Pak. J. Agri. Sci., Vol. 21 (3-4), 1984

HIGH, INTERMEDIATE AND LOW YIELD TECHNOLOGIES OF PADDY PRODUCTION IN A SELECTED AREA OF THE PUNJAB*

Mian M. Aslam**

ABSTRACT

Using cross-sectional data from 66 farms, components of alternative technologies of paddy production were identified. It was found that not only the factor proportions but also techniques and practices of the three classes of farms differed significantly. The low-yield farms could, at least, double their productivity by adopting inputs and techniques of the high-yield farms provided factor supply and access constraints are removed.

INTRODUCTION

The management of a business firm is a complex function of making and executing decisions and it requires capability to cope with endogenous and exogenous situations of social, economic and psychic (labour welfare) significance. This function comprises :

Perceiving a problematic situation.
Identifying the decision choice set.
Visualizing the dynamic sequence of decisions.
Anticipating and analyzing socio-econmic outcomes of decisios.
Identifying complementing and supplementing decisions.
Establishing criteria for selecting decisions.
Attaching priority tags to selected decisions.
Analyzing resource markets and organizing resources.

*This paper is a part of the study, "Conventional, Transitional and Progressive Technologies of Paddy Production in a Mixed Farming Area" which was funded by the Agricultural Development Council. Mr. Abdul Haque worked hard to complete this study. Helpful comments of M/s B. Lockwood and A.S. Haider are gratefully acknowledged.

**Department of Agricultural Economics, University of Agriculture, Faisalabad (Pakistan).

Selecting technology and technique mix of a production process.

Monitoring and evaluation of decisions.

The management of a farm firm also follows a similar process of making and executing decisions. However, the decisions, apart from being less formal in procedure, are more diverse in nature and quick in sequence due mainly to seasonality of operations, multiplicity of production activities, uncertainty of weather and biological nature of the production process. The qualitative and quantitative dimensions of decision are reflected in technology and technique mix and product realized, processed and marketed. At a given point in time, different farm firms make different decisions depending on their profile, resource availability, agroclimatic conditions, system of farming, extent of diversification or specialization, known production technology, soci-oinstitutional organization and, above all, weather.

It is logical, therefore, to expect that the productivity per unit of a resource would be as varied as are decisions. Keeping thisvariation in view, three classes of farms were discernable; namely, conventional, transitional and progressive. Each class is expected to exhibit a more or less a uniform set of decisions executed by it and a study of such decisions is extremely important for evolving any strategy of crop development in Pakistan. This is especially true for paddy as it is a cash crop, its product and by-produts satisfy intermediate and final demands in national and international markets. Thus, income and employment opportunities in the related markets and industries would be related to actual technologies and techniques of paddy production. An analytical description of the technologies may be helpful in formulating programmes and policies for an improved management of the crop The exsension programme may be enabled to focus attention on teaching of speific crop operations and skills to farmers and exhorting them to adopt such skills. This study is, therefore, aimed at describing technologies and techniques adopted by paddy producers at different levels of productive efficiency.

METHODOLOGY : SAMPLE AND SURVEY DESIGN

The study is based on a sample survey of 56 respondents selected from four villages located at 6-10 km distance from Depalpur. The sample enfolded 11, 14 and 31 progressive, transitional and conventional farmers, respectively.

Data were collected in four visits to the field at different times during the crop season of 1979-80.

RESULTS AND DISCUSSION

For conceptual clarity, technology, technique and practice must be distinguished from each other. The definitions, due to Bartsch (1977), are very instructive.

"Technology is the application of knowledge involving the use of combinations of material inputs.....".

"Technique relates to the methods of delivery of these inputs and implemention of practices.....".

"Practice is a way of carrying out particular farming operations".

As an initial piece of evidence, it is appropriate to note that per farm area under coarse varieties ranged between 0 5 to 1.8 acres and fine varieties showed a wide range, i. e , 8.4 to 13 8 acres. This is because the farm size distribution was shewed in favour of large farms, the definition of large farms, being > 14.0 acres. On the basis of all farms, the area under fine varieties was about nine-tenth of the total and the residual, one-tenth, was shared by coarse varieties. It may be inferred that the sample respondents specialized in fine rice production in addition to cotton. A natural endowment of sweet sub-soil water may largely be responsible for it.

The yield per acre showed striking variation. In the case of coarse rice, the progressive farmers obtained fifty per cent more than the conventional producers and the difference in their mean yields was significantly different from zero (as shown by the two-tailed t-test). The yield-gap between HYF and LYF was large in the case of fine rice; the former obtained about 2.5 times more than the latter. As expected, the difference in their mean yields was found statistically significant. The estimated yield per acre of the transitional producers was about three-fourth of the corresponding estimate of the progressive cultivators.

To push transitional farmers to the productivity boundary of progressive

*For an elaborate discussion of the survey design, see Aslam (1980 & 1982).

would be a least-cost strategy which would also save time in achieving targets of growth of this crop. As the yield-gap between HYF and LYF is large, it will take more time and resources to abridge it. However, it should not be misconstrued that only the INTYF may be encouraged to run along the road of crop development while the LYF simply walks along it. As substantial unrealized productivity lies with the majority of low-yield farms, they would, of course, be the target of the long run crop development strategy.

Table 1. *Yield of paddy per acre (quintals)*

Yield class	Coarse	Fine	Both
HYF	20 2	12.2	12.7
INTYF	14.3	9.6	10.1
LYF	13 5	5.4	6 2
All farms	14.5	7.9	8 5

The Productive Efficiency

The productive efficiency is measured by operating capital and man-days of labour used per quintal of paddy produced. The labour and capital per unit of land are also used but part of the area under the crop may be damaged by insects and, therefore, may lead to over-estimation of the parameter. The ratio estimates per unit of output are unbiased estimates. The estimated ratios are presented in Table 2. To produce a quintal of fine paddy, the progressive farms used about one-half of the operating capital used by the conventional farms; the progressive farms being hundred per cent more efficient than the conventional farms in the use of operating capital. Nevertheless, on an acre basis, as compared to the conventional farms, the capital intensity was high by 11 per cent on progressive farms. As expected, the intensity of labour per acre was the highest on the progressive farms followed by the transitional and the conventional farms that were almost equal in respect of this parameter. On the basis of a quintal of paddy, the LYF used 63 per cent more labour than the HYF.

Components of Input Matrices

a. *Land preparation*

The ploughing, planking, levelling, and puddling operations were carried

out by one or more times depending on the type of farm power and machinesy available to a given farmer and the real cost of hiring their services in the market. About 66 per cent of the respondents used tractor for ploughing. Only 34 per cent used tractor more than four times. Out of those using tractor for ploughing, nearly one-fourth belonged to the HYF. One-sixth of the farmers used tractor for puddling operation and five out of six cases used animals for this purpose. A high maintenance cost of tractor after pudding might be a prohibitive factor.

Table 2. *Labour and capital ratios in paddy production*

Yield class	Operating capital* (rupee)		Human labour (days)	
	per quintal	per acre	per quintal	per acre
HYF	76.5	973.2	2.4	30.3
INTYF	87.1	882.2	2.4	24.3
LYF	141.7	878.5	3.0	25.0
All farms	105.0	894.2	3.0	25.0

*Operating capital includes ploughing, planking, puddling charges with tractor, spraying cost, seed and seedling cost, fertilizer cost, tubewell water charges and payments to casual hired labour.

The field observations revealed that many of the low and intermediate yield farms were not precisely levelled and, as a result, uneven distribution of water was common which may explain uneven plant growth across the field.

b. *Nursery cost*

The nursery cost per acre depends on variety of a given class of rice (e. g., coarse or fine), labour and pest-management inputs and expected plant density per acre. As may be seen from Table 3, the cost estimate came to Rs. 63 per acre of fine paddy for the HYF. The estimate for the LYF was one-third of the figure for the HYF.

Table 3. *Expenses on seed and nursery of paddy (in rupees per acre)*

Yield class	Coarse	Fine	Both
HYF	22.7	62.6	60.4
INTYF	22.2	32.5	31.3
LYF	36.9	24.5	29.1
All farms	30.3	33.1	34.6

The HYF spent about twice the estimated amount of the INTYF on nursery of fine paddy. The mean expenditure on nursery of fine paddy was significantly different from zero at $p \leqslant 0.5$ for any combination of two classes of farm. The expenditure on the nursery showed a positive and significant correlation with the productivity per acre; the coefficient being 0.61. This test applied to fine paddy alone. Here, it is plausible to suggest that farmer's knowledge about the nursery cultivation and its management be improved as a step in the direction of getting higher productivity per unit of land. A set of about ten practices is recommended for adoption by the growers but a large majority of respondents did not know complete details of given critical step such as pest-management of the nursery. And it is commonly said that adoption is a step further to the acquisition of knowledge.

Chemical fertilizer application

Assuming that the insect attack is insignificant, the potential incremental output due to fertilizer will be realized if (a) the quantity applied is within the reach of roots of the plants (not in the empty space between hills), (b) weeds are controlled effectively, (c) dose and its type are related not only with deficiencies in the soil but also with the stage of plant growth and maturity, (d) water stress is minimal and (e) plant density is optimum and uniform. To the extent these conditions are not met with, the actual output will be lower than its potential. During the field work, it was noticed that plant hills were sparsely placed and weed population was high on the INTYF and the LYF. Commonly, the fertilizer was broad-cast by hand resulting in its uneven distribution and inefficient use.

With high doses of fertilizer, infestation of fields with weeds becomes

Table 4. *Techniques of seed-bed preparation for paddy*

Operations	Source of power	Range of operations	Observations			All farms	
			HYF	INTYF	LYF	Observations	Per cent
Ploughing	Tractor	1-3	1	1	—	2	3.6
		4-5	2	4	10	16	28.6
		> 5	6	6	7	19	33.9
	Animal	4-5	1	1	10	12	21.4
	Tractor-animal	4-5		1	3	4	7.1
		> 5	1	1	1	3	5.4
Planking	Tractor	1-3	2	4	8	14	25.0
		4-5	4	7	10	21	37.5
	Animal	1-3	4	3	6	13	23.2
		4-5	1		6	7	12.5
	Tractor-animal	1-3			1	1	1.8
Puddling	Tractor	Once	1	3	5	9	16.1
	Animal	Once	10	11	26	47	83.9

Table 5. *Bags of fertilizers used in paddy production (per acre)*

Yield class	Fine			Coarse		
	Urea	Nitrophos	Total	Urea	Nitrophos	Total
HYF	1.4	2.1	3.4	1.4	2.1	3.4
INTYF	1.5	1.3	3.1	1.5	1.3	3.1
LYF	1.5	1.8	3.4	1.5	1.8	3.4
All farms	1.5	1.9	3.3	1.5	1.9	3.3

high and, hence, the need to weed more frequently and intenstively. An additional demand for labour is created. High dose of fertilizer is associated with heavy pest infestation since dense and genetically uniform stands provide a more favourable environment for pests. The high-yield technology brings with it the demand for (a) pesticides, sprayers and pest-management knowledge and (b) additional demand for labour. The dependence of one element of high-yield technology on the other is very obvious.

Bags of fertilizers used are shown in Table 8. There seemed no difference in bags of urea used per acre of fine or coarse paddy among HYF, INTYF and LYF; one and a half bags being the standard practice. However, mean number of bags of nitrophos differed significantly for any combination of the two farm classes. The HYF used 61 per cent more nitrophos than the INTYF in coarse and fine paddy.

On the basis of a quintal of fine paddy, the HYF were the most efficient users of N as they used about 50 and 20 per cent less nitrogen than the LYF and INTYF, respectively. In the use of P also, the efficiency situation remained almost the same. The nature, type, intensity and timing of operations and practices were responsible for the high efficiency of the HYF.

d. *Pest management*

Data were collected only on cost of chemical method of controlling insect pests, that is, dusting and/or spraying. A reference to Table 7 will bring out a set of inescapable facts: (i) the expenditure per acre is too small to protect the crop from the damage and (ii) the LYF spent even less than half the amount of the HYF. Be it noted that the complementarity of high doses of fertilizer with insect infestation caused the HYF to incur comparatively high cost on plant protecion by chemical means. Anyway, the users had a remarkable edge of two quintals per acre (as compared to non-users).

e. *Labour input*

As compared to the LYF, the HYF used more of physical inputs, followed a larger number of recommendations and realized greater yield per acre,

Table 6. *Nutrient kilogrammes of fertilizers used in paddy production*

Yield class	Per acre										Per quintal			
	Fine			Total		Coarse			Total		Fine		Coarse	
	Transplanting dose		Second dose			Transplanting dose		Second dose						
	N	P	N	N	P	N	P	N	N	P	N	P	N	P
HYF	24	24	31	55	24	24	24	31	55	24	4.3	1.9	4.3	1.9
INTYF	15	15	35	50	15	15	15	35	50	15	5.0	1.5	5.0	1.5
LYF	21	21	36	57	21	21	21	36	57	21	9.1	3.3	9.1	3.3
All farms	19	19	33	54	19	19	19	33	54	19	6.3	2.3	6.3	2.3

Table 7. *Costs of chemical means of plant protection and yield of fine paddy*

Yield class	OAC/A	Users				Non-users		
		n	%	Y/A	E/A	n	%	Y/A
HYF	34.7	5	45.4	11.7	42.5	6	54.6	10.6
INTYF	39.2	10	71.4	9.7	47.9	4	28.6	8.9
LYF	15.1	7	22.6	5.3	34.2	24	77.4	5.0
All farms	26.2	22	39.3	8.6	41.9	34	60.7	6.6

Table 8. *Technical coefficients of human labour in paddy production (days per acre)*

Yield class	Farm size	Operations					Total days		Type of labour		
		Land preparation	Transplanting of nursery	Interculture	Others	Harvesting and threshing	Per acre	Per quintal	Family	Casual	Permanent
HYF	Small	2.1	9.3	1.5	3.3	15.0	31.2	2.4	5.4	25 8	0.0
	Large	0.9	7.2	2.1	0.6	18.9	30.0	2 4	3.0	26.1	0.9
	Both	0.9	7.5	2.1	0.9	18.6	30.3	2.4	3.3	26.4	0.6
INTYF	Small	4.5	8.4	0.9	3.3	9.9	27.3	2,8	14.4	12.9	0.0
	Large	0.9	6.9	3.0	0 6	12.9	24.0	2.4	0.6	22.2	1.2
	Both	1.2	7.8	2.7	0.6	12.6	24.3	2.4	1 8	21.3	1.2
LYF	Small	3.3	8.1	2.1	3.6	11.7	28.5	5.1	12.6	15.6	0.9
	Large	0.9	8.1	3.0	1.2	10.5	23.7	3.0	0.9	21.0	1.8
	Both	1.2	8.1	2.7	1.5	10.8	24 0	3.9	2.1	20 4	1.5
All farms	Small	3.3	8.4	2.1	3.3	11.7	28.5	3.7	10.4	18.0	0.1
	Large	0.9	7.5	2.7	0.9	12.6	24.9	3.0	1.2	22.5	1.2
	Both	2.1	7.8	2.7	2.1	12.6	26.2	3.0	2.1	22.2	0.9

Land preparation comprised ploughing, planking and puddling operations. Others cover the operations of manuring, spraying and fertilizer application.

hence, it was logical to observe that they used about 26.2 per cent more labour. The variation in labour use across farm classes was explained by labour intensity of land preparation, interculture and harvesting operations. The use of labour in other operations showed no significant variation across farm classes.

The high yield technology was found to be labour-intensive as compared to the other two technologies as this technology necessitated the performance of labour-intensive operations. This result compared well with that of Shapiro (1973) and Aslam (1982) who reported that improved management is labour-augmenting.

Incomes

The net income per acre was negative in the case of LYF but the INTYF harvested about half the corresponding estimate of the HYF. Fifty-five per cent of the cases showed negative average income (NI-1) per acre of fine paddy and forty-five per cent (INTYF : 25% and HYF : 20 %) of them showed positive NI-1 per acre. The income is arrayed in intervals in Table 9. More than four-fifth of the HYF fell in the two high income intervals. As one moved from the HYF to INTYF and then to LYF, the distribution clustered in the low income intervals. More than sixty per cent of the INTYF were in the income bracket of $>100-\leq 700$ rupees per acre. In contrast to the income position of the HYF and INTYF, about 80 per cent of the LYF were bracketed between $<$ 0-$\leq$100 rupees per acre. Slightly more than 50 per cent of the farms were within $<0-\leq 100$ rupees income per acre.

Table 9. *Distribution of NI-1 per acre of fine paddy*

Intervals (rupees)	HYF		INTYF		LYF		ALL	
	n	%	n	%	n	%	n	%
<0	—	—	—	—	22	71.0	22	39.3
>0-100	2	18.2	3	21.4	2	6.4	7	12.5
$>$100-250	—	—	3	21.4	4	12.9	7	12.5
$>$250-400	—	—	2	14.3	3	9.7	5	8.9
$>$400-700	3	27.3	4	28.6	—	—	7	12.5
$>$700	6	54.5	2	14.3	—	—	8	14.3
Total	11	100	14	100	31	100	56	100

n : number of cases.

Table 10. *A comparison of mean inputs and incomes of seed-cotton and fine paddy*

Enterprise	Yield class	Per acre							Per quintal					
		Productivity	L	CF		PM	VC	NI-I (Rs.)	NI-I (Rs.)	L	VC	CF		PM
				N	P							N	P	
Seed-cotton	HYF	>522	42.0	55.5	25.1	309.0	1075.5	2171.0	290.8	5.6	146.7	7.6	3.4	41.4
	INTYF	>261_≤522	34.3	55.3	18.4	83.3	694.5	730.0	201.5	9.5	193.9	15.3	5.1	23.0
	LYF	>0_≤261	28.9	36.1	12.2	40.5	464.1	160.3	99.9	18.0	299.0	022.8	7.7	26.2
Fine paddy	HYF	>10.40	30.3	55.0	24.0	34.7	1058.6	869.3	71.1	2.4	86.1	4.3	1.9	2.8
	INTYF	>8.0_≤10.40	24.3	50.0	15.0	29.2	943.7	489.7	50.9	2.4	98.3	5.0	1.5	4.0
	LYF	0_≤8.0	24.0	57.0	21.0	15.1	954.4	_123.8	_22.9	3.9	176.7	9.1	3.3	2.8

Productivity : Kilogrammes of seed-cotton and quintals of paddy per acre; L : human labour in man-days; CF: chemical fertilizers in nutrient kilogrammes; PM: expenditure on pest control by chemical means and VC: variable cost. Source of cotton (Aslam and Akhtar, 1980).

About one-fourth of the farmers realized high income (>400 rupees) and the rest three-fourth were distributed unevenly in the four intermediate and low income intervals.

Inter-enterprise Comparis on

Cotton and fine paddy

As cotton and paddy are planted in the same season, they compete for given scarce resources such as labour, chemical fertilizers and capital. Intresting facts are expected to emerge from an analysis of per acre and per quintal use of these resources in the production of the two crops and incomes derived from them. A study of Table 10 would highlight a number of facts: (i) given any of the three technologies of production, cotton is more capital-(variable cost) and labour-intensive per quintal, (ii) this conclusion remains unaltered even when the most efficient technologies of the two enterprises are compared, (iii) the fertilizer content of a quintal of cotton was higher than the corresponding estimate for the paddy, (iv) similar conclusion holds good for expenditure on pest management by chemical means, (v) the net income per acre of cotton moved in sympathy with the variable cost but the net income and the variable cost per quintal of cotton were inversely related, (vi) these relationships were not clear in the case of fine paddy and the reason for it may be found in the expenditure on pest management which was too small to control the damage and contain the productivity within its expected bounds and (vii) cotton turned out to be more profitable than fine paddy even when the respective low-yield classes were compared.

The income estimates per unit of the scarce resources of capital, fertilizer and labour are arrayed in Table 11.

Two points may be noted. One, the LYF of cotton earned, at least, half of the going wage rate of hired labour and it was also half of the earnings per day's labour of a traditional non-cultivating rural labourer (Aslam and Akhtar, 1979). Negative income per day of labour in fine paddy production by low-yield farms further contributed to their relative poverty. Second, the allocation of fertilizer to fine paddy (when its allocation to cotton would have yielded higher income) may be explained by the hypotheses of (a) family subsistence and (b) natural and market risk minimization through diversification.

Table 11. *Income estimates per unit of scarce resources*

Enterprise	Yield class	NI-1 Per one		
		Rupee of variable cost (capital)	Nutrient kilograms of fertilizer	Day of olabur
Seed cotton	HYF	2.0	26.9	51.6
	INTYF	1.0	9.9	21.3
	LYF	0.3	3.3	5.5
Fine paddy	HYF	0.8	11.0	28.6
	INTYF	0 5	7.5	20.5
	LYF	_0.1	_1.6	_5.1

CONCLUSIONS

The study revealed significant yield-gaps between any combination of the two out of three technologies of paddy production. To produce a quintal of fine paddy, the progressive farms used about one-half of the the operating capital used by the conventional farmers. On an acre basis, the capital intensity of prograssive farms was higher than that of the conventional farms by 11 per cent. Also, human labour per acre was the highest on progressive farms followed by transitional and conventional farms who were almost equal in this respect. On the basis of a quintal of paddy, however, the LYF used 63 per cent more labour than the HYF.

Assuming that fine paddy price is constant, the differences in the productive efficiency may largely be responsible for differences in net incomes of the three farm classes. The net income per acre of fine paddy demonstrated wide variation and its distribution was skewed towards the lower tail. Only one-fourth of the cases earned more than Rs. 400.0 (per acre) and the remaining three-fourth distributed unevenly in the lower income intervals.

Some of the points which might be emphasized in the formulation of the the Rice Maximization Programme are :

a) In our extension programme, priority should be given to the diffusion and

adoption of recommendations about seed selection, nursery management, fertilizer use (time, dose break-down and method), weed control (through adequate land preparation and irrigation), pest-scouting and pest management. These methods, practices and techniques are low-cost means of significant additions to the productivity especially on low-yield and transitional farms. Poor management of the crop operations constrains the materialization and realization of potential incremental output of scarce resources of water and fertilizers. The emphasis of extension workers on increasing the use of fertilizers would not produce significant results in the face of a severely limitational resource of management as the demand for fertilizer is a derived demand and would expand via the process of adoption of the package of improved management practices and methods.

b) The improved technology should be demonstrated in the package form to the farmers in the form of field demonstration plots. A piece by piece demonstration would not exhibit the potential yield and, also, would not convince farmers of the realizable size of the yield-gap.

c) As the low-yield farms were the lowest in the income distribution scale, it is suggested that they should be taken as the target group for the long run crop development programme. Farm management advisory work at the farm would make the distribution of income per unit of land or fertilizer more even and would thus contribute to social stability of poor farmers.

d) In transition from low-yield to high yield technology, the demand for plant protection service and pest management knowledge would expand and, thus, thereis need to extend frontiers of applied pest management knowledge related to equipment and pesticides.

e) The provision of credit at zero rate of intrest should be tied with the adoption of a minimum and given set of critical recommendations for the production of the crop. This would ensure high productivity and reduce incidence of default in repayment apart from developing managerial capability of farmers.

REFERENCES

Aslam, M. M. 1979. Economics of major crops : Some further results of the production and profit functions. Pak. J. Agri. Sci. 16 : 41-59.

Aslam, M. M. and R. M. Akhtar. 1979. A scenario of rural labour utilization with special emphasis on landless classes: The evidence from a Punjab district. Pakistan Manpower Review, 5 : 1-48.

Aslam, M. M. 1980. Technologies and techniques affecting interfirm variation in seed cotton productivity in the Punjab. Mimeographed, University of Agriculture, Faisalabad.

Aslam, M. M. 1982. Technical recommendations and constraints in their adoption : The case of seed-cotton in the Punjab. The Pakistan Cottons, 26 : 1-24.

Aslam, M. M. 1982. Technologies of seed-cotton production in a progressive area of the Punjab. Pak. J. Agri. Sci. 19 : 96-120.

Bartsch, W. H. 1977. Employment and Technology Choice in Asian Agriculture, Praeger Publishers, New York.

Centre International de Mejormiento de Maiz, Trigo. 1976. From agronomic data to farmer recommendations. Information Bulleton, 27.

Government of Pakistan. 1972. Reconnaissance soil survey of Sahiwal. Soil Survey Department, Lahore.

IRRI. 1971. Constraints to high yields on Asian rice farms : An interim report. The International Rice Research Institute, Phillippines.

Shapiro, K. H. 1973. Efficiency and modernization in African agriculture : A case study in Geita district, Tanzania, Ph. D Dissertation, Stanford University, USA.

APPENDIX
DEFINITIONS

HYF, INTYF and LYF	High, intermediate and low yield farms, i. e., >10.4, $>8.0-\leqslant 10.4$, $0-\leqslant 8.0$ quintals of fine paddy per acre. Since fine varieties of paddy claimed a large proportion of the area under this enterprise, the classification is based on fine paddy alone. If the use of value-laden terminology is permitted, HYF, INTYF and LYF may be labelled as progressive, transitional and conventional farms.
Farm size :	A farm was small if its cultivated area was $\leqslant 14.0$ acres and large, otherwise.
Human labour :	Total of family, casual, permanent and exchange labour used in paddy production in days.
Operating capital :	Actual or imputed cost of ploughing planking, puddling, with tractor, seed and seedlings, chemical fertilizers, tubewell water and casual hired labour.
Plant protection cost :	Summation of cost of pesticides, labour and machinery used.
NI-1 :	Gross income minus expenses on land preparation, transplanting, nursery, yard manure, chemical fertilizers, pesticides, tubewell water and casual hired labour. This income defined the break-even point of each class in the short-run.