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Research Note

MARKETABLE AND MARKETED SURPLUSES OF SOME LEADING CROPS IN BANGLADESH: RECENT TRENDS AND POLICY IMPLICATIONS

Shamsul Alam
Siren Afruz

ABSTRACT

In this paper, investigation has been made to analyse the marketable and marketed surpluses of leading crops viz. different varieties of rice, wheat, potato, mustard and lentil. This study suggests that marketed surplus as percentage of total production was found highest in potato (64 per cent) followed by lentil (59.5 per cent), Boro paddy (57.5 per cent), mustard (52.7 per cent), Aman paddy (48 per cent), Aus paddy (38 per cent) and wheat (14 per cent). Small farmers were the large suppliers of agricultural crops during harvest time and sell out crops to meet up their cash obligation when the prices remain low. On the other hand, they purchase the same crop at off-season to meet up their consumption requirement and at that time prices remain high. So, small farmers were worse off by this seasonal sales pattern and price variation. Large farmers received the highest prices prevailed in the market relatively with strong bargaining capacity with the market intermediaries and their pre-harvest time sales is higher than other size group of farms. This study suggested that among different explanatory variables, farmers were very much price sensitive irrespective of their farm sizes. Price elasticity of marketable surplus as estimated for Aman paddy, Boro paddy, wheat, potato and mustard appeared 1.89, 2.7, 1.23, 2.46 and 1.40, i.e. prices significantly influenced marketable surpluses of these crops. In general, marketable surpluses of crops reflect farmers well-being. So, price policy influencing output prices have important role in increasing marketable and marketed quantities. This study suggested some policy options based on research findings which should help the policy markers to adopt appropriate measures to increase marketed surplus in Bangladesh agriculture leading to a gradually commercialised agriculture.

I. INTRODUCTION

Marketed surplus of agricultural crops plays a significant role, where agriculture is the main source of household income. The surplus of crops not only meet up our food and fibre deficit, it can also contribute to capital formation and provides the basic wage goods,

The authors are respectively Professor and Post-graduate student at the Department of Cooperation and arketing, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. The authors are ateful to the anonymous referees for their useful comments and suggestions in improving the paper. owever, usual disclaimer applies for this article too. E-mail address of the first author is sabau47@yahoo.com, for any query.

supplying raw materials, and foreign exchange to the non agricultural sector. For policy purposes, the seasonal variation of prices (e.g. harvest time price and pre-harvest time price) and their responsiveness is also important for policy formulation (Alam 1991, p.45). To be self sufficient in food and saving foreign exchange, important crops like rice, wheat, potato, mustard and lentil play a significant role in the entire economy. We are on the verge of commercialisation of crop agriculture. Increasing marketed supply will reflect more market considerations by the farmers in production decisions and the level of increasing affluences in farm sector.

Inspite of its considerable importance in the economy, very few researchers worked in this field in Bangladesh. Raquibuzzaman (1966) found that 60 per cent of the variation in the "marketed surplus" for tenant farmers is explained by per capita production and rent payment. Quasem (1987) found that the gross and net marketed surplus of paddy is estimated to be 28 and 11 per cent of total production. Among those paddy sellers about one-third were deficit market participants and the proportion of them is the highest in the small size groups (37 per cent). Murshed and Rahman (1988) found that the marketed surplus of paddy were about 26 per cent, 28 and 36 per cent of production for small, medium and large farm types. Sabur (1988) found that on an average, 89 per cent of potatoes are sold, of which 71 per cent are sold during harvest and 18 per cent in the latter period. In reviewing the above studies the authors felt the need of conducting and analysing the marketable and marketed surplus of major crops like rice, wheat, potato, mustard and lentil in Bangladesh, because most of these studies have been done only for rice not covering all other important crops except Sabur (1988) who only studied the case of potato. In this study, an attempt has been made to identify the important influencing factors of marketable surplus of important crops, sales and price variation in different season. Such a study is called for by the policy planners, agricultural researchers and economists to assess the current extent of commercialisation of agriculture after almost passing of three decades on concentrated efforts to modernise crop-sector agriculture in developing the overall economy towards a full blown take-off stage. This study tried to formulate policy lessons based on the empirical findings which will help the policy makers to adopt appropriate measures to increase more marketed surpluses even for exports in near future.

The prime thrusts of this research endeavour are to estimate marketable and marketed quantities of crops like varieties of rice (Aus, Aman and Boro), wheat, potato, mustard and lentil. Analyse the behavioural pattern of households selling and buying over time and to identify the factors quantitatively influencing marketable surpluses of these selected crops (marketable and net marketed surpluses has a very high positive correlation). Methodology of the study has been described in section II followed by presentation of results and discussion in section III. Policy conclusions are drawn in section IV.

II. METHODOLOGY

Area Selection and Data Sources

The data used in this study were obtained from the field survey of 180 households in two districts namely, Comilla (Chandina Upazila; a relatively agriculturally developed area) and Mymensingh (Ishwargonj Upazila; a relatively agriculturally backward area). Considering time and resource constraints, two areas, one very advance, that is intensively cultivated area and the other one a relatively backward having low cropping intensity were purposively chosen to have an overall balanced view. The survey has been conducted for the period from March 2001 to April 2002. For the selection of households random sampling method was adopted from the list of households (as of voter list for the selected villages). After selection of households (excluding absentee households), all households were further categorized into three sub classes of farm size groups: small size groups of farms (cultivating less that 1 ha), medium size group of farms (cultivating 1 ha to 3 ha), large size group of farms (cultivating above 3 ha). Out of total samples (180; 90 from each selected Upazila), 89 small farms, 60 medium farms and 31 large farms were surveyed thoroughly. The information were gathered through direct personal interview for primary data from the respondents in the study areas.

Model Specification

i) In this study, to estimate the marketable surplus, the following formula was used:

$MS = P - C$

Where,

MS = Marketable Surplus

P = Total Production and

C = Total requirements (family consumption requirement, farm seeds, payment to labour, payment for social and religious purpose, storage loss).

ii) To estimate marketed surplus (net) the following formula was used :

$M = G - B$

Where,

M = Net Marketed quantity

G = Gross sales

B = Buyback quantity before the next harvest

iii) Multiple log linear and linear regressions were estimated to quantify the impact of different independent variables in explaining marketable surplus of major crops. On the basis of R^2, expected sign, and F value, log linear form equations gave the best fit than linear form of equations. The following two models were used to estimate the relationship:

Mode I : $MS = a + bA_t + cAI + dF + eY_0 + fP_{t-1} + gY_f + hD_1 + iD_2$

Model II : $LnMS = Lna + bLnA_t + cLnAI + dLnF + eLnY_0 + fLnP_{t-1} + gLnY_f + hD_1 + iD_2$

where,

MS = Per farm marketable surplus (dependent variable)

Ln = Natural log of the variable

a = Intercept term
A_t = Total area under the crop in hectare
AI = Proportion of irrigated area
F = Family size
Y_0 = Current year off farm income (off farm income of a farm family stimulates capital formation in farm production activities and hence shown separately as a variable).
P_{t-1} = Last year output harvest price per quintal.
Y_f = Current year farm income
D_1 = Market distance from the village (dummy variable) in kilometres. If market distance from the village is up to 2 km we used 1 and otherwise zero.
D_2 = Tenurial status of the farm operator (dummy variable). If farmer is owner/part operator we used 1, otherwise zero.

iv) To test the significance of individual explanatory variable, t-test was used and to test the overall significance of a regression F-test was used. After regression analysis, multicolinearity test (as cross-section survey data were used) of the explanatory variables (by Klein's rule) in the regression analysis was used and by dropping 'the problem (correlated) variable' was followed to solve the problem of multicolinearity when detected.

III. RESULTS AND DISCUSSION

Family Composition of the Respondents According to Farm Size

Table: 1 reveals that the average family size of the selected sample households (7.74) was larger than the national average of 4.8 (Population Censes 2001). Two areas selected for the study were densely populated areas of Bangladesh. Members in the age group of 6 – 10 and 10^+ – 15 was the highest in the large size farms (i.e. having more younger population). Marketable surplus of at least for food crops might show inverse relationship with farm sizes.

Land Ownership Pattern of the Sample Households

Land ownership pattern has relevance to generation of marketable surplus of the crops. As to Table 2, the rented in land as expected was highest (0.12 ha) in case of small farms and rented out land was highest (0.58 ha) in case of large farms. Average net cultivated area of a large farm was 4.37 times higher than the small farms and 2.2 times higher than the medium farms. Small farm households had more cultivated area compared to their own land. The medium and large farms had less cultivated area than what they owned.

Income of the Sample Households

Income is considered as a significant and direct determinant of marketable and marketed surpluses. It has been observed that 67 per cent of total income was originated in farm sources. Percentage of non farm income to total income was found to be high in case of small farms than other size group of farms. Total income per household annually was estimated at Tk. 67,345.00 (approx. 149 US$ per capita for rural farm person while this was US$ 170 per

capita nationally during the mid-nineties). Farmers in the study areas were not dis-savers, in general.

Table 1. Family composition of the respondents according to farm size

Age group of the family members	Small farm		Medium Farm		Large farm		All farms	
	No. of family members	Average per family	No. of family members	Average per family	No. of family members	Average per family	No. of family members	Average per family
6 to 10	132	1.48	89	1.48	64	2.06	285	1.58
10+ to 15	118	1.33	74	1.23	60	1.94	252	1.4
Above 15	367	4.23	292	4.87	189	6.09	857	4.76
Total	626	7.04	455	7.58	313	10.09	1394	7.74

Source: Survey data

Table 2. Land ownership pattern for the sample households by farm Size (field/survey)

Farm size	Land ownership pattern					
	Own land (ha)	Rented in land (ha)	Mortgage in land (ha)	Rented out land (ha)	Mortgage out land(ha)	Net cultivated area (ha)*
Small	0.63	0.12	0.01	0.03	0.06	0.68
Medium	1.58	0.02	0.04	0.13	0.16	1.35
Large	3.95	0.01	0.08	0.58	0.50	2.97
All farm	1.52	0.07	0.5	0.16	0.16	1.32

* Area has been calculated on average and average worked out from all the respondents in the size group

Table 3. Average income from farm and non-farm sources by farm size

Farm Size	Income from farm sources (Tk) a	Income from non-farm sources (Tk) b	Farm total income(Tk) c = (a+b)	Farm household expenditure(Tk) d	Farm gross saving (Tk) c = (c-d)	Per capita saving per annum * (Tk)
Small	28231.00 (64.34)	15644.95 (35.66)	43875.90 (100.00)	30392.12	13483.78	1915
Medium	47860.80 (65.84)	24829.16 (34.16)	72689.96 (100.00)	40927.25	31762.71	4190
Large	88045.00 (70.79)	36330.70 (29.21)	124375.80 (100.00)	70730.16	53645.64	5316
All farm	45075.60 (66.93)	22268.90 (33.06)	67344.50 (100.00)	40012.05	27332.45	3531

Source : Field Survey

( ) in parentheses indicate percentage of total income

* Per capita saving = Farm saving divided by average family size

Distribution of Production and Marketable Surplus

Production and on-farm consumption directly affect 'marketable' and 'marketed' surpluses. Many households, in the subsistence context, may not produce actual crop surpluses. Even they sell some produces at the market not consuming at all in the family which in real sense 'does not' constitute surplus through is considered as market arrivals. So, in considering marketed surpluses, buy-backs were taken into consideration to arrive at net marketed arrivals. Among all varieties of rice, marketable surplus as percentage of total production was highest in Boro paddy (60 percent) followed by Aman paddy (50 per cent) and Aus paddy (41 per cent). Of all crops, it was highest in large size farms because their percentage of home consumption was lower relative to their land possession than other size group of farms. In the contrary, small and medium size farms consume most of their total produce at home (Table 4). And, other important uses of crops are seed and wage payment in kind. Marketable surpluses truly reflect family security against economic upheavals of farm households. Depending on the economic upturns, the households determine the ultimate market disposals (marketed surpluses). Marketed surplus as percentage of total production was highest in potato (60 per cent) and lentil (59 per cent; Table 5). That is, these crops were grown primarily on market considerations. Among all crops Boro paddy, potato and lentil were important for all size group of farms and they produce these crops rather commercially. Negative marketed surplus (buy more than sold) was found in wheat producing small farms (Table 5). In the study areas, for medium and large farms, buy-back as percentage of marketed surplus was negligible. Buy back was very much high in small size group of farms particularly for wheat and mustard crop. Distress selling was yet a serious economic problem for small farm households. Net-marketed surpluses for Aus, Aman, Boro, Mustard and lentil were 38, 48, 58, 53 and 60 per cent and have conspicuously increased than any time before (Table 6; mustard and lentil covered in the present study only).

Trend of Gross and Net Marketed Surplus

This study shows that gross and net marketed surpluses of Aus paddy, Aman paddy and Boro paddy is higher than any previous studies (Table 5 and Table 6). This study reveals substantial increase of gross and net marketed quantity of all important crops and bears testimony of success of green revolution particularly for rice crop at the end of the nineties.

Table 4. Distribution of output, retentions (seeds and other payments, consumption requirement) and marketable surplus of the selected crops by size of farm

Crops	Farm Size	Total Production /ha (Quintal)	Consumption Home (a)	Seed (b)	Debt. payment in kind (c)	Wage payment in kind (d)	Donation and Jakat (e)	Storage Loss (f)	MS gross (g)
Aus	Small	18.14	52.48	2.54	0.00	4.19	1.21	0.22	39.36
	Medium	18.78	46.47	4.26	0.00	9.49	1.55	0.06	38.14
	Large	20.20	38.16	5.98	3.14	4.33	2.48	4.66	41.25
	All farm	19.25	44.14	4.02	2.80	4.20	1.84	1.84	41.17
Aman	Small	20.06	42.02	3.63	0.16	0.36	1.28	0.00	52.56
	Medium	19.98	32.28	3.53	0.96	5.00	1.04	0.00	57.18
	Large	19.49	25.26	6.95	0.57	7.59	3.46	1.50	54.18
	All farm	20.94	31.57	4.68	3.29	15.75	3.41	1.31	50.00
Boro	Small	23.94	31.23	2.51	9.45	11.49	1.46	0.73	43.13
	Medium	25.09	36.00	3.01	1.54	5.77	2.57	0.87	50.23
	Large	25.47	20.37	10.00	0.92	2.47	2.47	1.68	62.00
	All farm	24.18	28.79	8.92	2.09	3.53	2.66	0.96	60.47
Wheat	Small	10.25	85.37	4.88	0.98	0.00	0.00	0.00	8.78
	Medium	10.88	45.98	22.99	3.45	0.00	0.00	0.00	27.59
	Large	12.33	77.02	0.00	0.00	0.00	0.00	0.00	22.98
	All farm	11.80	69.49	3.39	0.34	0.00	0.00	0.00	22.13
Potato	Small	89.48	7.37	8.98	2.52	14.61	0.91	0.00	65.60
	Medium	114.45	6.85	12.32	3.80	12.49	1.32	0.00	63.30
	Large	118.55	7.86	11.84	4.06	5.00	1.17	5.11	64.95
	All farm	97.26	8.13	12.64	0.10	7.93	1.33	3.88	64.19
Mustard	Small	5.50	36.36	27.27	0.00	0.00	0.00	0.00	36.36
	Medium	6.50	30.77	3.85	0.00	0.00	0.00	0.00	65.38
	Large	8.50	29.41	9.41	0.00	0.00	0.00	3.53	57.65
	All farm	7.86	36.36	8.19	0.00	0.00	0.00	0.00	55.45
Lentil	Small	6.00	29.41	17.65	0.00	0.00	0.00	0.00	52.94
	Medium	7.40	18.91	16.21	0.00	0.00	0.00	0.00	64.86
	Large	6.79	13.95	7.75	0.00	0.00	0.00	0.00	78.29
	All farm	6.14	20.93	18.60	0.00	0.00	0.00	0.00	60.47

Source : Survey Data

[Marketable Surplus (MS) = Total production – consumption at home-seed – debt payment in kind – payment in kind of labour – Donation & jakat-storage loss]

Note: Column a, b, c, d, e, f, g have been calculated as percentage of total production

Table 5. Average marketable and marketed surpluses of the selected crops by size of farm

Crops	Farm size	Total production (quintal)	Marketable surplus (quintal)	Amount of buy back (quintal)	Marketed surplus (quintal)	Marketable surplus as percentage of total production	Buy back as percentage of total production	Marketed surplus (net) as percentage of total production	Marketed surplus as percentage of marketable surplus
Aus	Small	9.07	3.57	1.44	2.13	39.36	42.35	23.48	59.70
	Medium	10.33	3.94	-	3.94	38.14	0.00	38.14	100.00
	Large	24.24	10.00	-	10.00	41.25	0.00	41.25	100.00
	All farm	11.44	4.71	0.33	4.38	41.17	6.83	38.28	93.00
Aman	Small	14.04	7.38	0.49	6.89	52.56	7.11	49.07	93.36
	Medium	22.98	13.14	0.24	12.90	57.18	1.86	56.14	98.17
	Large	35.06	15.34	-	15.34	54.66	0.00	54.66	100.00
	All farm	17.58	8.79	0.30	8.49	50.00	3.66	48.29	96.60
Boro	Small	19.15	8.26	0.94	7.32	43.13	12.84	38.22	88.62
	Medium	24.09	12.10	0.37	11.73	50.23	3.15	48.69	96.94
	Large	40.50	25.11	0.07	25.04	62.00	0.35	61.83	99.72
	All farm	22.97	13.89	0.68	13.21	60.47	6.76	57.51	95.10
Wheat	Small	0.41	0.04	0.12	-0.08	9.76	150.00	-19.51	-199.89
	Medium	0.87	0.24	0.02	0.22	27.38	9.09	25.29	91.67
	Large	0.74	0.17	-	0.17	41.56	0.00	41.56	100.00
	All farm	0.59	0.13	0.05	0.18	22.13	45.45	13.55	61.54
Potato	Small	24.16	15.85	2.50	13.35	65.60	18.73	55.26	84.23
	Medium	35.48	22.46	0.78	21.68	63.30	3.60	61.10	96.53
	Large	55.72	36.19	0.50	35.69	64.95	1.40	64.05	98.62
	All farm	30.15	19.90	1.71	18.19	66.00	9.40	60.33	91.41
Mustard	Small	0.11	0.04	0.02	0.02	36.36	100.00	18.18	50.00
	Medium	0.26	0.17	0.01	0.16	65.38	6.25	61.54	94.42
	Large	0.85	0.49	-	0.49	57.65	0.00	57.65	100.00
	All farm	0.55	0.30	0.01	0.29	54.45	3.45	52.73	96.67
Lentil	Small	0.06	0.03	0.01	0.02	52.94	12.50	36.67	68.75
	Medium	0.37	0.24	-	0.24	64.86	1.00	64.86	100.00
	Large	1.29	1.01	-	1.01	78.29	0.00	78.29	100.00
	All farm	0.43	0.26	0.004	0.25	60.47	1.56	59.53	98.46

Source: Field survey

* Marketed surplus = Gross sales – Buy back

'-' non existence of the particular item in the size group

* Quantity of buy-back calculated on average of all the respondents in the size group

Table 6. Marketed surplus of paddy in Bangladesh shown in different years by the previous studies

Authors and year of publication	Marketed surplus as percentage of total production	
	Gross *	Net **
1. 1960 national sample survey (second round)	10.4	Not available
2. 1967 master survey of agriculture (seventh round)	10.4	Not available
3. Atiq Rahman 1974 / 75 survey	36.70	17.20
4. Raisuddin Ahmed (1973/74-1977/78)	19.0-22.70	18.1
5. Islam et.al., 1985	23.60	Not available
6. Qusem's study, 1987	27.60	11.20
7. Murshed and Rahman (1986/87)	30.00	Not available
8. Sarker (1989/90)	49.00	48.05
9. Present study (2001/2002)	Aus: 41.17 Aman: 50.00 Boro: 60.47	Aus: 38.28 Aman: 48.29 Boro: 57.51

Source : Sarker (1989/90) reported findings upto serial # 7

* Gross marketed surplus includes total quantity of produce marketed without considering whether there is any buy back by those sellers later on.

** Net marketed surplus = Gross marketed surplus – buy back

Reflections on Seasonal Sales Pattern

In this section, attempts have been made to analyse sales and price variation of the crops at different seasons and who were affected most by such variations. Harvest time sales as percentage of total quantity sales is highest in case of small size groups of farms for all crops followed by medium and large farms. On the other hand, pre-harvest time sales (three months before the new harvest starts) was found to be highest in large size group of farms and the lowest in small size group of farms (Table 7). So, small farms were adversely affected by this seasonal sales pattern because prices are lower in the harvest and immediate post harvest period and they also suffer because of higher are- harvest time price, when they buy-back compared to other size groups of farms. Again, it was observed that purchase price was always higher than sales price. So, small farms were loser in the prevailing pattern of market transactions. Large farms can fetch highest prices prevailed in the market with their relatively strong bargaining capacity in the market, with both quantity of product sale and by choice of sale period than other size group of farms.

The results revealed that benefits of any price support program me (through product price increase) will be distributed among farmers in proportion of their sales. Small farmers will be benefited if government procurement drive is operated during and just after harvest when small farmers sell more and small farms and consumers will be benefited more if Open Market Sales (OMS) are practiced just pre-harvest periods for food crops.

Table 7. Average harvest time sale and pre-harvest time sale as percentage of total quantity sold of the selected crops by size of farm

Crops	Farm Size	Total Sales (Quintal)	Harvest time sales (Quintal)	Pre-harvest sales (Quintal)	Harvest sale as % of total sales	Pre harvest sale as % of total sales
Aus	Small	4.84	2.52	0.22	52.07	4.55
	Medium	4.64	2.63	0.84	56.68	18.10
	Large	11.96	4.52	5.60	37.79	46.82
	All farm	5.16	2.24	1.36	43.41	26.36
Aman	Small	7.36	5.04	1.36	68.299	18.29
	Medium	13.14	7.11	4.82	54.11	36.68
	Large	14.08	4.70	9.07	33.38	64.42
	All farm	8.50	4.50	3.00	52.94	35.29
Boro	Small	8.26	7.00	1.00	87.75	12.10
	Medium	12.10	6.45	5.00	53.30	41.32
	Large	20.26	9.38	7.99	46.30	39.44
	All farm	10.74	6.67	3.00	62.10	27.93
Wheat	Small	0.036	0.036	-	100.00	0.00
	Medium	0.24	0.22	0.02	91.67	8.33
	Large	0.17	0.10	0.05	58.82	29.41
	All farm	0.16	0.13	0.02	81.25	12.50
Potato	Small	15.85	14.89	0.29	87.63	1.83
	Medium	22.46	2.38	0.63	90.73	2.80
	Large	36.19	20.00	14.05	55.73	38.82
	All farm	19.90	13.80	3.55	69.35	17.84
Mustard	Small	0.04	0.03	0.00	75.00	0.00
	Medium	0.17	0.06	0.03	36.36	18.18
	Large	0.49	0.35	0.04	71.42	8.16
	All farm	0.25	0.20	0.02	80.00	8.00
Lentil	Small	0.09	0.36	0.01	88.89	11.11
	Medium	0.24	0.20	0.04	83.33	16.67
	Large	1.01	0.46	0.54	45.54	53.67
	All farm	0.26	0.19	0.07	73.07	26.92

Source: Field survey

* Average worked out from all the respondents in the size group.

Reasons for Harvest Time Sales

In view of price variation and higher prices paid for purchase than received for sales, it may be worthwhile to investigate the reasons for such a pattern of selling by the farmers. When farmers opinions were sought for specifying reasons for harvest time sales, they reported that most prominent reason for harvest time selling was meeting family urgent expenditures and repayment of loans of the farm families (Table 8).

Table 8. Reasons of harvest time sale of the selected crops

Crops	To repay loan and wage payment	For family expenditure, social and religious purpose	House repair	Lack of storage facility	To buy land and tolls	For business purpose
	(% of sample)	(% of sample)	(% of sample)	(% of sample)	(% of sample)	(% of sample)
Aus	26.47	73.53	-	-	-	-
Aman	42.59	26.85	3.70	-	24.07	2.78
Boro	49.17	24.17	6.67	8.83	10.83	0.83
Wheat	-	90.00	-	5.00	5.00	-
Potato	25.89	36.61	2.68	25.89	8.03	6.89
Mustard	7.40	88.85	3.70	-	-	-
Lentil	-	72.73	4.54	-	22.73	-

Source : Field Survey

* Percentage of sample has been calculated from those samples who have sold in harvest time.

'-' Non existence in the particular item

Factors Influencing Marketable Surplus

In this section, impact of price and also other independent variables on marketable surplus' of crops are shown with the help of multiple log linear regression analysis. The results of log-linear form of equations gave better results statistically than simple multiple linear regression analysis. Estimated log-linear results are reported. Price changes in markets largely influence marketable surplus of crops. Price elasticity of marketable surplus for Aman, Boro, potato, wheat and mustard were 1.89, 2.68, 2.46, 1.23 and 1.40 respectively (Tables 9. 10, 11 and 12). So, price policies for price sensitive crops should carefully be framed to make the crop sector productive optimally according to the need of the entire economy. In the case of Aus and lentil, last season's price does not influence on increasing marketable surplus. Aus is a chance crop and cultivated if weather remains favourable and jute prices when found depressing for the farmers. And lentil is yet a residual crop getting little attention of market price changes. Low productivity level with low cash inputs use and high yield risk may make a crop less price sensitive and lentil is such a crop. Total area under cultivation was significant and positively influence marketable surplus of all varieties of rice, wheat, potato, mustard and lentil. Proportion of irrigated area was significant and positively influence marketable surplus of Boro, potato and wheat. Farm income appeared more sensitive and influencing factor for increasing marketable surplus of wheat and estimated co-efficient is 0.94 (Table 12. If farm income increases 1 per cent marketable surplus of wheat increases 0.94 per cent. Current year off-farm income is positive and significantly influenced marketable surplus of all varieties of rice and wheat. Off-farm income increase will increase production of rice and wheat. Except in wheat and mustard, family size was negatively related to marketable surplus of the selected crops that is, increasing population will reduce marketable surplus of rice and other crops. Estimated R^2 for Aus, Aman, Boro, wheat, potato, mustard and lentil appeared very satisfactory to accept the log-linear results. (Tables 9, 10, 11 and 12). Neither market distance nor tenurial condition did depict any significant pattern on marketable surplus of the crops i.e.

physical access to markets now-a-days was not much problematic to producer farmers. This is quite plausible when roads and feeder roads in the rural areas were established remarkably.

Table 9. Factors influencing marketable surplus of aman by farm size

Factors	Small	Medium	Large	All farm
Intercept	-59.03	-10.24	-3.13	-11.42
Total area (A_t)	NI	1.14^{hs}	0.46^{hs}	0.94^{hs}
		(5.34)	(2.76)	(8.89)
Family Size (F)	-0.05	-0.70^{s}	-0.09	-0.04
	(0.49)	(2.28)	(-0.24)	(-0.22)
Off-farm income(Y_0)	NI	0.98	-0.01	0.12^{hs}
		(0.31)	(-0.14)	(2.89)
Last year out put price (P_{t-1})	8.84^{hs}	2.11^{s}	0.98^{c}	1.89^{hs}
	(11.66)	(3.91)	(1.70)	(4.65)
Farm income (Y_f)	0.36	0.03	0.04	0.05
	(0.59)	(0.89)	(0.57)	(1.54)
Market distance (D_1)	-0.07	-0.16	-0.51	-0.12
	(-0.89)	(-0.82)	(-1.84)	(-0.80)
Tenurial status (D_2)	-0.02	-0.13	0.50	0.151
	(-0.26)	(-0.75)	(1.26)	(0.84)
R^2	0.93	0.73	0.58	0.57
D.F.	59	42	29	132
F value	149.98^{hs}	13.26^{hs}	4.34^{hs}	23.33^{hs}

Figure in parenthesis indicates t-statistics. hs, s, c denotes highly significant, significant and critically significant at 1%, 5%, 10% error level respectively. NI=Not included in the equation because of multicolinearity problem (Farm multicolinearity test of the explanatory variables of Aman, see appendix Table 1). Note: For small size farms Aman results are colinearity corrected.

Table 10. Factors influencing marketable surplus of boro by farm size

Factors	Small	Medium	Large	All farm
Intercept	-6.53	-4.03	-46.22	-14.90
Total area (A_t)	1.45^{hs}	0.95^{hs}	0.19^{hs}	0.71^{hs}
	(6.33)	(7.75)	(3.58)	(10.49)
Irrigated area (AI)	-0.08	0.13^{hs}	0.03	0.07^{c}
	(-0.66)	(2.87)	(1.48)	(1.90)
Family Size (F)	-0.52^{s}	-0.13	-0.02	-0.15
	(-2.40)	(-0.80)	(-0.24)	(-1.22)
Off-farm income(Y_0)	-0.00	0.05^{c}	0.76^{s}	0.05^{s}
	(-0.08)	(1.79)	(2.16)	(2.01)
Last year out put price (P_{t-1})	1.61^{c}	0.95^{s}	6.46^{hs}	2.68^{hs}
	(1.96)	(2.27)	(2.30)	(7.59)
Farm income (Y_f)	0.02	0.02	-0.01	0.01
	(0.68)	(0.73)	(-0.55)	(0.49)
Market distance (D_1)	0.00	-0.16	0.10	0.03
	(0.01)	(-1.35)	(1.26)	(0.36)
Tenurial status (D_2)	0.14	-0.04	-0.036	-0.00
	(0.94)	(-0.43)	(-0.38)	(-0.03)
R^2	0.84	0.84	0.73	0.80
D.F.	57	43	27	129
F value	31.49^{hs}	22.28^{hs}	6.33^{hs}	61.48^{hs}

Table 11. Factors influencing marketable surplus of potato by farm size

Factors	Small	Medium	Large	All farm
Intercept	-13.91	1.79	-42.63	-14.02
Total area (A_t)	0.11^{c}	1.02^{hs}	0.73^{hs}	0.48^{hs}
	(1.98)	(15.26)	(4.07)	(7.81)
Irrigated area (AI)	0.43^{hs}	0.09^{hs}	0.01	0.26^{hs}
	(15.05)	(3.44)	(0.32)	(9.55)
Family Size (F)	-0.10	-0.66^{hs}	-0.07	-0.65^{hs}
	(-0.47)	(-4.43)	(-0.25)	(-3.93)
Off-farm income(Y_0)	-0.04	0.05	1.89^{s}	0.13
	(-0.39)	(0.77)	(2.81)	(1.40)
Last year out put price (P_{t-1})	2.49^{hs}	0.28	3.13	2.46^{hs}
	(4.65)	(0.19)	(0.39)	(3.51)
Farm income (Y_f)	0.09^{s}	0.14^{c}	0.51^{s}	0.11^{s}
	(2.07)	(1.93)	(1.00)	(2.19)
Market distance (D_1)	0.27^{s}	-0.33^{s}	-0.16	-0.02
	(2.45)	(-2.49)	(-0.89)	(-0.21)
Tenurial status (D_2)	0.14	-0.39^{s}	-0.29	-0.24^{s}
	(0.91)	(-3.61)	(-1.02)	(-1.65)
R^2	0.94	0.97	0.98	0.87
D.F.	57	44	25	128
F value	88.45^{hs}	131.86^{hs}	128.37^{hs}	96.20^{hs}

Figure in parenthesis indicates t-statistics. hs, s, c denotes highly significant, significant and critically significant at 1%, 5%, 10% error level respectively. Multicolinearity test of the explanatory variables for Boro and potato see appendix Tables 2 and 3.

Table 12. Factors influencing marketable surpluses of aus, wheat, mustard and lentil for all farms.

Factors	Aus	Wheat	Mustard	Lentil
Intercept	-23.95	-23.86	-16.58	-6.39
Total area (A_t)	0.81^{hs} (9.74)	0.26^{hs} (5.63)	0.27^{hs} (3.15)	0.75^{hs} (5.44)
Irrigated area (AI)	NI	0.14^{s} (2.21)	NI	NI
Family Size (F)	-0.03 (-0.28)	-0.07^{hs} (-1.43)	0.23 (1.54)	-0.00 (-0.01)
Off-farm income(Y_0)	1.04^{hs} (5.18)	0.77^{hs} (6.56)	NI	-0.03 (-0.02)
Farm income (Y_f)	0.47^{c} (1.71)	0.94^{hs} (8.29)	NI	0.13 (1.42)
Total Income (Y)	NI	NI	0.67^{hs} (3.48)	NI
Last year out put price (P_{t-1})	1.65 (0.07)	1.23^{hs} (8.32)	1.40^{hs} (3.16)	0.77 (0.86)
Market distance (D_1)	-0.06 (-0.94)	-0.00 (-0.04)	-0.00 (-0.02)	-0.03 (-0.19)
Tenurial status (D_2)	0.01 (0.22)	0.00 (0.40)	-0.14 (-1.50)	0.16 (1.19)
R^2	0.98	0.99	0.94	0.90
D.F.	59	24	30	30
F value	335.41^{hs}	1124.05^{hs}	66.46^{hs}	30.09^{hs}

Figure in parenthesis indicates t-statistics. hs, s, c denotes highly significant, significant and critically significant at 1%, 5%, 10% error level respectively. NI: Not included in the equation Note: Mustard results are colinearity corrected. Regression equation for mustard included total income (off farm income + farm income) because of multicolinearity problem. For multicolinearity test of the explanatory variables of Aus paddy, wheat, mustard and lentil, see appendix Table-4.

IV. POLICY IMPLICATIONS

Marketable surplus as percentage of total production got highest in Boro paddy, potato and lentil. Farmers produce Boro paddy, potato, lentil and mustard crops commercially. Higher amount of total produce of Aus, Aman and wheat were used for consumption purposes. In the study areas, medium and large farmers buy-back of the selected crops were negligible. But in case of small farms, amount of buy-back was the highest. So, distress

selling remained a serious economic problem for small farm households. In this study, it has been observed that gross and net marketed surplus of varieties of rice were remarkably higher than previous studies. That means, marketed quantity of crops has increased over time. Small farms were large suppliers of agricultural commodities during harvest and immediate post harvest periods in the markets. They have more pressing cash needs and therefore cannot stock commodity to sell during off-season. For this reason they cannot be benefited by pre-harvest time prevailing highest price. On the contrary, pre-harvest time sale was highest among large farms except in Boro paddy and mustard. Large farms can fetch highest prices prevailed in the market with their relatively strong bargaining capacity and better quality of product than other size group of farms. Bearing family expenditure, meeting social and religious obligation, repayment of loan and wage payment were the important reasons for harvest time sales. Last season's price appeared more important influencing factor for increasing marketable surplus of Aman paddy, Boro paddy, potato, wheat and mustard. If last season's price increases 1 per cent marketable surplus increases 1.84 per cent, 2.68 per cent, 2.46 per cent, 1.23 per cent and 1.40 per cent for these crops respectively. Marketable surpluses were rather highly elastic to previous reason's (observed) prices than normally appeared to area responses to price changes. This is very rational as selling decisions have direct relevance to price changes. Product prices appeared as the most important influencing variable in increasing crop production and marketable surplus. Several policy options emerge from this field survey study.

Before designing procurement policy of food crops, policy makers should be aware of timing of food grains collections as small farmers sell-off their produces during or just immediately after harvest time at lowest prices. If government want to support small farmers, procurement drives should be intensified during the crop-harvesting season. By doing so, procurement costs will also be minimized.

As total area under crop and last year's price were most important variables affecting marketable surplus of a crop, it is to be encouraged to increase production by using modern variety of seed, irrigation facilities, fertilizer use as well as promoting better technology because land becomes a scarce input already. That is, agriculture should be on intensive margin of land use. All size group of farmers were much affected by seasonal price variations and thus there is basis of providing price support to increase marketed surplus.

For increasing marketable surplus it is needed to intensify family planning measures because family size is negatively related to marketable surplus of the crops. Family size is yet disgustingly high in rural areas.

To increase marketable surplus it is needed to increase off-farm income opportunities because this also increases marketable surplus which has been empirically proven in this study.

Procurement drives should be cost effective and time bound. For betterment of the small farm families, procured food grain stocks can also be distributed at schools as food for

education. Open market sales of Government stocks can dampen market prices and recommended to use minimally now-a-days, while in most of the time agricultural product prices remain low.

For stopping distress selling programmes like 'SOGORIP' (Shasya Godam Rin Prokalpa) should be expanded in more areas extending production loans to farmers on the basis of their stored amounts as hypothecation (SOGORIP- A Department of Agricultural Marketing; DAM project of the Ministry of Agriculture).

Foot Notes:

1. Marketable surplus is considered as more reliable a variable than to net marketed surplus (having often several mini-transactions in terms of market disposal)
2. Marketable surplus may be less than even marketed surplus when farmers retain a smaller quantity of the crop than his actual requirements. This is applicable more for small farmers. The marketed surplus may be less than the marketable surplus when the farmers retain some of the surplus for family security. The marketed surplus may also be equal to be marketable surplus when the farmers neither retain more or less than his actual requirements.

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APPENDIX TABLES

Table 1. Test of multicolinearity of the explanatory variables (By Klein's Rule) used in the log linear regression analysis of aman

Regression equation	Total R^2	Partial R^2 (each explanatory variable as a dependent variable to others)					Comment on the status of colinearity
		Total area (A)	Family size (F)	off farm income (Y_o)	Last year output price/quintal (P_{t-1})	Farm income(Y_f)	
Small	a)0.43 b)0.94 c)0.93	a)<0.46 b) NI c) NI	a)>0.086 b)>0.23 c)>0.23	a)>0.34 b)<0.95 c) NI	a)<0.56 b)<0.96 c)>0.80	a)>0.19 b)>0.78 c)>0.77	Severe colinearity between total area and last year output price/quintal (a and b)
Medium	0.73	>0.33	>0.11	>0.07	>0.35	>0.245	No sever correlation
Large	0.58	>0.11	>0.21	>0.44	>0.36	>0.55	No sever correlation
All Farm	0.57	>0.21	>0.21	>0.06	>0.27	>0.23	No sever correlation

NI= Not included in the equation

Table 2. Test of multicolinearity of the explanatory variables (By Klein's Rule) used in the log linear regression analysis of boro

Regression equation	Total R^2	Partial R^2 (each explanatory variable as a dependent variable to others)						Comment on the status of colinearity
		Total area (A_t)	Irrigated area (A_t)	Family size (F)	off farm income (Y_o)	Last year output price/ quintal (P_{t-1})	Farm income (Y_f)	
Small	0.84	>0.74	>0.094	>0.08	>0.24	>0.74	>0.20	No severe correlation
Medium	0.84	>0.38	>0.16	>0.17	>0.15	>0.44	>0.24	No severe correlation
Large	0.73	>0.19	>0.194	>0.33	>0.39	>0.57	>0.52	No severe correlation
All farm	0.80	>0.44	>0.13	>0.08	>0.24	>0.41	>0.123	No severe correlation

Table 3. Test of multicolinearity of the explanatory variables (By Klein's Rule) used in the log linear regression analysis of potato.

Regression equation	Total R^2	Partial R^2 (each explanatory variable as a dependent variable to others)						Comment on the status of colinearity
		Total area (A_t)	Irrigated area (A_t)	Family size (F)	off farm income(Y_o)	Last year output price/quintal ($_{Pt-1}$)	Farm income (Y_f)	
Small	0.94	>0.37	>0.22	>0.41	>0.04	>0.44	>0.41	No severe correlation
Medium	0.97	>0.61	>0.30	>0.53	>0.14	>0.45	>0.35	No severe correlation
Large	0.98	>0.94	>0.63	>0.85	>0.93	>0.97	>0.91	No severe correlation
All farm	0.87	>0.49	>0.17	>0.47	>0.11	>0.38	>0.30	No severe correlation

Table 4. Test of multicolinearity of the explanatory variables (By Klein's Rule) used in the log linear regression analysis of aus, wheat, mustard and lentil.

Regression equation	Total R^2	Partial R^2 (each explanatory variable as a dependent variable to others)						Comment on the status of colinearity
		Total area (A_t)	Irrigated area (A_t)	Family size (F)	off farm income (Y_o)	Last year output price/quintal ($_{Pt-1}$)	Farm income (Y_f)	
Aus	0.98	>0.88	NI	>0.77	>0.89	>0.51	>0.88	No severe correlation
Wheat	0.99	>0.95	>0.79	>0.93	>0.95	>0.80	>0.85	No severe correlation
Mustard	0.59	<0.95	NI	<0.94	<0.86	<0.91	<0.62	Severe correlation among total area, Family size, off farm income, last year output price/future income
Lentil	0.90	>0.79	NI	>0.75	>0.70	>0.61	>0.53	No sever correlation

NI = Not included in the equation

Note: Multicolinearity would be a severe problem only if $R^2_y > R^2_i$. Where $R^2_y = R^2_y$. $X_1, X_2 \ldots\ldots X_k$ and $R^2_i = R^2 X_i$ on other X_s. That is, R^2_y is total explanatory power of an equation and R^2_i is partial explanatory power when one of the explanatory variables (i' th variable) of the equation is used as dependent variable and regressed on keeping other explanatory variables on the right hand side of the equation (for more detail, see Alam 2001, p.21).