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Accelerating Agriculture Productivity Improvement (AAPI)

Survey on Gross Margin of Farmers for *Aman* 2011

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Acronyms and Abbreviations

AAPI	Accelerating Agriculture Productivity Improvement
DAE	Department of Agricultural Extension
DAP	Diammonium Phosphate
FTF	Feed the Future
GDP	Gross Domestic Product
ha	Hectare
IFDC	International Fertilizer Development Center
MOP	Muriate of Potash (Potassium Chloride)
mt	Metric Tons
N	Nitrogen
NPK	Nitrogen, Phosphorus, Potassium
Tk	Taka (Bangladesh currency)
TSP	Triple Superphosphate
UDP	Urea Deep Placement
US \$	United States Dollar
USAID	United States Agency for International Development

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Survey on Gross Margin of Farmers for Aman 2011

Introduction

Calculation of the Gross Margin for resource poor farmers is a new result indicator for AAPI project as required under Feed the Future (FTF) upscale program of USAID. The AAPI project is promoting farmer use of urea deep placement (UDP) technology to improve resource efficiency in rice production in 22 selected districts of the country in the South, Southwest and Northeast. *Guti* urea (UDP) is a resource efficient technology that allows farmers to significantly reduce the use of nitrogen fertilizer (up to 33 percent); it contributes to significant (20-25 percent) increases in yields per unit of land area. AAPI has been working on diffusion of UDP technology through training and creating awareness among farmers; a total of 243,275 hectares (ha) of land have come under UDP technology in the first year of implementation of AAPI.

This report estimates the Gross Margins realized by farmers producing paddy with *Guti* urea during the *Aman* 2011 season and compares the same with paddy being produced with prilled urea. The difference between the total revenue from *Aman* rice and the total input cost is termed gross margin¹. The gross margin is used to analyze how efficiently a farm is using its inputs -- raw materials, labor and production-related fixed assets to generate profit. Improving the gross margin for farm products contributes to increasing agriculture gross domestic product (GDP), which will increase income, and thus directly contribute to improving production and reducing poverty.

Objective

The major objectives of the study are to calculate the productivity, gross margin, and employment at farm level and cost benefit ratio of sample farmers using “*Guti* urea” compared to those of broadcasted urea.

¹USAID FTF indicator definition: The gross margin is the difference between the total value of sales of the agricultural product (crop) and the cost of producing that item excluding family labor, divided by the total number of units (hectares of crops) in production. Gross margin per hectare, for targeted commodities, is a measure of net income for that farm activity.

Methodology

The study was carried out in all the 20 FTF districts and 2 Northeast districts under AAPI intervention. The survey included 450 respondents (farmers), selected from upazilas which had a total area greater than 2,500 ha under *Guti* urea during *Aman* cultivation in 2011. The number of samples in each upazila was decided in proportionate to the total size of the area under *Guti* urea in these upazilas.

BR 11 was expected to be the most popular variety being grown during *Aman* throughout Bangladesh². Therefore, the survey focused on those farmers who grew this variety in *Aman* 2011. Another reason for selecting one variety was to get uniform information on all aspects of production. The farmers were selected randomly. Primary data was collected from the respondent farmers through personal interviews using a structured questionnaire.

The survey results were tabulated, coded and data entry performed by competent AAPI staff. All the local measurements were converted into standard unit and final analysis was done by using computer software packages: Microsoft Excel, Microsoft Access and SPSS. The analyses performed were based upon total costs analysis.

Cost of Production

The input costs include production costs for seed, fertilizers, other inputs, land preparation, human labor, land rent and interest on working capital. Total cost of production was calculated by adding all the expenditure on inputs as shown below:

Total cost = Σ of cost of all inputs = cost of land preparation + cost of fertilizer + cost of human labor + cost of other inputs+ land rent+ interest on working capital

Only hired labor costs were considered for gross margin calculation³. The cost of “owned land” that was used has been substituted with the prevailing rent of land during the season because in Bangladesh more than 40 percent of the farmers are share croppers who pay land rent.

² However, in this survey we found that 36 percent of the land was used for BR11 out of total *Aman* cultivated area this season (2011). But small farmers cultivated 51 percent of their land with BR11.

³ As per FTF indicator definition

Interest on working capital is the cost of investment used for cultivation of the *Aman* crop. Interest expense was added so that farms with different financial structures can be compared.

Total Revenue Earned

The revenue earned was calculated as the total production of rice multiplied by the market price of the rice. The market price received by farmers for selling rice is used to value it. In addition, the value of straw was added with total revenue earned as farmers now sell straw to others.

Gross Margin Analysis

The gross margin provides a simple and quick method for analyzing the financial returns to the farm business. Gross margin per ha is the difference between the gross return per ha and the total input cost incurred per ha⁴. It may be noted as the farmers in Bangladesh do not pay tax; thus, gross margin equates to net profit.

Gross margin/ha = Gross return/ha - Total input cost excluding family labor/ha

Where, Gross return = Σ of Gross returns = Return from grain + Return from straw.

Benefit Cost Ratio Analysis

The benefit cost ratio is calculated to assess the return on investment in farming. It is calculated as the ratio between the gross return and total cost of investment.

B: C ratio = Gross return/ Total cost

Results

Average Farm Size

The average farm size of the sample respondents was 1.24 ha. According to the definition of the Preliminary Report of Bangladesh Census of Agriculture (2008)⁵, farms have been categorized in to small, medium and large sized holdings. Out of the total respondents, the majority (55 percent) are

⁴ As per FTF indicator definition

⁵ “[Preliminary Report of Agriculture Census – 2008](http://www.bbs.gov.bd/PageReportLists.aspx?PARENTKEY=44)”. Bangladesh Bureau of Statistics, Accessed on January 03, 2012, <http://www.bbs.gov.bd/PageReportLists.aspx?PARENTKEY=44>

categorized as small farms, followed by medium (39 percent) and large (6 percent). The average farm size in Mymensingh zone is 0.98 ha and in FTF districts 1.55 ha.⁶

As shown in Table 1, small farmers planted BR 11 in 50 percent of their total cultivated land during the *Aman* season 2011.

Table 1: Number of Sample Respondents by Farm Category, Area Cultivated, Area under BR 11

Farm Size Group	Total Number	Percentage	Average farm size (ha)	Total <i>Aman</i> Area of sample farmer (ha)	Percentage	Area under <i>Aman</i> BR 11 (ha)	Percent-age of Total <i>Aman</i> Area under BR 11	Percentage of BR 11 Area under	
								<i>Guti</i> Urea	Broad-casted Urea
Small farmers (0.2-1 ha)	248	55	0.58	145	26	73	51	48	52
Medium farmers (1-3 ha)	175	39	1.62	283	51	95	33	41	59
Large farmers (>3 ha)	27	6	4.76	128	23	30	24	32	68
Total	450	100	1.24	556	100	198	36	121	179

Source: Field Survey Aman 2011

Note: Percentages are rounded to the nearest one.

Yield

As shown in Table 2, the weighted average yield per ha was higher in large farms compared to other farm sizes. This was because 75 percent of the large farmers were located in FTF districts, where terrain is naturally fertile and favorable climatic condition led to higher yield during this season.

Table 2: Weighted Average Yield by Farm Size (mt/ha)

Farm Size	<i>Guti</i> Urea	Broadcasted Urea	Incremental
Small	4.93	4.10	0.83
Medium	5.07	4.22	0.85
Large	5.25	4.22	1.04

Source: Field Survey Aman 2011

As indicated in Table 3, yield was higher in the FTF districts than those realized in the Mymensingh zone. FTF districts have higher yield because terrain is naturally fertile and favorable

⁶ Please see Appendix for details by FTF and Mymensingh Zones.

climatic condition led to higher yield during this season. On the other hand, there was drought in some parts of Mymensingh zone this season, which led to loss of crops.

Table 3: Weighted Average Yield by Zone (mt/ha)

Zone	<i>Guti</i> Urea	Broadcasted Urea	Incremental
Mymensingh Zone	4.83	4.05	0.78
FTF Districts	5.25	4.32	0.93
Total	5.03	4.18	0.85

Source: Field Survey Aman 2011

Note: Percentages are rounded to the nearest one.

Gross Margin

Gross Margin by Farm size

As shown in Table 4, the weighted average gross margin is higher under *Guti* urea for all three farm sizes.

Table 4: Weighted Average Gross Margin by Farm Size (Taka/ha)

Item	<i>Guti</i> Urea Area			Broadcasted Urea Area		
	Small	Medium	Large	Small	Medium	Large
Total Return	86,934	85,663	83,229	72,311	71,234	66,800
Total Cost	52,865	52,196	49,940	53,794	54,751	52,931
Gross Margin	34,069	33,467	33,290	18,517	16,483	13,869
Gross Margin (%)	64	64	67	34	30	26
Benefit Cost Ratio (BCR)	1.64	1.64	1.67	1.34	1.30	1.26

Source: Field Survey Aman 2011

Note: Percentages are rounded to the nearest one.

The gross margin realized during the season varies across small, medium and large farms, for both *Guti* and broadcasted urea; it is highest for small farms both in the UDP and broadcasted urea plots. Total return was highest in small farms and costs were comparatively lower since family labor was not included in the calculations. As small farms are more likely to use family labor, there was significant effect of this on the costs of small farms.

Even though yield was highest in large farms, the revenue was less because 75% of the sample was in FTF districts where price of paddy were low. The lower costs induced by low land rent and irrigation costs and associated with scale of economies in large farms have been offset by the fact that large farms are more likely to use hired labor.

Gross Margin by Zone

As shown in Table 5, the weighted average gross margin is higher in *Guti* urea plots for both the Mymensingh Zone and FTF districts. And, comparing between the two zones, the gross margin is higher in the FTF districts for both the *Guti* urea and broadcasted urea plots.

Table 5: Weighted Average Gross Margin by Zone (Taka/ha)

Item	<i>Guti</i> Urea		Broadcasted Urea	
	FTF	Mymensingh	FTF	Mymensingh
Total Return	81,187	90,274	66,737	75,720
Total Cost	43,724	59,496	46,333	61,053
Gross Margin	37,463	30,778	20,403	14,668
Gross Margin (%)	86	52	44	24
Benefit Cost Ratio (BCR)	1.86	1.52	1.44	1.24

Source: Field Survey Aman 2011

Note: Percentages are rounded to the nearest one.

As indicated in Table 5, the weighted average cost in Mymensingh zone is higher both in *Guti* and broadcasted urea plots compared to FTF districts. This higher cost is due to high land rent, larger number of hired labor and higher quantity of urea and other fertilizers used in the Mymensingh zone. Irrigation cost is also higher in Mymensingh zone since farmers used supplemental irrigation due to drought experienced in that area during this season.

The total amount of production is higher in the FTF districts than Mymensingh zone; however total revenue in the Mymensingh zone is higher due to high market price of paddy and straw in these areas.

Total Gross Margin⁷

The major cost items in paddy production were human labor and land rent (Appendix 3). The quantity of urea used in broadcasted plots is higher than that of *Guti* urea plot; therefore use of *Guti* urea saved cost on fertilizer. The average productivity of paddy using *Guti* urea was 5.03 mt/ha which is higher than national average productivity⁸ of 3.36 mt/ha and also higher than average productivity of BR 11 rice using broadcasted urea of 4.18mt/ha. The reason for higher yield may be attributed to the fact that the national yield is shown for 2008-2009 when price of all fertilizer except urea was comparatively much high. After reduction of prices of other fertilizers in 2010, especially muriate of potash (MOP) and increase in the prices of urea in 2011, farmers are inclined to use other fertilizers resulting in increased yield.

As shown in table 6, the average total returns/ha from *Guti* urea was 20 percent higher than the average total returns of broadcasted urea. The average gross margin/ha of broadcasted urea was TK 17,505 while the average gross margin of *Guti* urea was TK 34,285 per ha. The income from *Guti* urea was much higher than that of broadcasted urea and therefore is more profitable.

Table 6: Weighted Average Gross Margin for All Sample Farmers (Taka/ha)

Item	<i>Guti</i> Urea	Broadcasted Urea
Total Return	86,777	72,041
Total Cost	52,492	54,536
Gross Margin	34,285	17,505
Gross Margin (%)	65	32
Benefit Cost Ratio (BCR)	1.65	1.32

Source: Field Survey Aman 2011

Note: Percentages are rounded to the nearest one.

The BCR with *Guti* urea use was 1.65 which indicates that farming using *Guti* urea is profitable and the farmers are realizing a return of Tk. 1.65 on average per taka invested in rice production with *Guti* urea as the fertilizer technology.

⁷ Please see appendix for detail.

⁸ Report on the Cost of Production of *Aman* Paddy 2008-09 by Bangladesh Bureau of Statistics

Table 7⁹ analyzes the P values¹⁰ (test of statistical significance) of total return, total cost and gross margins. It shows that there is no statistical significant difference between the average total cost of *Guti* urea and broadcasted urea; but the difference between average return of *Guti* urea and broadcasted urea are significantly different. For gross margin/ha, the P value is less than 0.001; implying that there are statistically significant difference between gross margins of rice produced using *Guti* urea and that of broadcasted urea.

Table 7: Analysis of P Values of Total Return, Total Cost and Gross Margins for Aman Rice Production using *Guti* and Broadcasted Urea

		Significant (2-tailed) P value	95% Confidence Interval of the Difference	
			Lower	Upper
Total Return	Equal variances assumed	0.000*	13960.47	16729.94
	Equal variances not assumed	0.000*	13960.41	16730.01
Total Cost	Equal variances assumed	0.849	-7800.73	6418.58
	Equal variances not assumed	0.849	-7800.73	6418.58
Gross Margin	Equal variances assumed	0.000*	8856.89	23215.68
	Equal variances not assumed	0.000*	8856.89	23215.68

* Significance at 0.001

Sales of Product

The sample farmers were asked how much paddy was produced and how much they sold in the market immediately after harvesting. Based upon the survey results, a total of 900 mt of paddy was produced of which 170 mt (19 percent) was sold and 731mt (81 percent) was kept for the farmers own family consumption¹¹. As shown in Table 8, of the portion of the harvest amount sold, the large farmers sold the highest quantity (33 percent) followed by medium farmers (18 percent) and small farmers (15 percent).

Table 8: Sales of Paddy by Farm Size (mt)

⁹ t-test for Equality of Means

¹⁰ The p-value is the probability of obtaining a test statistic at least as extreme as the one that was actually observed, assuming that the null hypothesis is true. When the null hypothesis is rejected, the result is said to be statistically significant.

¹¹ However at times farmers are seen to wait for better price in the market before they sell their produce.

Farm Size	Total Rice Production	Sale	Own Consumption
Small	330 (100)	48 (15)	282 (85)
Medium	432 (100)	77 (18)	355 (82)
Large	138 (100)	45 (33)	93 (67)
Total	900 (100)	170 (19)	731 (81)

Source: Field Survey Aman 2011

Note: Figures in parentheses are percentages and rounded to the nearest one.

Sales of paddy by zones are presented in Table 9. In both of the zones, farmers sell 19% of their product immediately after harvest.

Table 9: Sales of Paddy by Zones (mt)

Zone	Total Paddy Production	Sale	Own Consumption
Mymensingh Zone	451 (100)	86 (19)	365 (81)
FTF Districts	449 (100)	84 (19)	365 (81)
Total	900 (100)	170 (19)	730 (81)

Source: Field Survey Aman 2011

Note: Figures in parentheses are percentages and rounded to the nearest one.

Conclusion

Empirical results show that in the case of *Aman* paddy production, farmers that use *Guti* urea realize positive gross margins and the gross margin is higher than that which results from use of broadcasted urea. The magnitude of gross margin differed notably between paddy produced using *Guti* urea and broadcasted urea.

This study also revealed that paddy production using *Guti* urea is more cost effective than that is the case with broadcasted urea; yields are higher on average with *Guti* urea. The higher productivity of paddy cultivation using *Guti* urea (viz-a-viz the national average) substantiates that using *Guti* urea is a viable option for the sustainable food production and food security.

Comparing gross margins of *Aman* paddy produced using *Guti* urea and broadcasted urea confirms that there are significant differences between them. The results imply that there are significant variance in the cost and revenue of *Aman* paddy production using *Guti* urea and broadcasted urea. Therefore paddy production using *Guti* urea is profitable.

Appendix 1: Number of Sample Farmers by Upazila

District	Upazila	No of Sample
Bagerhat	Bagerhat Sadar	11
Bagerhat	Morrelganj	10
Barguna	Amtali	18
Barguna	Barguna Sadar	11
Barisal	Babuganj	12
Barisal	Bakerganj	16
Patuakhali	Bauphal	27
Patuakhali	Galachipa	47
Patuakhali	Kalapara	27
Patuakhali	Patuakhali Sadar	12
Pirojpur	Mathbaria	11
FTF Districts		202
Mymensingh	Bhaluka	17
Mymensingh	Fulbaria	16
Mymensingh	Gaffargaon	13
Mymensingh	Haluaghat	14
Mymensingh	Ishwarganj	24
Mymensingh	Muktagacha	23
Mymensingh	Mymensingh Sadar	11
Mymensingh	Nandail	21
Mymensingh	Phulpur	44
Mymensingh	Trishal	11
Sherpur	Nakla	13
Sherpur	Nalitabari	16
Sherpur	Sreebordi	10
Sherpur	Sherpur Sadar	15
Mymensingh Region		248
Total		450

Appendix 2: Number of Sample Respondents by Zone, Area Cultivated during *Aman* 2011, Area under BR 11 Variety using *Guti* and Broadcasted Urea

Zone	Total Number	Percentage	Average farm size	Total <i>Aman</i> Area of farmer sample	Percentage	Area under <i>Aman</i> BR 11	Percentage of Total <i>Aman</i> Area under BR 11	Percentage of BR 11 Area	
		(%)	(ha)	(ha)	(%)	(ha)	(%)	<i>Guti</i> Urea (%)	Broadcasted Urea (%)
Mymensingh Zone	248	55	0.98	242	44	103	43	42	58
FTF Districts	202	45	1.55	314	56	95	30	42	58
Total	450	100	1.24	556	100	198	36	42	58

Appendix 3: Gross Margin per Hectare of BR-11 Aman 2011 Paddy in Guti and Broadcasted Urea Plot

Item	Unit	Guti Urea Area (Ha): 83.33			Broadcasted Urea Area (Ha): 115.13			Difference
		Unit Price	Quantity	Total Cost/Return	Unit Price	Quantity	Total Cost/Return	
		(Taka)		(Taka)	(Taka)		(Taka)	(Taka)
YIELD				-			-	-
Main crop—paddy	mt	15,094	5.03	75,968	15,094	4.18	63,067	12,901
Byproduct	mt	2,148	5.03	10,809	2,148	4.18	8,973	1,836
RETURN								
Total Return				86,777			72,041	14,736
COST								
Human labor	Person Day/ha	300	57	17,008	300	59	17,628	(621)
Power tiller	Rent/ha	4,988	1	4,988	5,363	1	5,363	(375)
Seed	kg	36	39.59	1,417	36	40.29	1,454	(37)
Fertilizer nutrient				-			-	-
- N from Urea	kg	43.48	51.73	2,249	47.83	70.43	3,368	(1,119)
- N from DAP	kg	30.00	0.91	27	30.00	0.75	22	5
- P ₂ O ₅ from TSP	kg	50.00	28.89	1,444	50.00	28.46	1,423	21
- P ₂ O ₅ from DAP	kg	30.00	2.32	70	30.00	1.91	57	13
- K ₂ O	kg	26.67	27.00	720	26.67	25.45	679	41
- S	kg	44.44	1.97	87	44.44	1.76	78	9
- ZnSO ₄	kg	380.56	0.03	10	380.56	0.02	6	4
Cow dung/compost/organic	Mt	1,119	1.14	1,278	1,120	1.03	1,153	124
Pesticides	Tk/ha	836	1	836	812	1	812	24
Irrigation cost	Tk/ha	718	1	718	755	1	755	(37)
Interest on working capital				2,500			2,597	(97)
Land rent for the season	Rent/ha	19,140	1	19,140	19,140	1	19,140	-
Total Cost				52,492			54,536	(2,044)
Gross Margin				34,285			17,505	16,780
Benefit Cost Ratio				1.65			1.32	

Interest on working capital is calculated as (working capital) x 12% / 12 x 5, where 5 represents cropping season or months

Cost : Benefit ratio is calculated as (Gross Return / Total Cost)

US \$1 = TK 76.85

Source : Field Survey Aman 2011