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CHEMICAL FERTILIZER USE PREVALENCE AMONG SMALL AND TENANT CULTIVATORS IN BANGLADESH

(A Survey and Analysis)

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CHEMICAL FERTILIZER USE PREVALENCE

AMONG SMALL AND TENANT CULTIVATORS IN BANGLADESH

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Summary of Findings

Between May and October 1978 755 small owner-cultivator and tenant (sharecropper) farmers were surveyed to assess the prevalence of chemical fertilizer use among them. The findings of the survey can be summarized as follows:

1. Chemical fertilizer use was prevalent among both tenure groups though much higher for owner-cultivators (69 percent of respondents) than sharecroppers (43 percent).

2. Chemical fertilizer use was closely associated with cultivation practice; 95 percent of HYV cultivators used chemical fertilizer as compared to 34 percent of local variety cultivators.

3. No clear relationship existed among respondents between area cultivated and chemical fertilizer use. Almost all farmers cultivated small plots; the smallest used chemical fertilizer as often as others.

4. Only a small proportion (between 10 and 15 percent depending on the crop) of chemical fertilizer users applied chemical fertilizer at rates approaching "recommended" dosages. No sharecroppers or cultivators of local varieties did so. On the other hand, the number of HYV cultivators using no chemical fertilizer was negligible.

5. Respondents registered significant yield increases on HYV's in comparison to local varieties even when chemical fertilizer was applied in less than recommended dosages. The difference in yields between respondents using "no" and "some" chemical fertilizer was modest for local varieties; the difference in yields between "some" and "recommended" dosages of fertilizer on HYV's was greater.

6. Sharecroppers appeared to benefit little from chemical fertilizer use on either local or HYV's because nearly all the increment in output was required to pay land rent and added input costs.

Chemical Fertilizer Use Prevalence

Among Small and Tenant Cultivators in Bangladesh

Introduction

The foodgrain self-sufficiency and rural development strategy of the Bangladesh Government is based in part on assuring the supply of HYV inputs to agricultural producers in quantities and at prices favorable enough to boost their output and incomes. Chemical fertilizer has become a key agricultural input for food-grain self-sufficiency; access to chemical fertilizer by small and tenant cultivators is important to achieving rural development goals.

Agronomic trials conducted under suitable weather conditions have demonstrated that both local and HYV grain varieties respond well to chemical fertilizer use. Strictly on a technological basis, there is wide scope for increasing food-grain production through the expanded use of chemical fertilizer.

When socio-economic constraints are considered, however, there is reason to suspect that the pace of expanded chemical fertilizer use may be slowed. Specifically, there is concern that small farmers lack the political leverage and financial resources to obtain chemical fertilizer supplies. Tenant farmers are believed to be reluctant to use chemical fertilizer because net cash returns from its use are so low. Even those small and tenant farmers with access to chemical fertilizers generally use less than recommended dosages either out of ignorance or because they are unable or unwilling to obtain more.

Between May and October 1978, USAID/Bangladesh surveyed chemical fertilizer use among cultivators of the country's principal crops -- aman, boro, and aus rice, wheat and jute -- during the last agricultural year. The survey data provide an idea of current chemical fertilizer use practices among respondents according to farm size, tenure relationships and cultivation practices. It was also possible to calculate the impact of chemical fertilizer use intensity on cultivators' yields. This report summarizes the Mission's findings from the survey.

The Survey Respondents

The 755 small cultivators surveyed by USAID/Dacca over the May - October 1978 period were chosen from major crop producing districts of the country. Selection was constrained to permit a stratified sampling of farmers employing different cultivation practices, on different size plots and under different tenure relationships.

Each subgrouping (e.g., sharecroppers of HYV boro rice on plots of less than one acre) is relatively small and caution is advised in projecting to a national scale the characteristics that were found present in the survey. The data should be interpreted simply as a verification of what farmers in each group did or did not do regarding fertilizer use.

A district breakdown of respondents according to each of the crops cultivated is shown below (in parentheses are numbers of respondents):

Crop and Year		Survey Districts
T. Aman - 1977/78	(102)	Dinajpur (68); Comilla (34)
Boro - 1977/78	(100)	Chittagong (44); Comilla/Sylhet (25); Mymensingh (31)
Aus - 1978/79	(226)	Comilla (80); Mymensingh (71) Faridpur (75)
Wheat - 1978/79	(96)	Bogra (27); Jessore (30); Comilla (39)
Jute - 1978/79	(231)	Pabna (80); Mymensingh (76); Bogra (75).

Cultivators of each crop were selected so as to have a sampling from two tenure groups -- owner-cultivator or sharecropper -- and two types of cultivation practices -- traditional (local) and improved (HYV) -- as shown in Table 1. Of the respondents 542 or 72 percent were owner-cultivators and 213 or 28 percent sharecroppers.

The respondents cultivating HYV's totaled 348 or 46 percent of the sample; 407 or 54 percent cultivated local varieties. This is a higher proportion of HYV users than occurs nationally and probably reflects the side-of-the-road bias of our sampling procedures which, because of time constraints, excluded more remote areas that get HYV inputs as well as field surveyors less frequently.

Table 1 : Classification of Respondents According to Tenure Type and Cultivation Practices

(Numbers of Respondents)

Crop Cultivated	Owner-cultivator		Sharecropper		Total	
	Local	HYV	Local	HYV	Local	HYV
T. Aman	49	21	26	6	75	27
Boro	20	59	10	11	30	70
Aus	115	53	50	8	165	61
Wheat*	--	63	--	33	--	96
Jute	95	67	42	27	137	94
Total	279	263	128	85	407	348
	542		213		755	

* Almost all wheat cultivation in Bangladesh is done with improved (HYV) seed varieties.

Respondents were selected from a range of farm sizes but emphasis was given to cultivators of small plots. The classification of respondents according to size of cultivated area is summarized in Table 2. No farmer cultivated more than 7 acres and the smallest was 0.2 acres (20 decimals or about one bigha in local measures).

Of the 755 respondents, 414 (55 percent) cultivated plots less than 0.51 acres in size and 668 (88 percent) less than 1.01 acres. This proportion was almost uniform for Aman, Boro, and Aus. For Jute and Wheat even more concentration on small plots was apparent.

Table 2 : Classification of Cultivators by Area Cultivated and Crop

(Number of Respondents)

Area Cultivated	Crop Cultivated					
	Aman	Boro	Aus	Wheat	Jute	Total
0.01 to 0.50 acres	29	52	102	61	170	414
0.51 to 1.00 "	51	36	88	33	46	254
1.01 to 2.00 "	14	11	36	2	13	76
2.01 to 3.00 "	4	1	-	-	2	7
3.00 or more "	4	-	-	-	-	4
Total respondents	102	100	226	96	231	755

Data were also collected on the amount of land owned for 557 of the respondents. These figures, broken down by land size and tenure group, are summarized in Table 3. The figures differ from area cultivated (Table 2) because many cultivators own land that is fragmented into two or more plots, often somewhat distant from each other and often differing in soil and water conditions that influence what crop is grown.

"Land owned" in the survey also included "homestead" land on which a cultivator and his family have a home, shelter cattle and raise a few fruits and vegetables. Respondents with 0.50 acres of land or less are generally considered functionally "landless"; i.e., not possessing enough land to grow crops. About 17 percent (93) of the respondents fell within the "landless" category. 1/

Only 83 of the 557 respondents or 15% of the total reported owning 3.01 acres of land or more. The "wealthiest" land owner interviewed reported owning 18 acres of land, the next wealthiest 11 acres. Only 8 respondents owned more than 5 acres placing them in the category of "big farmers".

Farmers owning 0.51 to 3.00 acres fall into the "small producer" category; they numbered 381 or 68 percent of the total. The average area owned among owner-cultivators was 2.25 acres. The average among sharecroppers was 0.45 acres. Interestingly 70 sharecroppers reported owning more than 0.50 acres but still took in land probably to supplement the limited amount they owned or because they lacked land suitable for the crop they desired to cultivate. In this regard they were not truly "landless" sharecroppers but rather land-owners taking in additional land to sharecrop.

Table 3 : Area Owned By Respondents According To Tenure Type

(Number and Percent of Respondents)

Area Owned (Acres)	Owner-cultivator (Number)	(%)	Sharecropper (Number)	(%)	Total (Number)	(%)
Owns no land	-	-	25	17	25	4
0.01 to 0.50 acres	5	1	63	42	68	12
0.51 to 1.00 "	49	12	44	30	93	17
1.01 to 2.00 "	176	44	15	10	191	35
2.01 to 3.00 "	96	23	1	1	97	17
3.01 or more "	83	20	-	-	83	15
Total Respondents	409	100	148	100	557	100

1/ This definition varies somewhat from the definition of "landless" used in the AID "Report on the Hierarchy of Interests in Land in Bangladesh", September 1977. That report defined landless families as those possessing 0.50 acres of land or less IN ADDITION TO homestead land.

Analysis of Fertilizer Use Practices

Chemical Fertilizer Use by Tenure Group

Table 4 summarizes the proportion of owner-cultivators and sharecroppers among the respondents who used chemical fertilizer on each of the five crops surveyed. The data reveal that for all of the crops chemical fertilizer use was prevalent among both owner-cultivators and sharecroppers. Certain patterns of chemical fertilizer use stand out in the table:

1. For each crop the percentage of sharecroppers using chemical fertilizer is less than that of owner cultivators. The difference is greatest for T. Aman paddy, the most widely cultivated crop accounting for 50 percent of all crop acreage in 1977/78; only 34 percent of sharecroppers used chemical fertilizer as opposed to 73 percent of owner-cultivators. For wheat, the chemical fertilizer use percentages are much closer for the two tenure groups -- 89% for owner-cultivators and 70% for sharecroppers.

2. The two crops with which chemical fertilizer use has been most closely associated are Boro paddy and wheat. The figures show that for owner-cultivators and sharecroppers alike, the percentages using chemical fertilizer were the greatest : 85 and 48 percent respectively for Boro paddy and 89 and 70 percent respectively for wheat.

3. High-risk, flood-irrigated Aus paddy was the crop least frequently fertilized by respondents; only 53 percent of owner-cultivators and 28 percent of sharecroppers applied chemical fertilizer to Aus paddy.

Table 4 : Number and Percent of Respondents Using Chemical Fertilizer

by Tenure Group and Crop

Crop	Owner-Cultivator		Sharecropper		Total Users	
	Number	Percent	Number	Percent	Number	Percent
T. Aman (1977/78)	51	73%	11	34%	62	61%
Boro (1977/78)	67	85%	10	48%	77	77%
Aus (1978/79)	89	53%	16	28%	105	46%
Wheat (1978/79)	56	89%	23	70%	79	82%
Jute (1978/79)	113	70%	32	46%	145	63%
Total	376	69%	92	43%	468	62%

"Number" = Number of respondents using chemical fertilizer;
"Percent" = Percent of total survey respondents (from Table 1).

Chemical Fertilizer Use by Cultivation Practice

The close association of chemical fertilizer use with HYV technology is illustrated in Table 5 which summarizes for each crop and tenure group the use of chemical fertilizer in local variety and HYV cultivation. The total number of cultivators of local and HYV varieties is summarized in Table 1. Table 5 illustrates the following pattern of fertilizer use in local and HYV cultivation:

1. Chemical fertilizer is used much less frequently on local varieties by both tenure groups. Only 43 percent of owner-cultivators and 15 percent of sharecroppers used chemical fertilizer on local variety crops.

2. A high percentage of both owner-cultivators and sharecroppers used chemical fertilizer on HYV's. For all crops 97% of the owner-cultivator respondents employed chemical fertilizer. Only in the case of wheat were there owner-cultivators who did not use chemical fertilizer. The percentage of sharecroppers using chemical fertilizer was 86 percent for all crops and uniformly high for each crop with the exception of Aus paddy (50 percent) and wheat (70 percent).

3. It would appear, then, that cultivators of local varieties are either less confident of getting increased yields from chemical fertilizer on local varieties or less capable of obtaining fertilizer to use.

Chemical Fertilizer Use by Area Cultivated

Table 6 summarizes data on the number and percent of respondents using fertilizer according to the area cultivated in each crop. The figures indicate there is no regular pattern among crops relating the numbers using chemical fertilizer to the area cultivated. Those farming very small plots under 0.50 acres appeared to employ chemical fertilizer about as frequently as the average for Aus (47%), Jute (64%) and Wheat (89%).

The total sample has a very small number of respondents cultivating over 3.00 acres so it is difficult to assess whether this group used chemical fertilizer relatively more frequently. The data do suggest, however, that farmers cultivating very small plots were getting and using chemical fertilizer on this last years' crops about as frequently as were cultivators of larger plots.

Table 5 : Number and Percent of Respondents Using Chemical Fertilizer By Cultivation Practice - HYV or Local

Tenure Group and Crop	Number		Percent	
	Local	HYV	Local	HYV
Owner-cultivator	120	256	43%	97%
Aman	30	21	61	100
Boro	8	59	40	100
Aus	36	53	31	100
Wheat	-	56	-	89
Jute	46	67	48	100
Sharecropper	21	71	18	86
Aman	5	6	19	100
Boro	0	10	0	90
Aus	8	8	16	100
Wheat	-	23	-	70
Jute	8	24	19	89
Total (all crops)	141	327	34%	95%
Total (all users)	468		62%	

"N" = Number of respondents using fertilizer; "Percent" = Share of total respondents (from Table 1) using fertilizer.

Table 6 : Number and Percent of Respondents Using Chemical Fertilizer by Area Cultivated

Area Cultivated (Acres)	T. Aman		Boro		Aus		Jute		Wheat		Total	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
0.01 to 0.50 acres	12	41%	35	67%	48	47%	109	64%	54	89%	258	62%
0.51 to 1.00 "	37	73%	33	92%	29	33%	27	54%	24	73%	150	59%
1.01 to 2.00 "	6	43%	9	82%	24	77%	9	69%	1	50%	49	69%
2.01 to 3.00 "	4	100%	-	-	4	80%	-	-	-	-	8	66%
3.01 or more "	3	75%	-	-	-	-	-	-	-	-	3	75%
Total fertilizer users	62	61%	77	77%	105	46%	145	63%	79	82%	468	62%

"N" = Number using fertilizer; "%" = Percent of total respondents (from Table 2) using fertilizer.

"Area Cultivated" is defined as the total area dedicated by a respondent to the particular crop being surveyed and may consist of one or more plots of varying sizes and qualities.

Fertilizer Use Intensity Among Respondents

The survey also collected data on the intensity of chemical fertilizer use among cultivators. Of particular interest was the number of farmers using recommended dosages of fertilizer on their crops.

Recommended dosages of chemical fertilizer for each of the crops surveyed are summarized in Table 7. These dosages should be approached with caution recognizing that recommendations vary according to seed varieties and soil types. Detailed Ministry of Agriculture chemical fertilizer recommendations exist that take into account the range of seed varieties and soil types in Bangladesh but for the purposes here a more simplified list is used.

Table 8 summarizes the numbers of respondents using "some" chemical fertilizer and "recommended" chemical fertilizer dosages on their crops. Many farmers in our survey also used organic fertilizer (cow-dung ash or oil-cake) in combination with chemical fertilizer on their crops. In such cases, recommended chemical fertilizer dosages would be less. 1/ In the case of jute, for example, recommended chemical fertilizer dosages in combination with organic fertilizer (cow-dung) are only about half recommended dosages without cow-dung.

In compiling Table 8, therefore, a liberal interpretation of "recommended" chemical fertilizer use was adopted. Giving farmers the benefit of the doubt and assuming that most also used some organic fertilizer, respondents were classified as using recommended dosages of chemical fertilizer if they applied at least 80 percent of the levels recommended in Table 8. Clearly, the percentage of respondents using recommended levels of chemical fertilizer was very low.

No cultivators of local varieties of any of the crops reported using chemical fertilizer in amounts approaching recommended dosages. All respondents using recommended fertilizers were HYV cultivators. Except for jute, owner-cultivators dominated the uses of recommended fertilizer dosages. The number of sharecroppers using recommended fertilizer dosages by crop were: T. Aman (O); Boro (2); Aus (2); Wheat (O) and Jute (34). Only eight "landless" sharecroppers -- 0.50 acres of less -- used recommended chemical fertilizer dosages; all eight cultivated jute.

1/ As a general rule of thumb, 10 maunds of good organic (cow-dung) compost can be substituted for 2.0 seers of Urea, 1.5 seers of TSP and 2.0 seers of MP.

Table 7: Recommended Chemical Fertilizer Dosages for Major Crops

(Figures in Pounds of Product)

Crop	Fertilizer Application Per Acre			
	(Urea)	(TSP)	(MP)	(Total)
T. Aman HYV	160	120	60	340
" Local	90	90	40	220
Boro HYV	210	160	120	490
" Local	100	90	50	240
Aus HYV	80	80	66	226
" Local	60	60	25	145
Wheat	190	170	30	390
Jute (w/o cowdung)	90	22	66	178
" (with cowdung at a rate of 50 mds/acre)	50	6	36	92

Source: Ministry of Agriculture, Agriculture Information Services, Crop Extension Bulletins.

Table 8: Chemical Fertilizer Use Intensity Among Respondents

(Numbers of Respondents)

Crop	Level of Application Among Fertilizer Users					
	Some Use		Recommended Use 1/		Total	
	(Number)	(%)	(Number)	(%)	(Number)	(%)
T. Aman	52	84	10	16	62	100
Boro	65	84	12	16	77	100
Aus	85	81	20	19	105	100
Wheat	69	87	10	13	79	100
Jute	73	50	72	50	145	100
Total	344	74	124	26	468	100

1/ At least 80 percent of dosages recommended in Table 8.

Fertilizer Use Intensity and Crop Yield Responses

Crop production figures obtained from survey respondents permit comparison of the relationship between chemical fertilizer use intensity and crop yield responses. Low crop yield responses would explain low chemical fertilizer use among respondents; high crop yield responses would suggest there were other causes for low or no chemical fertilizer use.

The reader is cautioned, again, that data on yields like data on fertilizer use were compiled from respondents' own production estimates and not from more rigorous scientific measures such as crop-cuts. Moreover, some error has probably crept into conversion of local measures of plot size to acres and local measures of fertilizer, grain and fibre output to maunds (82.2 pounds). The fertilizer use and crop yield figures calculated from the survey respondents, however, were found to be reliably close to national and district averages as well as to those from other selected crop studies.

In their transition from traditional to "modern" farmers, cultivators' use of chemical fertilizer has generally progressed in the following four steps:

Step # 1. "No" chemical fertilizer use (NF) on local varieties;

Step # 2. "Some" chemical fertilizer use (SF) on local varieties;

Step # 3. "Some" chemical fertilizer use (SF) on HYV's;

Step # 4. "Recommended" chemical fertilizer use (RF) on HYV's.

No respondents used "recommended" dosages of fertilizer on local varieties and the number of respondents using "no" chemical fertilizer on HYV's was negligible (21 wheat farmers; 1 Boro farmer and 3 jute farmers).

The survey respondents were grouped according to the "step" in which they were found at the time of the survey and the average yields of those cultivators at that step were calculated for each crop. 1/ Table 9 summarizes average yields along with the differencees in yields experienced in the transition from: Step # 1 to Step # 2; Step # 2 to Step # 3; and Step # 3 to Step # 4; as well as the total difference between the first and last steps in chemical fertilizer usage. Some interesting patterns emerge from a comparison of yields between each of these steps.

Step # 1 to Step # 2 - From "no" to "some" chemical fertilizer use on local varieties. Yields were remarkably close among those applying "no" fertilizer to local varieties of the three rice crops; T. Aman yields were highest (19) maunds/acre) followed by Boro (18) and Aus (16). The increase in yields experienced in moving to Step # 2 ("some" chemical fertilizer use) on local varieties was very small. For T. Aman and Aus the difference of one maund/acre was too small to be significant. For Boro the difference of 4 maunds would be enough to cover costs of fertilizer among owner-cultivators but not among share-croppers who after paying half the added output as rent would have an "effective" yield of only two maunds per acre.

This low yield response to fertilizer probably explains why cultivators apply chemical fertilizer to local varieties much less frequently than to other varieties. (See Table 5). In the case of jute, the boost in yields from some fertilizer on local (traditional) varieties was proportionately greater. From Table 5 it is also apparent that the proportion of cultivators using chemical fertilizer in traditional jute cultivation was also relatively higher than the other crops with the exception of T. Aman.

1/ No pattern of yields in relation to area cultivated or area owned was found for a given level of fertilizer use among the respondents grouped within the four steps.

Table 9: Fertilizer Use Intensity and Crop Yield Responses

(Figures in maunds per acre)

Crop	From: (Practice)	From: (Yield)	To: (Practice)	To: (Yield)	Difference in Yields
T. Aman:	Local - NF	19	Local - SF	20	1
"	Local - SF	20	HYV - SF	41	21
"	HYV - SF	41	HYV - RF	47	6
"	Total difference				28
Boro :	Local - NF	18	Local - SF	22	4
"	Local - SF	22	HYV - SF	48	26
"	HYV - SF	48	HYV - RF	55	7
"	Total difference				37
Aus :	Local - NF	16	Local - SF	17	1
"	Local - SF	17	HYV - RF	44	27
"	HYV - SF	44	HYV - RF	50	6
"	Total difference				34
Wheat :	HYV - NF	16	HYV - SF	24	8
"	HYV - SF	24	HYV - RF	30	6
"	Total difference				14
Jute :	Trad. - NF	14	Trad. - SF	19	5
"	Trad. - SF	19	Impr. - SF	21	2
"	Impr. - SF	21	Impr. - RF	23	2
"	Total difference				9

"N" = No fertilizer used; "SF" = Some fertilizer used; "RF" = Recommended fertilizer used.

Step # 2 to Step #3 - From "some' chemical fertilizer on local varities to "some" chemical fertilizer on HYV's

It is in the transition from Step #2 to Step #3 that the biggest payoff to fertilizer use was found among cultivators. For the three rice crops the use of HYV's with some chemical fertilizer meant more than a doubling of yields over local varities. Nearly one ton (27.25 maunds) per acre more of grain was achieved for Aus (27 maunds) and Boro (26 maunds) and somewhat less for T.Aman (21 maunds). In the case of jute, the difference (2 maunds) was almost negligible. 1/

It follows that for jute, with such little difference in fibre yields, traditional cultivation should continue to dominate among respondents (137 out of 231 respondents or 59 percent of the total). In the case of the three rice crops, however, the limited inroads of fertilized HYV's among respondents, given such excellent yield responses suggests the existence of obstacles to using fertilizer and HYV's such as a defective supply for HYV seed and chemical fertilizer or limited effective demand for chemical fertilizer among non-users or both.

Step #3 to Step #4 - From "some" to "recommended" chemical fertilizer use on HYV's

While much less dramatic than between Step #2 to Step #3, further increases in output were nevertheless experienced by respondents applying "recommended" levels of chemical fertilizer. Respondents cultivating rice and wheat averaged between 6 and 7 maunds per acre more output when "recommended" instead of just "some" dosages of chemical fertilizer were applied on HYV's.

The use of recommended dosages of fertilizer on improved jute cultivation boosted yields by about two maunds; relatively, this was much smaller but then so are chemical fertilizer recommendations for jute in relation to the other crops. (See Table 7). Wheat, which was the crop having the largest percentage of HYV users who applied no chemical fertilizer demonstrated a yield response of 6 maunds per acre going from "some" to "recommended" and 14 maunds per acre going from "none" to "recommended" dosages.

1/ However, the yield figures do not reflect the fact that improved jute cultivation produces a higher quality fibre bringing cultivators proportionately more income than the differences in yield figures suggest.

Relative Benefits from Chemical Fertilizer Use Among Owner-cultivators and Sharecroppers

The low rate of HYV and chemical fertilizer use among sharecroppers is better understood when their benefits from fertilizer use are compared with those of owner-cultivators. To make the comparison it is necessary to adjust gross increases in yields for the added costs of required chemical fertilizer, seed, labor, pesticides, and credit. In the case of sharecroppers, the gross increases in yields must also be reduced by fifty percent to account for the half of harvest paid as rent to land owners.

Cost of production data were collected from the survey respondents for local and HYV cultivation and analyzed in separate studies prepared by USAID/Dacca. These cost of production surveys for the five crops permit comparison of net benefits -- added yields adjusted for the amount of output sold to pay for the required added inputs -- from cultivation of local varieties with "some" fertilizer (Step # 2) and HYV's with "some" fertilizer (Step # 3), the two steps between which the greatest increase in yields was registered by respondents.

Table 10 indicates the added yield (from Table 9), the added cost (in maunds of grain) and the net benefit associated with the transition from Step # 2 to Step # 3 for owner-cultivators and sharecroppers of each crop. (In the case of wheat the transition from "no" chemical fertilizer use to "recommended" chemical fertilizer use on HYV's is presented).

The figures illustrate that owner-cultivators' net benefits from fertilizer use were positive for all crops except jute. In the latter case, returns from "some" fertilizer use on improved varieties of jute probably are better compared with "no" chemical fertilizer on traditional, the more common alternative cultivation practice, since those respondents using "some" chemical fertilizer on traditional varieties were few compared to those using "some" on improved and "none" on traditional varieties.

Table 10: Relative Benefits from Chemical Fertilizer Use Among Tenure Groups

(Values in maunds of grain or fibre)

Crop	Owner-cultivator			Sharecropper		
	Added Yield	Added Cost	Net Benefit	Added Yield	Added Cost	Net Benefit
T. Aman	21	6	15	10.5	6	4.5
Boro	26	11	15	13	11	2.0
Aus	27	9	16	13.5	9	4.5
Wheat	9	4	5	4.5	4	0.5
Jute	2	2	0	1	2	-1

"Added Yield" is from Table 9; for sharecroppers yield is reduced 50 percent. "Added Cost" is calculated as the amount of added output sold to pay for added production costs, based on USAID/Dacca cost-of-production surveys and 140 Taka/maund of fibre.

Sharecroppers' net benefit from chemical fertilizer and HYV use, once gross yields are adjusted for land-rents (50 percent of added output) plus the amount of grain sold to pay for added inputs, are only a fraction (20 to 25 percent) of owner-cultivators' net benefits and, in some cases, so marginal as to raise doubt whether any gain from chemical fertilizer adoption was possible.

When the greater risk inherent in chemical fertilizer and HYV use is also considered, the incentive among sharecroppers to adopt these inputs is further constrained. For example, should wheat or paddy prices at harvest fall from 84/taka/maund, the official procurement price, to 65/taka/maund, the post harvest price in some regions during the time of the survey, sharecroppers would have experienced negative returns from chemical fertilizer on HYV's even under good yield conditions.

Understandably, then chemical fertilizer and HYV use among sharecroppers is not so prevalent. Why, then, would sharecroppers even attempt relatively more risky HYV cultivation? One reason may be they are guided by their cash-costs and discount the value of their own and their family's labor employed in cultivation. Another insight is provided by a comment of one landowner, now a government official living in Dacca, who leased his land to sharecroppers. He prided himself for encouraging his sharecroppers to use HYV's. "They had better use HYV's and fertilizers," he boasted, "or I'll find other sharecroppers who will. There are plenty of farmers willing to sharecrop my land every season. I can set my terms."