be substituted by hired labour for family prestige considerations when family income rises, hired labour rarely substitutes for women's work in cooking, etc even in the economically well-off rural households.

All in all what is sought to be highlighted in the above discussion is that the issue of the implications of HYV rice on women is a complex one, which needs to be considered in the light of the existing sexual division of labour both in the field and in the home, and in relation to which aspects such as the intra-household distribution of cash and consumption items, cannot be ignored.¹⁷

When we consider the implications of HYV rice for men, many of the mentioned complexities do not arise. Firstly, it can realistically be assumed that any increase in the household income will benefit the men while, as noted, for women no such assumption can be made *a priori*. Secondly, in the agricultural operations that men primarily perform there are few of the noted health hazards. Thirdly, for households where the members have to sell their labour power for a livelihood, the chances of a man finding employment would, in general, be

higher because men can be hired for a wider range of agricultural tasks, they have the possibility of finding employment as permanent labourers, and they have a greater geographic mobility.

It may further be added here that in a long-term and dynamic context, the introduction of HYVs is also likely to have an impact on the pattern of land ownership and control. For instance, both in some of the wheat-growing regions and in several of the rice-growing regions, it has been observed that due to the higher profitability in cultivation associated with HYVs, many land owners have evicted their tenants and resumed land for self-cultivation (see e.g. Bhalla (1977) for Haryana; and Bardhan and Rudra (1978) for some of the eastern, rice-growing States). This would mean that many of the former small and marginal cultivator households would have been pushed to the ranks of agricultural labourers. This is corroborated by Gaiha's (1983) study (based on data from the National Council for Applied Economic Research) in which a sharp increase in landlessness (that is, cultivating no land), from 25 per cent to 35 per cent, is noted among the same set of households, in an all India sample, between 1968-69 and 1970-71. While both the men and the women of such households would be left worse off as a result, the greater burden of any such effects is likely to fall on the women for reasons already spelt out.

IV

Summary and Concluding Comments

From the results presented in the body of the paper we have noted that women, especially those employed as casual labour, contribute a significant and often a major proportion of the total labour used in rice cultivation. The adoption of HYV rice increases the use of total labour on the farm; and much of this increase is accounted for by female and male casual labour, implying an increase in employment opportunities for those seeking agricultural wage work. The effect on female family labour use on the farm is found to vary by State, being the net effect of two contradictory tendencies, one relating to the increased requirements for labour on the farm with HYVs, and the other relating to family prestige considerations which cause women to withdraw from manual work in the fields

as family income increases with HYVs.

However, as noted in Section III of the paper, all these effects must be seen in a wider context, where women of the poorer households already have high work-loads, often higher than borne by men; where cash income is usually controlled by men and often spent by them largely on their own needs; where the intra-household distribution of food favours men over women; and where working in the rice fields exposes the women to many health hazards which men working largely in a different set of agricultural operations are not exposed to. Given this backdrop, the noted increased demand for female casual labour may not benefit the women of agricultural labour households if, firstly, there is no increase in daily real wages (which are found to have declined in all three States) and, secondly, there are intra-household inequalities in access to income and consumption items. Also, where the women of small cultivator households now work longer hours in the fields, this would imply an increase in their work-loads without necessarily implying a compensatory improvement in their standard of living.

The discussion in the paper also points to the significance of women's work and economic contribution for the family's survival, especially in landless or near-landless households where women are not infrequently the main or the sole income earners. It underlines the need for a special focus in policy on the employment and income requirements of such women; and for a special consideration of the gender implications of any income and employment impact of technological change.

Notes

[This paper is based largely on an earlier paper of mine presented at a conference on "Women in Rice Farming Systems" at the International Rice Research Institute, Philippines, September 23-30, 1983. I am grateful to Terry Byres for his comments on the earlier paper although the extensions suggested by him could not entirely be explored here. Discussions with Kanchan Chopra and S K Ray on some of the statistical aspects were also helpful.]

1 For some excellent analytical reviews of existing studies see Dasgupta (1977), and Byres (1972, 1981).

2 Andhra Pradesh, Tamil Nadu and Orissa respectively account for 12.0 per cent, 10.8 per cent and 8.0 per cent of total rice produc-

tion in the country (taking the average for three years, 1976-77 to 1978-79) and are among the top six rice-producing States in India.

3 In 1977-78, at the State-level, Andhra Pradesh and Tamil Nadu respectively had 65.9 per cent and 87.6 per cent of their total rice areas under HYVs, the all-India average being 40.0 per cent. In Orissa, by contrast, the percentage was only 14.7. Sources: Government of India (1980, 1982).

4 The original samples for AP and TN consisted of 100 farms (spread over 10 districts) and 90 farms (spread over 7 districts) respectively. One farm from AP and 3 from TN were dropped from the analysis since the data pertaining to these were incomplete. For Orissa, the original sample was much larger, covering all the districts of the State. However, because of the limited adoption of HYV rice in most parts of the State, only the cultivators located in 6 districts were selected for the present analysis. These districts constitute the geographic belt in which most of the HYV rice adoption in the State has occurred; these districts are also broadly homogeneous in terms of agro-climatic conditions.

5 Of course, where traditional varieties too are transplanted, the shift to HYVs may well decrease labour needs for this operation because the HYV plants are usually spaced farther apart.

6 The positive association of irrigation and cropping intensity has been noted in several studies, e.g. Jhll (1972); Rao (1976); Agarwal (1983).

7 For instance, there is likely to be a greater demand for female labour in the cultivation of crops such as cotton or rice, relative to say wheat, in so far as cotton picking or paddy transplanting are more commonly done by women.

8 For details of the impact of mechanisation on different types of labour, in the context of the Punjab, see Agarwal (1981a).

9 This is in keeping with the State-level picture as well. AP, for instance, by the 1981 census data (main workers classification), has a rural female labour force participation rate of 32.8 per cent, one of the highest in the country; while TN is close behind with 28.1 per cent. The all-India figure is 16.5 per cent. In addition, AP has the highest concentration of rural female agricultural labourers in the country, viz. 20.2 per cent of the all-India total, even though it has only 8.3 per cent of the all-India rural female population.

10 To some extent caste may also play a role in determining whether or not the women in such households participate in manual work.

12

- as observed by Mencher and Saradmoni (1982) in the course of their data collection. However, we need much more information on the particular interlinkages between caste, class and gender factors to assess their implications for women's involvement in field-related work.
- 11 Except in the case of 1 farm in AP and 1 in Orissa, in none of the other farms in the samples were family women reported as hiring themselves out to work in the fields of others for a wage, although in many instances male members did hire themselves out for some part of the year. It is possible of course that in the case of family women there is some under-reporting due to family prestige considerations (e.g. see Agarwal, 1979).
 - 12 These geographic variations in the extent of sex-based discrimination are likely to stem for a complex range of historical, cultural and economic factors. Among these, the expected employment / earning opportunities for women and their marriage costs both appear to be important, since they affect whether women and female children are seen as assets or liabilities in economic terms. The southern States relative to the northern, are characterised by higher female participation rates and lower female marriage costs, with marriage usually involving reciprocity or (especially among the unpropertied) brideprice. (For an interesting discussion on these aspects see Miller, 1981.)
 - 13 Unfortunately, as noted earlier, the data do not permit us to assess the number of agricultural labourers who may have got additional employment as a result.
 - 14 This decline in real wages closely follows changes in foodgrain prices, since foodgrains form the principal component of the consumption basket of agricultural labour households. The increase in foodgrain prices, despite the rise in food output, cannot be separated from the strong upward pull on State-administered procurement prices (which also affects trends in market prices) exercised by the larger farmers, whose position has been consolidated economically and politically with the new technology.
 - 15 This conclusion is supported by other studies. For instance, Parthasarthy and Adishesu (1982) have analysed the trends in real wages in AP, between 1958-59 to 1967-68 and 1968-69 to 1978-79, based on crop and season reports. They find that in both periods, real wages of agricultural labourers have stagnated. A further district-level analysis indicates that this holds even for the agriculturally most advanced districts of the State.
 - 16 For instance, Pathak (1983) notes, on the basis of a three village study for Punjab, that despite the increasing importance of commercial energy inputs in agricultural production, households in all classes depend almost entirely on non-commercial fuels for meeting cooking energy needs. And from Sarin's work (1983) on cooking stoves it is seen that usually associated with non-commercial fuels for cooking is a smoky, primitive stove.
 - 17 An additional dimension of relevance here is the economic vulnerability of all women (even women of rich peasant households) because they do not usually hold land titles or own other property. Omvedt (1981) in her study on rural Maharashtra documents instances where women of rich peasant households, divorced or deserted by their husbands, are now working as agricultural labourers in the farms of their brothers who are substantial landowners. As she emphasises (p 21): "Perhaps this fact more than any other shows the essential propertylessness of women as women."

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