

## BANGLADESH

*Shahiduzzaman M. Elias and Muhammad S. Hussain*

### Introduction

Bangladesh, with an area of about 144,000 km<sup>2</sup> and a population of 112 million, is one of the most densely populated countries in the world (775 persons/km<sup>2</sup>) and among the lowest per capita income countries in Asia (US\$210 in 1994). The population has grown dramatically, from about 75 million in 1970, equivalent to a population growth rate of 2%. Per capita cultivable land is about 0.09 ha. The share of agriculture in total GDP has declined steadily in recent years, but the agriculture sector still contributed about 37% of GDP and 65% of overall employment in 1992 (GOB 1993). About 80% of the population resides in rural areas. The country is divided into 63 administrative districts (Fig. 1).

In 1988–89, average daily per capita food consumption was 869 g, of which cereals constituted 57.6%, non-cereal plant food 34.5%, and food products of animal origin 7.9% (GOB 1990). Vegetables made up 12.5% of the diet. However, the average food consumption figures conceal the deprivation suffered in the country; about half of the population consumes less than the recommended intake of energy, protein, and micronutrients.

About 150 different crops are grown in Bangladesh, but rice occupies about 74% of the total cultivated area. Wheat, pulses, oilseeds, sugarcane, jute, potato, vegetables, annual and perennial fruit, tobacco, tea, and spices are the other major crops. During 1993, the area under vegetable cultivation, excluding potato and sweet potato but including chili, onion, ginger, and garlic, was about 0.30 million ha (1.5% of the total cropped area). Average yield of vegetables is 4.7 t/ha, so vegetable production in the country totaled about 1.4 million t (with a value of about BDT10 billion). Per capita daily availability of vegetables in Bangladesh is only 34 g/day (which is low even compared to levels in neighboring countries), so to supply the AVRDC-recommended minimum per capita daily requirement of 200 g of vegetables, national production of vegetables needs to be increased to well over 8 million t. This would require massive effort. Intensive vegetable production would also improve nutritional security, employment and income generation, foreign exchange earnings, and diversification of food production.

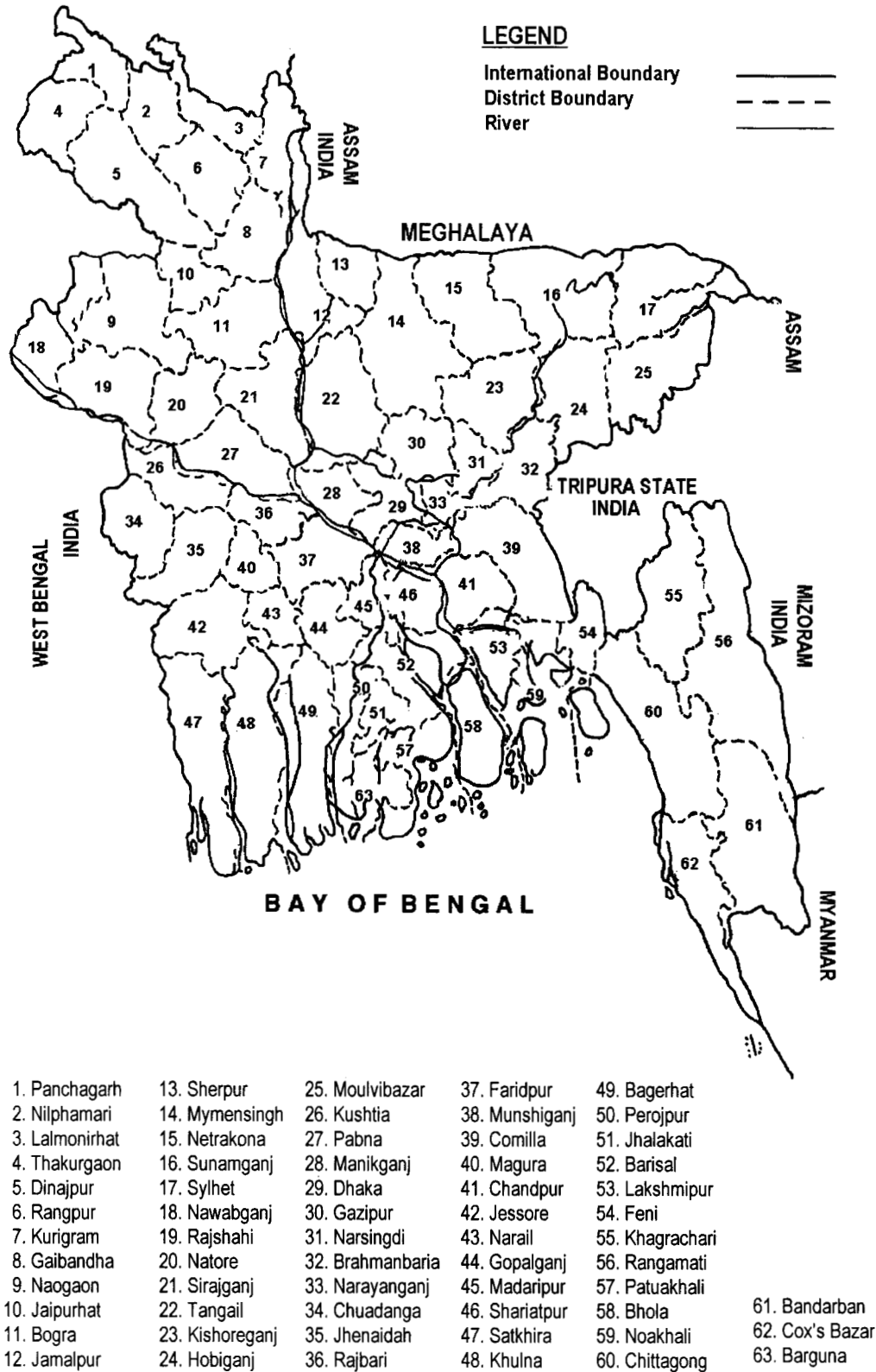


Fig. 1. Administrative districts of Bangladesh

## General Information

### Geography

Bangladesh is mostly flat, and comprises the delta of three major river systems—the Meghna, the Brahmaputra, and the Padma (Ganges). These rivers and their tributaries form a network of waterways. Other major features include the Pleistocene uplands in the north-west as well as the Modhupur tract, and the Barind tract rising from 10 to 50 m above the plain. In the Chittagong area in the south-east, Tertiary hills average some 300 m asl and reach their highest elevation, nearly 1000 m asl, at the Burmese border.

The country is prone to natural disasters, especially cyclones and flooding, which affect agricultural production in general and vegetable production in particular. Agricultural land makes up 64% of the country, forests account for almost 15%, urban areas occupy 8%, and other land uses and water takes up the remaining 13%.

### Topography

Five agricultural land types have been defined in Bangladesh on the basis of flood depths, i.e., high land (seasonal flood depth less than 0.30 m), medium-high land (flood depth between 0.31 and 0.90 m), medium-low land (flood depth varying between 0.91 and 1.80 m), low land (flood depth greater than 1.80 m) and very low land (flooded to a depth of 1.80 m or more seasonally or perennially). A detailed distribution of agricultural land types by administrative division is shown in Table 1. Most agricultural activities are intimately related to, and dependent on, flooding conditions. About 80% of the vegetable area in the country is concentrated in those agroecological zones having high and medium-high land. Few vegetables are grown in lowlands during the hot-wet season.

Table 1. Distribution of agricultural land types by division, 1991 (in km<sup>2</sup>)

Division	Area (km <sup>2</sup> )					Total
	High land	Medium-high land	Medium-low land	Low land	Very low land	
Chittagong	17014	9534	5512	4526	1007	37592
Dhaka	5198	10632	6026	3918	997	26772
Khulna	4672	19607	3189	648	0	28117
Rajshahi	6335	19302	2816	1866	155	30474
Total	33220	59075	17543	10958	2159	122955
Homesteads						10848
Urban						791
River belts						9405
Grand total						143999

Source: GOB (1992).

## Climate

The tropical monsoon climate of Bangladesh comprises three distinct seasons:

- the premonsoon season from March to May, with little rainfall and temperatures as high as 40°C
- the monsoon season from June to October, characterized by high humidity, rainfall, and temperatures (25–35°C)
- the dry winter season from November to February, characterized by cool temperatures (12–28°C) and little or no precipitation.

On average, 2000 mm of rain falls on 80% of the country annually. Seasonal and annual variability in rainfall is followed by considerable yearly variation in agricultural production, particularly in vegetables. Monthly mean temperatures range from 28°C in July to 18°C in February.

## Soils

The soils of Bangladesh are mainly alluvial with little profile development. Generally, soil characteristics do not pose a major constraint to vegetable production. A reconnaissance soil survey carried out between 1963 and 1975 provided comprehensive information on soils, land levels in relation to seasonal inundation, and land use, together with interpretations in terms of land capability and crop suitability.

## Social Taboos

Vegetables in Bangladesh are consumed in curries, as mixed vegetable "bhaji" dishes, and in the raw form. The following are some common taboos working in favor of or against vegetable consumption:

- Some old people in Bangladesh believe that taking sweet gourd as a curry can cause stomach problems and remittent fever, particularly during the monsoon season. Sweet gourd is also thought to cause allergic responses in some people.
- Indian spinach is thought to cause or exacerbate cough. It might also cause allergies.
- A baby might suffer from stomach problems if the breast-feeding mother eats too much leafy vegetables.
- Eating leafy vegetables at night is considered a sign of poverty.
- It is believed that eggplant causes skin disease.
- After giving birth, a woman should consume more gourd to stimulate breast milk production.
- Bitter gourd can cure many diseases and also help in blood refinement/purification.
- Green papaya and leafy vegetables can cure constipation and keep the liver healthy.

## Major Vegetable Species, and Planting Seasons

More than 70 kinds of subtropical vegetables are grown in Bangladesh; some characteristics and growing information of the major ones are presented in Table 2. Rangpur, Rajshahi, Dinajpur, Jessore, Khulna, Dhaka, Faridpur, Comilla, and Chittagong are leading vegetable production areas.

Vegetables are classified as rabi (grown during the winter months of October–March) or kharif (grown during the summer months of April–September).

Vegetable cultivation is concentrated in the high and medium high lands during the kharif season, and in the low lands during the winter season, which is normally dry.

Spring vegetables are short-duration varieties grown between the late winter and early summer seasons. Most vegetables in Bangladesh are seasonal in production, and the period of their availability is rather narrow. However, some vegetables are grown year round and do not have a specific cultivation period (e.g., eggplant, pumpkin, cucumber, and bitter gourd).

Table 2. Planting time, edible parts, and major growing districts for major vegetables in Bangladesh

Vegetable (% of area of all vegetables) <sup>a</sup>	Part used	Planting season <sup>b</sup>	Major growing districts (% of the total area of a given vegetable) <sup>c</sup>
Arum (3.5)	Leaf	Not available	Tangail (10.0), Dinajpur (8.7), Jessore (8.3), Khulna (6.7), Sylhet (6.0), Rangpur (5.7)
Ash gourd (1.3)	Fruit, leaf	Feb.-Oct.	Rangpur (8.5), Sylhet (7.4), Dhaka (7.0), Rajshahi (6.3), Bogra (6.0), Barisal (5.9)
Bengal spinach (0.6)	Leaf	Nov.-Mar.	Jessore (12.5), Kushtia (9.1), Khulna (8.6), Rangpur (8.0), Faridpur (7.5), Rajshahi (7.0)
Bitter gourd (1.4)	Fruit	Feb.-Oct.	Dhaka (11.5), Rangpur (9.7), Jessore (7.2), Dinajpur (7.1), Rajshahi (7.0)
Bottle gourd (2.3)	Fruit, leaf	Nov.-Apr.	Dhaka (10.8), Sylhet (10.4), Barisal (9.7), Comilla (8.3), Faridpur (6.2), Rangpur (6.0)
Cabbage (2.4)	Leaf	Nov.-Mar.	Jessore (12.2), Rangpur (9.2), Rajshahi (8.0), Khulna (7.6), Dinajpur (7.2), Kushtia (6.6)
Cauliflower (2.5)	Curd	Nov.-Feb.	Jessore (10.8), Rangpur (9.5), Dhaka (8.4), Tangail (6.9), Rajshahi (6.7), Dinajpur (6.3)
Chili (21.0)	Fruit	Mid April-mid July	Comilla (12.8), Bogra (11.1), Barisal (10.3), Patuakhali (9.8), Noakhali (9.7), Faridpur (8.8)
Cucumber (1.1)	Fruit	Year round	Dhaka (7.8), Faridpur (7.5), Rangpur (6.7), Bogra (6.2), Rajshahi (5.6), Tangail (5.3)
Eggplant (8.5)	Fruit	Year round	Winter: Chittagong (9.1), Jessore (7.9), Rajshahi (7.6), Bogra (7.5), Rangpur (7.0), Dhaka (7.0) Summer: Jessore (14.0), Dinajpur (8.5), Bogra (7.9), Rajshahi (7.1), Khulna (7.1), Kushtia (7.0)
Hyacinth bean (2.2)	Fruit, seed	Nov.-Feb.	Dhaka (10.1), Comilla (10.0), Noakhali (9.9), Chittagong (9.9), Jessore (6.7), Kishorganj (6.3)
Mungbean (17.9)	Seed	Mid Sep.-mid Dec.	Faridpur (23.7), Jessore (24.), Pabna (6.4), Rangpur (7.8)

Contd. Table 2.

Vegetable (% of area of all vegetables) <sup>a</sup>	Part used	Planting season <sup>b</sup>	Major growing districts (% of the total area of a given vegetable) <sup>c</sup>
Onion (10.5)	Bulb	Mid Nov.-Dec.	Faridpur (21.1), Pabna (9.3), Rajshahi (8.3), Jessore (8.2), Dhaka (8.0), Dinajpur (6.7)
Radish (6.0)	Root, leaf	Oct.-Mar.	Comilla (8.1), Sylhet (7.0), Rangpur (6.9), Chittagong (6.5), Dhaka (6.3), Jessore (5.9)
Pumpkin (3.5)	Fruit, leaf	Year round	Winter: Barisal (11.7), Sylhet (7.1), Faridpur (6.4), Jessore (6.2), Dhaka (5.7), Chittagong (5.5) Summer: Jessore (7.6), Rangpur (7.6), Dhaka (7.5), Barisal (6.6), Dinajpur (6.6), Faridpur (5.6)
Tomato (3.5)	Fruit	Nov.-Mar.	Comilla (15.7), Dhaka (13.3), Sylhet (7.7), Chittagong (7.6), Jessore (6.5), Rajshahi (4.8)
Ridged gourd (1.5)	Fruit	Feb.-Oct.	Dhaka (8.4), Rangpur (8.2), Chittagong (7.2), Rajshahi (7.2), Jessore (6.8)
Pointed gourd (1.2)	Fruit	Feb.-Oct.	Rajshahi (16.1), Rangpur (12.5), Jessore (11.7), Dinajpur (11.4), Kushtia (9.4), Pabna (9.3)
Stem amaranth (1.2)	Stem, leaf	Mar.-Oct.	Dinajpur (8.2), Kushtia (8.2), Jessore (7.5), Rangpur (6.7), Tangail (6.5), Mymensingh (6.0)
Indian Spinach (0.8)	Leaf	Nov.-Feb.	Kushtia (13.8), Khulna (10.9), Jessore (9.1), Dinajpur (7.1)
Lady's finger (1.1)	Fruit	Mar.-Oct.	Chittagong (7.9), Dinajpur (6.8), Dhaka (6.8), Khulna (6.5), Rangpur (6.2)
Snake gourd (0.7)	Fruit	Feb.-Oct.	Jessore (9.7), Barisal (9.4), Dinajpur (7.2), Rangpur (6.7), Tangail (6.5)
Yard long bean (0.7)	Fruit	Mar.-Oct.	Dhaka (3.5), Chittagong (2.3), Comilla (2.1)
String bean (0.7)	Pods and seed	Mar.-Oct.	Chittagong (15.1), Rajshahi (7.5), Dhaka (7.5), Rangpur (7.4), Jessore (7.0)
Other vegetables (3.9)	-	-	Khulna (12.0), Faridpur (11.0), Kushtia (8.1), Jamalpur (6.6)

<sup>a</sup> Average of 1991–93.

<sup>b</sup> The information on planting is from Rashid (1989), except for arum, chili, mungbean, onion, and string bean, which is from GOB (1993).

<sup>c</sup> Average of 1988–90.

## Trend Analysis

### Production

Total vegetable area in Bangladesh in 1993 was about 300,000 ha, which produced about 1.4 million t. Seventy percent of the output was produced during winter (rabi or winter season). Since 1972, the area under all vegetables in Bangladesh has increased at an annual rate of 1.2%, while vegetable production and yield both increased at quadratic rates (Table 3).

No significant trend in the production of garlic and chili was observed, while the production of ribbed gourd, arum, Indian spinach, stem amaranth, cabbage, tomato, radish, Hyacinth beans, winter spinach, ginger, and other vegetables increased at a linear rate. Yields per unit area of most of these

vegetables either declined or remained static, so most of the increase in the production of these vegetables came from an increase in cropped area (Table 3).

Table 3. Trend for vegetable production in Bangladesh, 1972-93

Vegetable	Area		Yield		Production	
	T	T <sup>2</sup>	T	T <sup>2</sup>	T	T <sup>2</sup>
<b>Summer vegetables</b>						
Arum	0.056	-	-0.009	-	0.048	-
Ash gourd	-	0.002	-0.029	0.001	-0.047	0.003
Bitter gourd	-0.014	0.002	-0.043	0.001	-0.057	0.003
Chili	-0.018	0.001	-0.023	0.001	-0.041	0.002
Cucumber	-	0.001	-0.028	0.000	-0.039	0.002
Eggplant	-	-	-0.015	-	-0.014	-
Indian spinach	-	0.002	0.041	-0.002	0.051	-
Lady's finger	0.047	-	-0.044	0.001	-0.018	0.002
Other vegetables	-0.096	0.004	-0.031	0.001	-0.127	0.005
Pointed gourd	0.046	-0.001	-0.017	-	0.031	-0.001
Pumpkin	-0.031	0.002	-0.031	0.001	-0.061	0.003
Ribbed gourd	0.041	-	-0.032	0.001	0.001	-
Snake gourd	-0.037	0.002	-0.012	-0.000	-0.049	0.002
Stem amaranth	0.049	-	-0.021	0.001	0.040	-
String bean	-0.034	0.003	0.299	-0.011	0.265	-0.008
Total summer vegetables	-	0.001	-0.008	-	-0.018	0.001
<b>Winter vegetables</b>						
Bottle gourd	0.015	0.001	0.007	-	0.020	0.001
Cabbage	0.040	-0.001	0.010	-	0.035	-
Cauliflower	0.046	-0.001	0.024	-0.001	0.069	-0.001
Chili	-0.009	-	0.012	-	-	-
Eggplant	0.006	-	-0.012	0.001	0.000	-
Garlic	-	-	-0.004	-	-	-
Ginger	0.016	-	-0.005	-	0.011	-
Hyacinth beans	0.033	-	-0.007	-	0.026	-
Onion	0.006	-	-0.038	0.001	-0.032	0.001
Pumpkin	0.028	-	-0.004	-	0.024	-
Radish	0.039	-	0.010	-	0.049	-
Spinach	0.046	-	-	-	0.048	-
Tomato	0.027	-	-	-	0.026	-
Other vegetables	0.015	-	-	-	0.020	-
Total Rabi vegetables	0.009	-	-	0.001	0.020	-
Total vegetables	0.012	-	-	0.0003	-	0.001

The linear term in the production equation for pointed gourd, string beans, and cauliflower was positive. However, negative quadratic coefficients indicate that the production of these vegetables increased in the beginning years, but then decreased in the later period and will ultimately stagnate or decline. However, the opposite was true for pumpkin, lady's finger, bitter gourd, ash gourd, cucumber, snake gourd, summer chili, other summer vegetables, and total summer vegetables.

## Prices

Real or deflated prices of vegetables show an increasing trend between 1974 and 1991 for all vegetables. The overall weighted average price index increased at about 2.7% per annum. The highest price increases were observed in tomato, cucumber, all types of gourds, beans, and pumpkin (Table 4). The increase in the real prices of vegetables is consistent with the static level of vegetable production in Bangladesh, because additional demand is generated by increased population as well as by higher incomes.

Table 4. Annual growth rates (%) in the wholesale deflated price<sup>1</sup> of vegetables in Bangladesh, 1974–91

Vegetables	Growth rate	Vegetables	Growth rate
Tomato	7.0	Lady's finger	4.3
Cucumber	6.6	Garlic	3.9
Ribbed gourd	6.2	Arum	3.5
Bitter gourd	6.0	Cabbage	3.5
Pumpkin	5.7	Ash gourd	3.2
Hyacinth bean	5.6	Spinach	3.2
String bean	5.5	Indian spinach	3.1
Snake gourd	5.4	Onion	2.2
Pointed gourd	5.0	Ginger	0.0
Eggplant	4.9	Radish	-1.0
Bottle gourd	4.9	Mungbean	2.7
Cauliflower	4.6	Overall vegetables <sup>2</sup>	2.7

<sup>1</sup>Current vegetable prices were deflated by the consumer food price index.

<sup>2</sup>Weighted average vegetable price index was estimated by using the Laspeyre Index (Pearce 1983).

Source: GOB (various issues).

## Risk in Vegetable Production

Risk in vegetable production was measured by estimating the detrended coefficient of variation (CV) in vegetable production, area, and yield (Table 5). Despite the counterbalancing effect of different vegetables, the CVs in area, production, and yield of total summer and winter vegetables are higher than the corresponding CV in rice production, indicating that vegetable production is more risky than cereal production. The CVs in area of all individual vegetables are higher than rice; also the CVs in yield of about half the vegetables reported in the table are higher than the corresponding CV in rice.

Table 5. Detrended coefficients of variation (%) in vegetable area, production, yield, and wholesale prices, 1972–92

Vegetable	Production	Area	Yield	Wholesale prices
<b>A. Winter vegetables</b>				
Eggplant <sup>1</sup>	4.14	2.52	2.25	39.04
Pumpkin <sup>1</sup>	16.76	29.64	29.65	37.41
Cauliflower	4.99	3.10	3.39	34.32
Cabbage	6.37	3.83	5.29	34.54
Bottle gourd	7.18	5.06	4.29	27.64
Tomato	9.39	3.16	9.60	41.71
Radish	5.13	3.78	2.49	29.61
Hyacinth beans	5.02	3.82	2.86	31.15
Spinach	8.85	5.35	6.97	12.22
Onion	8.54	2.53	7.47	23.63
Garlic	4.52	2.15	3.31	48.65
Ginger	3.57	3.73	2.76	30.04
Chili <sup>1</sup>	19.95	6.13	19.81	36.31
Other winter vegetables	4.49	9.21	16.37	-
<b>B. Summer vegetables</b>				
Eggplant <sup>1</sup>	6.96	4.17	4.26	-
Pumpkin <sup>1</sup>	12.26	8.19	5.03	-
Pointed gourd	5.80	3.73	2.77	36.71
Lady's finger	11.04	9.27	7.59	27.63
Ridged gourd	8.02	6.50	3.89	27.65
Arum	5.67	5.37	3.52	20.21
Bitter gourd	11.47	8.50	5.06	25.26
Ash gourd	11.38	9.35	3.54	9.21
Cucumber	8.03	7.20	2.68	27.64
String bean	24.06	10.69	36.91	28.90
Indian spinach	10.25	11.64	10.24	25.13
Snake gourd	8.08	7.75	2.81	33.85
Stem amaranth	4.60	5.44	3.11	-
Chili <sup>1</sup>	9.93	4.30	6.41	-
Other vegetables	24.66	19.09	4.82	-
All summer vegetables	6.67	3.31	5.79	-
<b>Rice</b>	4.03	2.03	4.69	4.50

<sup>1</sup>Although production figures are available for summer and winter, prices are not. So CV in the annual prices of these vegetables is reported in the winter season only.

Variability in production leads to variability in prices. The individual price variability was found to

range from 9.21% in ash gourd to 48.65% in garlic. Again, the CV for price for each vegetable was many times more than that for rice. As well as production induced variability, speculation also adds to the variability in vegetable prices; speculation is less a problem in rice as it is minimized by government policies such as price support.

## Seasonality in Vegetable Prices

### Macro-level Evidence

Seasonal price indices of individual vegetable types were estimated considering wholesale prices in a three-year period, 1991–93, in all districts (Table 6). Wide seasonal variations in vegetable prices were observed. For perishable and semi-perishable vegetables with limited storage possibilities, prices were usually lowest in the peak harvesting period and highest just before harvest. Seasonal variation in prices was observed to be stronger for short-duration, seasonally available vegetables than for long-duration, year-round vegetables.

Monthly prices of all vegetables as a group were estimated using the relative share of each vegetable in the total vegetable arrivals in the Dhaka market. Despite the counter-balancing effect of the prices for the various vegetables, high seasonality in overall vegetable prices can be observed. Prices are lowest in March and highest in October, producing 40% seasonality in prices.

Generally, seasonality is higher at the farm level than at the retail level (Table 7) mainly because middlemen help to smooth out seasonality by adjusting their profits. However, urban consumers face lower seasonality than do rural consumers because the former shop at relatively more developed markets which reduce seasonality by bringing supplies from various ecoregions. Rural markets are less developed and less connected to the production and supply centers. This results in gluts and shortages, and thus high seasonality.

Table 6. Price indices of vegetables by month, average of 1991–93\*

Crop	Month												Seasonality
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Cabbage	100	69	64	57	-	-	-	-	-	-	208	153	265
Cauliflower	100	88	89	-	-	-	-	-	-	-	-	149	69
Spinach	100	93	122	96	-	-	-	-	-	-	302	189	225
Eggplant	100	70	77	100	135	165	191	186	179	205	177	134	193
Pointed gourd	100	106	135	87	75	75	80	77	78	88	87	71	90
Ash gourd	100	87	91	102	103	114	104	103	98	108	127	131	51
Bottle gourd	100	82	73	69	80	130	114	123	120	146	145	126	112
Pumpkin	100	82	73	67	68	75	81	88	95	107	126	120	88
Bitter gourd	100	109	100	65	58	69	81	80	88	99	112	107	93
Lady's finger	100	90	112	90	76	77	70	78	88	100	123	125	79
Cucumber	100	98	151	188	157	180	202	232	222	261	215	198	166
Radish (local)	100	106	95	165	238	179	206	259	302	294	282	165	218
Radish (HYV)	100	95	45	-	-	-	-	-	-	-	157	137	249

Contd. Table 6.

Crop	Month												Seasonality
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Hyacinth bean	100	69	64	65	-	-	-	-	-	-	232	170	263
Tomato	100	84	91	151	124	-	-	-	-	218	240	125	186
Snake gourd	-	-	-	100	54	82	65	60	61	54	67	65	85
Ridged gourd	100	133	53	66	59	61	56	62	65	73	69	63	151
Red amaranth	100	118	106	116	128	147	140	130	129	153	121	11	129
Indian spinach	100	-	88	79	84	71	70	72	88	102	101	91	46
Stem amaranth	100	141	102	87	90	93	91	96	75	85	83	123	88
String bean	100	70	77	89	83	99	96	92	95	117	103	95	67
Potato (local)	100	72	76	93	114	128	139	140	141	151	164	178	147
Potato (HYV)	100	66	70	87	104	117	145	144	144	154	173	183	177
Onion	100	96	97	79	92	95	98	107	117	129	156	138	97
Chili (green)	100	94	86	90	70	62	92	118	93	137	141	107	127
Chili (dry)	100	171	162	160	152	137	162	168	162	166	164	138	71
Mungbean	100	107	103	101	91	92	95	94	97	99	101	98	18
Garlic	100	83	50	59	69	73	72	77	83	84	85	95	100
Ginger	100	114	119	125	140	188	154	160	156	120	119	119	88
All vegetables	100	110	97	103	109	115	121	126	126	136	133	109	40
Rice (course)	100	102	106	107	99	101	101	102	104	103	96	93	15

\* Price indices are calculated with the January price set to 100, except in snake gourd where the April price is equal to 100. (Source: GOB various issues)

Table 7. The seasonal price indices and seasonality of selected vegetables for growers and rural and urban consumers

Vegetable	Market level	Monthly price indices						Actual average price (BDT/quintal)	Seasonality
		Oct.	Nov.	Dec.	Jan.	Feb.	March		
Cabbage	Farmer	237	133	59	53	16	-	321	1381.3
	Rural consumer	209	145	88	41	15	-	445	1293.3
	Urban consumer	144	130	123	82	19	-	1177	657.9
Cauliflower	Farmer	269	147	66	63	35	18	522	668.6
	Rural consumer	236	159	94	53	39	16	665	505.1
	Urban consumer	204	145	135	52	38	24	2204	436.8
Radish	Farmer	207	110	110	51	34	-	238	508.8
	Rural consumer	175	133	133	58	37	-	397	373.0
	Urban consumer	151	148	148	40	38	-	806	297.4
Tomato	Farmer	140	140	90	84	35	46	925	300.0
	Rural consumer	160	160	98	81	36	43	1122	344.4
	Urban consumer	161	161	98	88	41	31	1908	292.7

Source : Survey data collected by BARI, Division of Agricultural Economics, 1990.

### Field-level Evidence

Sabur (1990) also observed high seasonality in the prices for radish, tomato, eggplant, pointed gourd, pumpkin, and potato. Seasonality in vegetable prices was higher than seasonality in the price of rice. Potato, however, had high seasonality compared to other vegetables studied even though it has a relatively long storage life and is stored in cold storage during the off season. This might be because some vegetables like eggplant and pumpkin are planted and available throughout the year. In other cases, such as radish, the low seasonality relative to potato was because the seasonality was estimated based on available prices for only a few months.

### Regional Disparity in Seasonal Vegetable Prices

Vegetable prices vary considerably from place to place; generally they are higher in non-producing areas than in the producing areas. Prices of most vegetables are relatively low in Jessore, Khulna, Rajshahi, Rangpur, Dinajpur, Dhaka, and Comilla (the largest vegetable producing areas) and relatively high in Patuakhali, Sylhet, Rangamati, Mymensingh, Tangail, and Noakhali (less important vegetable producing areas).

Regional vegetable markets seem not to be well integrated as is reflected by different monthly price variations for the same vegetable. For example, eggplant prices are more seasonal in Jamalpur district than in Faridpur district. Also, prices move in opposite directions (Fig. 2); when prices are lowest in Faridpur in June, they are near their highest levels in Jamalpur and Chittagong. The same is true for other vegetables.

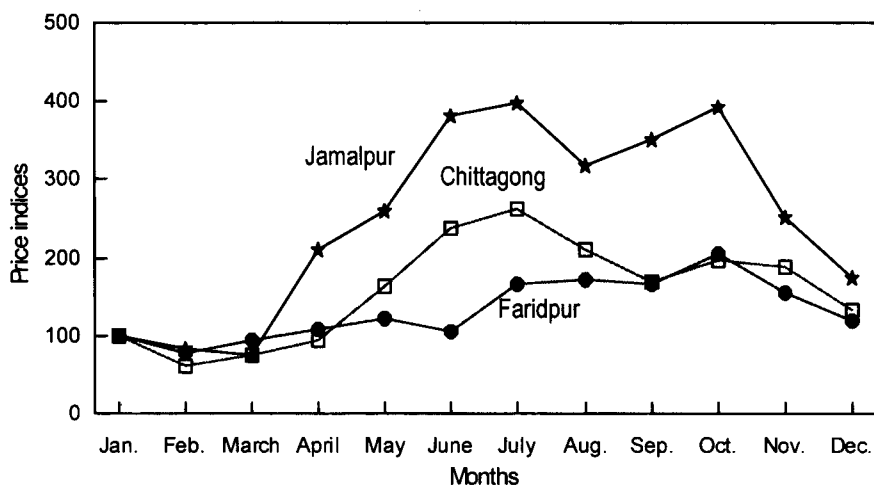


Fig. 2. Regional disparity in seasonal eggplant prices in Bangladesh (average 1991-93)

### Farm Management Practices

Many different cropping patterns are followed in vegetable cultivation (Table 8). The available farm-level studies show that winter vegetables are usually sown between August and November (except for hyacinth beans which are sown during July and August), and are harvested from October to April. Sowing and harvesting times for summer vegetables vary for different types of vegetable.

Table 8. Information on agronomic practices for different vegetables in Bangladesh

Vegetable	Sowing time (Month & Week) <sup>1</sup>	Land & soil type <sup>2</sup>	Management practices <sup>3</sup>				Harvesting time (Month & Week) <sup>1</sup>	Cropping pattern	Reference
			P	D	W	S			
Bitter gourd	April to August	HL, MHL	6	9	4	-	July to Nov	(i) Bitter gourd-Fallow (ii) Fallow-Bitter gourd-Potato	Hossain et al. 1994
Cabbage	Sep-i to Nov-iii	HL, MHL	7	8	2	-	Oct-ii to Feb-iii	(i) Rice-Cabbage-Rice (ii) Bitter gourd/Jute,- Cabbage/Potato- Cucumber/ Amaranth	Huq and Rahman 1993
Cauliflower	Sep-i to Nov-iii	HL, MHL	7	8	3	-	Nov-i to Feb-ii	(i) Rice-Cauliflower-Rice (ii) Bitter gourd/Snake gourd, -Cauliflower/Potato, Cucumber	Huq and Rahman 1993
Chili	Sep-i to Nov-ii	HL, MHL	8	17	5	-	Dec-iii to Apr-iii	(i) Aus (HYV)-Fallow-Chili (ii) Jute-Fallow-Chili	Elias and Hossain 1984
Eggplant	Sep-ii to Nov-iv	L	7	8	6	2	Dec-iii to Feb-iv	(i) Rice-Eggplant (ii) Jute-Eggplant (iii) Fallow-Eggplant	Hoque et al. 1991
Ginger	Mar-i to Apr-iv	HL, SL	4-12	4-12	3-4	-	Dec-ii to Jan-iv	(i) Annual crop/intercrop	Ahmed et al. 1990b
Hyacinth bean	Jul-ii to Aug-iii	HL, MHL	5	6	5	6-10	Oct-iii to Mar-ii	(i) Rice-Countrybean (ii) Bitter gourd/Eggplant - Countrybean	Huq and Rahman 1993
Mukhikachu	Dec-ii to May-ii	HL & MHL, SL, L, CL	3-10	4-12	8	-	Jul-iii to Oct-ii	(i) Mukhikachu-T.aman (ii) Mukhikachu-Fallow (iii) Mukhikachu-Lentil	Ahmed et al. 1990a
Mungbean	Aug-iii to Feb-ii	HL, MHL	1	0-7	0-1	0-7	Oct-iv to Jan-ii	(i) T. aus-T. aman- Mungbean (ii) Fallow-Fallow-Mungbean	Elias et al. 1986
Onion	Nov-ii to Jan-ii	MHL, SL to C	6	16	2	-	Mar-iii to Apr-ii	(i) B. Aman-Onion (ii) Jute-Fallow-Onion	Elias et al. 1988
Panikachu	Feb-I to Mar-ii	HL & MHL	9	11	6	-	July to Sept	(i) Panikachu-Potato (ii) Panikachu-Radish	Baksh et al. 1990
Pointed gourd	Sep-iii to Nov-iv	HL, MHL	7	8	-	-	Feb-ii to Nov-iv	(i) Potato-Pointed gourd	Ullah et al. 1994
Potato	Sep-iii to Jan-ii	HL, MHL L, SL	6	11	1	2	Nov-i to Apr-iv	(i) Aus-Aman-Potato (ii) Sesame-Aman-Potato (iii) Jute-Fallow-Potato	Elias et al. 1984
Radish	Aug-iv to Oct-iv	HL, MHL	8	9	2	-	Oct-i to Jan-ii	(i) Rice-Radish-Rice (ii) Jute-Radish-Potato/ Lentil,	Huq and Rahman 1993
Tomato	Sep-ii to Nov-iii	HL, L to S	5	7	3	2	Dec-ii to Apr-iv	(i) Jute-Fallow-Tomato	Matin et al. 1994
Teasle gourd	Feb-i to April-i	S, Red C	-	-	-	-	May to Oct.	(i) Kakrul-Bean & Bottle gourd-Kakrul (ii) Kakrul-Fallow-Kakrul	Barman et al. 1990

<sup>1</sup>i, ii, iii, and iv - refers to the weeks of a month.

<sup>2</sup>Land and soil type, MHL=Medium highland, HL=Highland; S=Sandy; C=Clay; L=Loam; SL= Sandy loam; CL= Clay loam.

<sup>3</sup>The symbols denote the following management practices; P = plowing (no.); D= leveling (no.); W= weeding (no.); S= spray (no.).

" - " implies information is not available.

Most vegetables are cultivated at high or medium-high elevations and the predominant soil types are loam, sandy loam, and clay loam. Vegetable growers perform 5 to 10 plowings and 6 to 12 levelings per crop. Usually 2 to 4 weedings are carried out. The number of top-dressings of fertilizer depends on the type of vegetable.

## Economics of Vegetables

### Commercial Vegetable Cultivation

#### *Input Use*

Levels of inputs in vegetable cultivation in Bangladesh, as reported in different farm-level studies, are summarized in Table 9. There is wide variation in the level of human labor input (the extremely high labor use in pointed gourd is mainly a consequence of its prolonged growing season). Human labor is available from three different sources: own family, seasonally or permanently hired labor, and casual hired labor. Family labor typically supplies about 60–80% of the total labor requirements. Disposal and marketing of vegetables also requires large labor inputs, because many vegetables are perishable and must be marketed quickly. Homestead vegetable garden production, especially, increases employment opportunities for women, because it is mainly women who take care of these gardens. Thus, production of vegetables provides ample opportunity for employment.

Table 9. Input use (per ha) for different vegetables

Name of crop	Labor (days)		Tractor (BDT)	Seed <sup>1</sup>	Irrigation (BDT)	Manure (kg)	Fertilizer (kg)				Pesticide (BDT)	Reference
	Human	Pair of bullock					Urea	TSP	MP	Total		
Bitter gourd	330	41	-	5.80 kg	581	10088	424	504	139	1267	3541	Hossain et al. 1994
Cabbage	234	20	353	42450 N	1397	4933	562	736	140	1448	3375	Huq and Rahman 1993
Cauliflower	270	22	266	33375 N	2221	9806	552	640	205	1497	1124	Huq and Rahman 1993
Chili	268	62	-	15.00 kg	772	19745	361	100	43	504	145	Elias and Hossain 1984
Eggplant	209	34	-	2.79 kg	91	7816	-	-	-	647	644	Sabur 1990
Eggplant	478	54	-	30750 N	-	11076	282	165	93	440	314	Hoque et al. 1991
Hyacinth bean	421	24	328	5.76 kg	2319	1007	249	262	9	520	5438	Huq and Rahman 1993
Mukhikachu	501	41	-	940 kg	322	10440	348	197	63	608	-	Ahmed et al. 1990a
Mungbean	69	15	-	14.00 kg	-	-	-	-	-	-	-	Elias et al. 1986
Onion	298	67	-	6.40 kg	-	2836	31	70	30	131	-	Elias et al. 1988
Panikachu	835	43	-	22640 N	1008	23146	536	242	100	778	13	Baksh et al. 1990
Pointed gourd	168	32	-	-	46	4889	-	-	-	727	398	Sabur 1990
Pointed gourd	1466	70	-	951 kg	2190	19150	323	420	115	858	5554	Ullah et al. 1994
Potato	257	31	803	1556 kg*	575	8870	450	469	264	783	823	Elias et al. 1984
Pumpkin	128	22	-	2.73 kg	-	6612	-	-	-	71	163	Sabur 1990
Radish	179	38	-	3.23 kg	-	4112	-	-	-	323	294	Sabur 1990
Radish	171	29	463	4.61 kg	1870	1022	218	327	87	632	429	Huq and Rahman 1993
Teasle gourd	472	-	-	294(T)	197	18409	896	326	94	1316	1987	Barman et al. 1990
Tomato	190	33	-	-	95	5785	-	-	-	667	202	Sabur 1990
Tomato	259	52	137	35250 N	951	9154	185	141	58	384	593	Matin et al. 1994

<sup>1</sup> Seed is expressed in number (N) if seedlings are used, in kg if seed, and T if tubers.

\* weight of the tubers in kg.

In vegetable cultivation, animal power is used only for land preparation. For some crops animal power is supplemented by tractor power. Most vegetable growers use cow dung as manure; the amounts used vary greatly across vegetables. The same holds for average doses of inorganic

fertilizer. Some farmers use gypsum, boron, and calcium as well. Large quantities of fertilizer are applied to most crops, the exceptions being pumpkin and onion.

### **Factor Share**

Production costs (both total and cash) vary widely (Table 10). Labor contributes most to the total cost of growing most vegetables, followed by fertilizer and manure. In mukhikachu, panikachu, cabbage, cauliflower, eggplant, onions, and potatoes, seeds and seedlings are also major costs. The high other costs in growing gourds and beans include the cost of protection/support with which these crops are grown.

Table 10. Factor share and costs of production in selected vegetables

Name of crop	Factor share (%) <sup>a</sup>						Cost (BDT/ha)		Reference
	Labor	Draft power	Seed/seedling	Manure/fertilizer	Pesticide	Others	Total	Cash	
Bitter gourd	29	6	9	23	8	24	46207	28221	Hossain et al. 1994
Cabbage	28	2	25	33	9	3	35901	29765	Huq and Rahman 1993
Cauliflower	33	3	21	37	3	2	34942	27205	Huq and Rahman 1993
Chili	47	10	4	35	1	2	10259	5710	Elias and Hossain 1984
Eggplant	47	8	2	35	5	4	13193	6564	Sabur 1990
Eggplant	59	6	18	15	1	0	25768	6635	Hoque et al. 1991
Hyacinth bean	46	3	3	10	14	24	38158	23713	Huq and Rahman 1993
Mukhikachu	50	7	24	16	0	4	34308	19435	Ahmed et al. 1990a
Mungbean	57	22	7	12	0	2	2473	1063	Elias et al. 1986
Onion	55	18	20	7	0	1	14906	5631	Elias et al. 1988
Radish	55	11	3	27	3	2	9505	4063	Sabur 1990
Radish	47	8	7	31	3	4	15466	11343	Huq and Rahman 1993
Rice	-	-	-	-	-	-	9655	3757	IRRI 1995
Panikachu	50	5	28	16	0	1	40083	-	Baksh et al. 1990
Pointed gourd	43	8	4	38	3	3	11579	5272	Sabur 1990
Pointed gourd	64	4	3	10	9	10	64213	31787	Ullah et al. 1994
Potato	22	4	36	27	4	7	18394	11431	Elias et al. 1984
Pumpkin	56	9	2	27	2	3	6780	3323	Sabur 1990
Teasle gourd	35	0	5	19	4	38	55481	25530	Barman et al. 1990
Tomato	48	8	3	35	2	4	11642	5984	Sabur 1990
Tomato	42	11	12	24	3	9	18571	9723	Matin et al. 1994

<sup>a</sup> The factor shares are estimated on the full cost basis.

### **Profitability**

Variation across vegetables in gross and net return, benefit-cost ratio, and cost per kg of output is evident from Table 11. Even the same vegetable can show different economics of cultivation over a different time period. However, it is evident from the studies that vegetable growers receive higher

net return from high-priced vegetables. Thus, price is an important factor in determining returns from vegetable growing.

Table 11. Economic returns from selected vegetable and field crops

Vegetable	Yield (t/ha)	Price (BDT/t)	Gross return (BDT/ha)	Net return (BDT/ha) <sup>a</sup>		Benefit-cost ratio		Cost (BDT/kg)	Reference
				Full cost	Cash cost	Full cost	Cash cost		
Bitter gourd	12.94	7218	93398	46610	65177	2.00	3.31	3616	Hossain et al. 1994
Cabbage	31.84	2557	81415	44117	51650	2.18	2.74	1171	Huq and Rahman 1993
Cauliflower	20.10	3412	68581	31418	41376	1.85	2.52	1849	Huq and Rahman 1993
Chili	3.78	7984	30187	19156	24477	2.74	5.29	2918	Elias and Hossain 1984
Eggplant	14.94	3200	47805	34521	41241	3.60	7.28	889	Sabur 1990
Eggplant	28.36	5514	156374	130441	149739	6.03	23.57	914	Hoque et al. 1991
Hyacinth bean	18.63	5376	100155	59678	76442	2.47	4.22	2173	Huq and Rahman 1993
Mukhikachu	13.96	3990	55700	21070	36265	1.61	2.87	2481	Ahmed et al. 1990a
Mungbean	6.98	7440	5382	2911	4319	2.18	5.06	354	Elias et al. 1986
Onion	4.72	4920	23232	8326	17601	1.56	4.13	3158	Elias et al. 1988
Pointed gourd	31.81	6000	190884	124481	159097	2.87	6.01	2087	Ullah et al. 1994
Radish	12.43	2697	33524	16188	22181	1.93	2.96	1395	Huq and Rahman 1993
Panikachu	99.81	1676	167287	126196	-	4.07	-	412	Baksh et al. 1990
Pointed gourd	10.74	6200	66606	54981	61334	5.73	12.63	1082	Sabur 1990
Potato	30.35	902	27383	8414	15952	1.44	2.40	625	Elias et al. 1984
Pumpkin	23.71	1100	26086	19306	22763	3.85	7.85	286	Sabur 1990
Radish	18.15	2000	36303	26798	32240	3.82	8.94	524	Sabur 1990
Rice	2.63	8275	21763	12108	18006	1.25	4.79	3671	IRRI 1995
Teasle gourd	27.78	11706	325214	269537	301365	5.84	13.64	2076	Barman et al. 1990
Tomato	7.30	5300	38688	26951	32704	3.30	6.47	1608	Sabur 1990
Tomato	20.43	1610	32897	14326	23174	1.77	3.38	909	Matin et al. 1994

<sup>a</sup> Gross return is defined as price multiplied by yield, and net return is defined as gross return less cost. The cost estimates are given in table 10.

Vegetable cultivation is generally more profitable than rice growing, in terms of both benefit-cost ratio and net return per unit area. Thus, vegetable cultivation can help farm families raise their income levels. However, cost per kilogram of output is also generally higher for vegetables than for rice.

### Homestead Vegetable Production

Traditionally, farmers all over Bangladesh have grown vegetables on their homesteads, primarily for family consumption. Chowdhury et al. (1992) observed a trend in the production and consumption of vegetables from the homestead for different farm categories; production was highest in the landless farm category and decreased with increase in farm size. Average production over all farm categories and sizes was about 165 kg/year. The package required few purchased inputs, and all labor could be

provided by family members, particularly women and children, so production costs were not high averaging BDT 120 per year. However, homestead farmers were found to consume most of their production. Only 10–30% of the produce was sold. Landless and marginal farmers sold higher proportions of their production than other groups.

## Economic Constraints

Table 12 reviews major constraints associated with vegetable production.

Table 12. Prioritization of production constraints in vegetables

Production constraints	Tomato (A,B)	Pointed gourd (B,C)	Bitter gourd (D)	Mukhi- kachu (E)	Pani- kachu (F)	Onion (G)	Mungbean (H)	Ginger (I)
High price of seed	-	-	-	8	-	-	-	-
Shortage of quality seed	3	-	-	-	-	3	4	-
High price of fertilizer	4	1	1	9	-	-	-	5
High price of insecticide	4	1	1	-	-	-	-	-
Infestation of pests & diseases	1	-	5	4	1	-	1	2
Low price of product during harvest period	2	-	-	10	-	-	9	-
Cumbersome procedure of institutional credit	5	2	6	3	-	2	-	3
Lack of storage facilities	-	-	-	2	-	-	-	-
Erratic rainfall/ unfavorable weather	-	3	3	5	-	8	7	-
Lack of scientific knowledge about modern cultivation	-	2	-	-	6	3	-	-
Lack of irrigation facilities	-	-	-	6	6	-	-	-
Lack of funds/cash needed	-	-	-	11	-	-	-	-
Scarcity of human labor	-	-	-	7	-	-	-	-
Theft	-	-	-	-	5	-	-	1
Lack of planting materials	-	-	-	4	-	-	-	-
Lack of production technology	-	-	-	3	-	-	-	-
Damage by livestock/poultry	-	-	-	7	-	4	-	-
Poor yield	-	-	-	-	-	-	2	-
Incidence of pests & diseases in storage	-	-	-	-	-	5	-	-
Poor soil moisture at sowing	-	-	-	-	-	6	-	-
Lack of improved/desired varieties	-	-	-	1	-	5	-	-

Ranking 1 to 11 was done according to importance/priority of the problems; the higher rank indicates greater severity.

Sources: A. Matin et al. 1994. B. Sabur 1990. C. Ullah et al. 1994. D. Hossain et al. 1994. E. Ahmed et al. 1990a.  
F. Baksh et al. 1990. G. Elias et al. 1988. H. Elias et al. 1986. I. Ahmed et al. 1990b.

Bacterial wilt in tomato and eggplant, powdery mildew in cucurbits and beans, mosaic and leaf curl virus in tomato and yellow vein mosaic virus in lady's fingers are some of the major diseases that cause heavy damage to vegetable crops almost every year. In addition, aphids in beans and cole vegetables, fruit and shoot borers in eggplant, and diamondback moth in cabbage, are major insect pests causing considerable production loss.

## Vegetable Marketing: Structure and Conduct

### Market Intermediaries

The intermediaries involved in the vegetable marketing chain from producer to consumer are the Farias, Beparis, Arathdars, Paikers, and Retailers. The business characteristics of these intermediaries are shown in Table 13.

Table 13. Business characteristics of intermediaries in vegetable marketing

	(% of traders)				
	Faria	Bepari	Arathdar	Paiker	Retailer
Nature of business					
Independent	100	86	90	100	97
Joint	0	14	10	0	3
Source of financing					
Self	82	92	90	83	73
Friends/relatives	0	2	0	0	17
Arathdar	0	4	0	17	0
Bank	18	2	0	0	3
Cooperative	0	0	10	0	3
Others	0	0	0	0	3
Have permanent shop	9	51	100	0	91
Duration of business					
< 6 years	18	29	10	83	29
6—10 years	37	27	50	17	23
11—15 years	18	32	20	0	17
16—20 years	9	12	0	0	17
21—25 years	9	0	10	0	7
>25 years	9	0	10	0	7
No. of staff					
None	100	98	0	100	56
One	0	2	20	0	17
Two	0	0	40	0	27
Three	0	0	40	0	0

Source: Sabur (1990).

### **Faria**

Farias are petty traders who buy vegetables from producers in the village or in the local market and sell them to Beparis, or sometimes directly to local consumers. Farias conduct their business independently, and most are self-financed. They normally do not have a permanent shop in the market, and they have no permanent staff. About half have been engaged in vegetable trading for more than 10 years. About half are seasonal traders; the rest do business throughout the year. Some Farias also deal in other commodities, such as jute or paddy. None of them is reported to offer credit.

### ***Bepari***

Beparis are professional traders who buy goods from producers or Farias at the local markets, ship their consignments to urban wholesale markets and sell to retailers through commission agents. Most Beparis are independently organized and self-financed. They have no permanent shops or staff, but they do hire casual labor to perform a variety of marketing functions. Most Beparis have more than five years experience in the vegetable business, and are involved in vegetable trading throughout the year; some also deal in other agricultural commodities. Cash sales or purchases are very common at this stage of the marketing channel. There exists strong competition among Beparis, and entry into this type of business has few barriers. As a result, Beparis cannot make excessive profits.

### ***Arathdar***

Arathdars are commission agents who operate from a permanent base (shop or other establishment). Most Arathdars are independently organized and self-financed. They employ both day (or monthly) laborers and other staff to perform various functions, and many employ a few permanent staff. Both licensed and unlicensed Arathdars are found in the wholesale markets. Arathdars charge commissions from Beparis and retailers; these commissions differ according to the vegetable. Arathdars often advance loans to Beparis (on condition that the Bepari sell his vegetables to the Arathdar) and provide shelter and occasional meals to Beparis. Competition at this stage is comparatively less and there are major barriers to entry (such as limited space in the market); as a result, Arathdars can make excessive profits.

### ***Paiker***

Paikers buy vegetables from Beparis through Arathdars and sell them to retailers or consumers. They operate independently and manage their own capital; sometimes they borrow money from Arathdars. Paikers have no permanent staff and work on a cash basis. They do not have shops, but instead conduct and perform their business at the Arathdars' shops. Some Beparis who do not like to wait a long time before selling their vegetables dispose of their stock to the Paikers at the Arath centers.

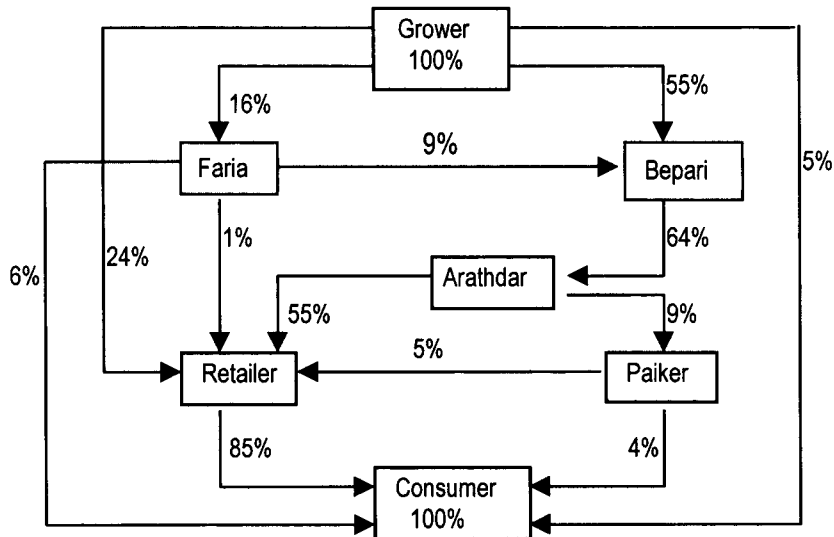
### ***Retailer***

Retailers, the last link in the marketing channel, buy vegetables from Beparis through Arathdars and sell them to consumers. Most retailers are independently organized and have a permanent shop in the market, although some, particularly in low-income areas, have no shop, but use the open marketplace. Most retailers are self-financed, but sometimes borrow money from friends and relatives. Some big retailers in high-income areas employ one or two people. In high-income localities, scarcity of space to set up a shop is an important barrier to entry, whereas in low-income areas, people who want to sell vegetables can simply sit in the open marketplace. Cash sales are very common in high-income areas, but in low-income areas retailers often sell vegetables on credit. Retailers sometimes make credit purchases from Beparis at Arath centers.

## **Market Flow System**

The marketing flow for vegetables, in general, is depicted in Fig. 3. Vegetable growers usually sell their produce (55%) to Beparis, either in the local primary market or in the village. About 24% of their produce is sold directly to retailers in the local market. Growers also dispose of their vegetables

to Farias (16%) and a few even sell directly to local consumers in the market.



Source: Sabur (1990).

Fig. 3. Marketing channels for vegetables in Bangladesh

The following channels are investigated in detail in different studies discussed in the following sections.

1. Producer → Consumer
2. Producer → Retailer → Consumer
3. Producer → Bepari → Arathdar → Retailer → Consumer
4. Producer → Bepari → Paiker → Arathdar → Retailer → Consumer
5. Producer → Faria → Retailer → Consumer
6. Producer → Faria → Bepari → Arathdar → Retailer → Consumer

### Marketing Functions

A marketing function may be defined as a major specialized activity performed in accomplishing the marketing process (Kohls & Uhl 1980). Pricing, transportation, storage, packaging, grading and standardization, and market information, are the various functions performed in vegetable marketing in Bangladesh.

#### Pricing

All traders involved in vegetable marketing follow the open bargaining method for fixing prices at the time of trading. The price is determined mainly by the number of buyers attending the market and the volume and quality of produce offered for sale. Because vegetables are highly perishable, sellers usually have low bargaining power vis-a-vis buyers.

### **Transportation**

Transportation is concerned with the availability of market produce at the proper time and place (Sabur 1990; Batan 1994). Rickshaws, headloads, and country boats are the important means of transportation from the farm gate to the local markets. Headloads, rickshaws, push carts, and country boats are the major means of transportation used by Farias. On the other hand, Beparis mainly use trucks to carry vegetables from the local market to the urban wholesale market; sometimes they use country boats, trains, and passenger buses to ship their purchased produce. Vegetables are carried by rickshaw vans from Arath centers to various retail markets in Dhaka city.

### **Storage**

Because they are highly perishable, vegetables require specialized storage facilities. Beparis and Farias do not store vegetables; they generally use bamboo baskets or sacks to keep their unsold vegetables in the open space in the market. Cold storage hardly exists at any stage of vegetable marketing in Bangladesh, mainly because consumers prefer to buy fresh vegetables and at least some varieties of vegetables are available in the market all year round. Also, consumers cannot afford to pay the additional costs of storage.

### **Packaging**

Farias and Retailers do not pack their vegetables for transportation. Beparis do, however, mostly in long sacks made from two or three open sacks sewn together. For some vegetables (for example, tomato and bitter gourd) a kind of bamboo basket (*tukri*) is used during transport and for temporary storage.

### **Grading and Standardization**

Grading means sorting vegetables according to quality. Standardization means having consistent and uniform specifications of quality among buyers and sellers from place to place and from time to time (Thomsen 1951).

Except for Farias, almost all traders grade their eggplant, tomato, and bitter gourd. Other vegetables are graded only occasionally. The purpose of grading is to facilitate sales and to obtain a higher price. At the retail level, vegetables are usually graded on the basis of size, variety, color, and defects.

### **Marketing Information**

'Fellow' and 'higher' intermediaries in the market chain are the main sources of market information. For example, Beparis receive information from other Beparis and from Arathdars; retailers collect information mainly from Arathdars, Beparis, and from other retailers. About 90% of the intermediaries reported that they collect market information from other intermediaries by personal contact only. Although the Department of Agricultural Marketing regularly disseminates market prices of vegetables through newspapers, radio, and television, traders do not seem to make much use of these sources of information. Marketers agree that official prices do not reflect actual market prices.

## Efficiency of Vegetable Marketing

### Marketing Costs and Margins of Producers

In most cases, transportation is the major marketing cost at the growers' level. Headloads and rickshaws/rishshaw vans are the major modes of transport used by vegetable growers. When producers market their own produce, in most cases they do so in local markets (Table 14).

Table 14. Transportation mode, place of sale, and marketing cost for producers in selected vegetables

Vegetable	Marketing channel*	Transportation mode (% grower)				Sale place (% grower)			Market cost (BDT/t)				Reference
		Head/shoulder	Van/rickshaw	Bullock cart	Other	Farm	Village	Market	Transport	Toll	Other	Total	
Bitter gourd	5	-	-	-	-	-	62	38	359	113	200	672	Baten 1994
Cabbage	3	24	55	-	5	16	-	-	186	25	-	211	Ahmed et al. 1990b
Cauliflower	3	42	48	-	-	10	-	-	295	32	-	327	Ahmed et al. 1990b
Eggplant	3,6	42	62	4	4	-	30	70	53	-	11	64	Sabur 1990
Lady's finger	5	-	-	-	-	-	26	74	388	102	225	715	Baten 1994
Pointed gourd	3	67	67	-	17	-	67	33	107	-	39	146	Sabur 1990
Pointed gourd	3	-	-	-	-	-	31	69	428	113	275	816	Ullah et al. 1994
Pumpkin	3	67	100	67	-	-	87	13	60	-	16	76	Sabur 1990
Pumpkin	5	-	-	-	-	-	55	45	453	101	300	854	Baten 1994
Radish	3	83	100	-	-	-	87	13	53	-	9	62	Sabur 1990
Radish	3	26	57	-	5	12	-	-	250	66	-	316	Ahmed et al. 1990b
Tomato	1,2,3	32	62	-	4	2	-	-	225	77	-	302	Ahmed et al. 1990b
Tomato	3	75	75	-	-	-	77	23	69	-	26	95	Sabur 1990

- implies that information is not available.

\* For channels corresponding to each number, see page 50.

### Marketing Costs and Margins of Intermediaries

Marketing costs and margins of vegetable marketing intermediaries are shown in Table 15.

#### *Faria*

Transportation accounts for more than half of the total marketing cost incurred by Farias. The marketing margin varies, mainly due to variation in profits made by Farias. However, profit generally constitutes more than 50% of the marketing margin.

#### *Paiker*

Transportation accounts for more than 60% of Paikers' total marketing costs. There is considerable variation (in absolute terms as well as in terms of percentage contribution of different cost items) in margins for the various vegetables.

*Bepari*

Transportation and wastage are the major costs incurred by Beparis. The distance of the local assembling centers from the urban wholesale markets, the nature of the commodity, and the commissions paid to Arathdars are the key factors that determine the Beparis marketing costs. The margins vary, largely due to variation in profits. In most cases about two-thirds of the marketing margin is costs, with one-third left for profits.

*Arathdar*

The labor cost of employed workers, merged in "other costs" in Table 15, is the Arathdars' single highest cost item. The cost of entertaining Beparis and other people (personal expenses) is the second highest cost item. There is considerable variation in the profit of Arathdars. Even the margins of the same commodity vary considerably across studies.

Table 15. Marketing costs and margins (10 BDT/t) of marketing agents

Vegetable	Marketing cost							Marketing margin	Profit	Reference	
	Transport	Load/unload	Market tolls	Wastage	Personal expense	Commission	Other				Total
<b>Farias</b>											
Bitter gourd	33	N/A	4	10	5	N/A	2	54	147	93	Baten 1994
Eggplant	13	N/A	1	1	11	N/A	11	27	135	108	Sabur 1990
Eggplant	31	N/A	4	7	6	N/A	1	49	123	74	Baten 1994
Lady's finger	25	N/A	3	7	5	N/A	1	41	148	107	Baten 1994
Pumpkin	25	N/A	4	1	5	N/A	1	36	95	59	Baten 1994
Radish	5	N/A	3	N/A	20	N/A	N/A	28	49	21	Sabur 1990
Tomato	9	N/A	1	N/A	8	N/A	N/A	18	106	88	Sabur 1990
<b>Paikers</b>											
Bitter gourd	35	N/A	5	9	9	N/A	6	64	100	36	Baten 1994
Eggplant	33	N/A	4	6	8	N/A	2	53	138	85	Baten 1994
Eggplant	N/A	N/A	N/A	7	14	10	3	34	92	58	Sabur 1990
Lady's finger	27	N/A	5	5	7	N/A	3	47	159	112	Baten 1994
Pumpkin	33	N/A	5	2	9	N/A	2	51	98	47	Baten 1994
Tomato	N/A	N/A	N/A	13	13	62	4	92	135	43	Sabur 1990
<b>Beparis</b>											
Bitter gourd	35	3	1	45	12	13	1	110	176	66	Baten 1994
Cabbage	44	17	6	48	N/A	N/A	5	120	659	539	Ahmed et al. 1990b
Cauliflower	46	19	6	86	N/A	N/A	8	165	1204	1039	Ahmed et al. 1990b
Eggplant	73	7	3	10	6	27	2	128	163	35	Sabur 1990
Eggplant	31	5	2	41	10	13	2	104	125	21	Baten 1994
Lady's finger	28	3	1	23	13	10	2	80	96	16	Baten 1994
Radish	41	24	5	30	N/A	N/A	5	105	361	256	Ahmed et al. 1990b
Pointed gourd	62	14	8	57	21	19	3	184	229	45	Sabur 1990

Contd. Table 15.

Vegetable	Marketing cost								Marketing margin	Profit	Reference
	Transport	Load/unload	Market tolls	Wastage	Personal expense	Commission	Other	Total			
Pointed gourd	100	18	10	12	N/A	N/A	10	150	197	47	Ullah et al. 1994
Pumpkin	25	4	1	44	1	12	2	89	122	33	Baten 1994
Pumpkin	14	1	1	9	2	3	0	30	48	18	Sabur 1990
Radish	31	1	1	21	N/A	24	N/A	78	136	58	Sabur 1990
Tomato	80	16	3	60	32	30	4	225	386	161	Sabur 1990
Tomato	50	22	7	82	N/A	N/A	6	167	702	535	Ahmed et al. 1990b
<b>Arathdars</b>											
Bitter gourd	N/A	N/A	N/A	N/A	5	N/A	7	12	112	100	Baten 1994
Cabbage	N/A	N/A	N/A	N/A	2	N/A	3	5	146	141	Ahmed et al. 1990b
Cauliflower	N/A	N/A	N/A	N/A	2	N/A	3	5	259	254	Ahmed et al. 1990b
Eggplant	N/A	N/A	N/A	N/A	2	N/A	3	5	20	15	Sabur 1990
Eggplant	N/A	N/A	N/A	N/A	4	N/A	6	10	100	90	Baten 1994
Lady's finger	N/A	N/A	N/A	N/A	4	N/A	6	10	61	51	Baten 1994
Pumpkin	N/A	N/A	N/A	N/A	4	N/A	6	10	52	42	Baten 1994
Pointed gourd	N/A	N/A	N/A	N/A	2	N/A	3	5	135	130	Sabur 1990
Radish	N/A	N/A	N/A	N/A	2	N/A	3	5	53	48	Sabur 1990
Radish	N/A	N/A	N/A	N/A	2	N/A	3	5	90	85	Ahmed et al. 1990b
Tomato	N/A	N/A	N/A	N/A	2	N/A	3	5	121	116	Sabur 1990
Tomato	N/A	N/A	N/A	N/A	2	N/A	3	5	244	239	Ahmed et al. 1990b
Pumpkin	N/A	N/A	N/A	N/A	2	N/A	3	5	27	22	Sabur 1990
<b>Rural Retailers</b>											
Bitter gourd	13	3	3	1	10	N/A	10	40	68	28	Baten 1994
Cabbage	5	5	4	N/A	N/A	N/A	2	16	133	117	Ahmed et al. 1990b
Cauliflower	5	1	4	N/A	N/A	N/A	2	12	143	131	Ahmed et al. 1990b
Eggplant	13	3	3	11	11	N/A	12	53	133	80	Sabur 1990
Lady's finger	12	3	4	8	10	N/A	12	51	160	111	Baten 1994
Radish	5	3	4	N/A	N/A	N/A	2	14	159	145	Ahmed et al. 1990b
Pumpkin	13	2	2	8	10	N/A	10	45	103	58	Baten 1994
Tomato	5	5	5	N/A	N/A	N/A	2	17	197	180	Ahmed et al. 1990b
<b>Urban Retailers</b>											
Bitter gourd	45	8	6	24	6	9	6	104	332	228	Baten 1994
Cabbage	11	N/A	N/A	N/A	N/A	97	N/A	108	206	98	Ahmed et al. 1990b
Cauliflower	7	N/A	N/A	N/A	N/A	173	N/A	180	478	298	Ahmed et al. 1990b
Eggplant	44	7	6	13	5	8	7	90	252	162	Baten 1994
Eggplant	25	5	1	23	30	10	2	96	124	28	Sabur 1990
Lady's finger	41	8	6	13	6	8	6	88	169	81	Baten 1994
Radish	25	5	1	22	12	33	2	100	124	24	Sabur 1990

Contd. Table 15.

Vegetable	Marketing cost								Marketing margin	Profit	Reference
	Transport	Load/unload	Market tolls	Wastage	Personal expense	Commission	Other	Total			
Radish	11	N/A	N/A	N/A	N/A	60	N/A	71	207	136	Ahmed et al. 1990b
Pointed gourd	5	N/A	N/A	N/A	N/A	N/A	N/A	55	178	123	Ullah et al. 1994
Pumpkin	26	5	3	3	17	18	0	72	85	13	Sabur 1990
Pumpkin	39	9	6	2	6	8	6	76	109	33	Baten 1994
Pointed gourd	27	4	1	2	23	78	1	136	182	46	Sabur 1990
Tomato	10	N/A	N/A	N/A	N/A	163	N/A	173	281	108	Ahmed et al. 1990b
Tomato	25	5	1	76	23	61	2	193	238	45	Sabur 1990

N/A = not applicable

### *Retailer*

Retailers' marketing costs are directly related to the distance between Arath centers and retail markets (transportation costs), the level of Arathdari commissions, the degree of perishability of the vegetables, and inversely with scale of operation. For the urban retailers, transportation costs, Arathdari commissions, personal expenses, and, in a few cases, wastage, are the major cost items. For the rural retailers, marketing cost is very low.

Retailers' margins, in general, are the lowest (both in absolute and percentage terms) among all intermediaries, despite the fact that they assume greater risks. Retailers' margins are directly related to the income status of the locality; i.e., in high-income localities margins are high and in low-income areas they are low. Sabur (1990) found that the marketing margins of intermediaries increase (in absolute terms) as prices increase, but the rate of increase in the margin is less than the increase in price.

### *Price Spread*

The spread between farm price and retail price is another measure of marketing efficiency. It is the difference between the retail price and the value of an equivalent amount of food sold by farmers (Khol's & Uhl 1980).

The producers' share of the consumers' price and marketing margin depends on various factors, such as processing and marketing services, perishability, bulkiness, distance of shipment, number of intermediaries in the marketing channel, unit price of the product, etc. On average, producers receive nearly 50% of the consumer's price (range 12–66%, depending on the vegetable) (Table 16). In most cases, the producers' share is high for high-priced vegetables, and low for low-priced vegetables.

Regressing the producers' share on number of marketing agents gave a significant negative relationship, implying that reducing the number of agents will increase the producers' share. Adding one agent to the channel causes a 12% reduction in the farmers' share.

Farias' profit accounts for the highest portion of the total price spread—one-third to three-fourths of the price spread between producers and consumers (Table 16). Therefore, policy efforts to reduce the

share of Faria profit could greatly reduce the price spread, and increase the contribution of producers' profit in the consumers' price. The Beparis' share of marketing costs is generally high, mainly due to the complexity of the functions they perform. Retailers' costs are also high because of the high cost of transportation, Arathdari commissions, and wastage.

Table 16. Contribution of marketing cost and profit (%) in the total price spread by various intermediaries

Vegetables	Marketing channel*	Marketing cost (%)				Profit (%)					% of consumer price received by producers	Reference
		Faria	Bepari	Paiker	Retailer	Faria	Bepari	Paiker	Arathdars' commission	Retailer		
Bitter gourd	5	19	-	-	19	33	-	-	-	29	53	Baten 1994
Eggplant	6	2	30	-	28	12	2	-	-	27	14	Sabur 1990
	3	-	45	-	33	0	12	-	-	10	36	
Eggplant	4	-	17	8	7	-	12	13	8	35	23	Baten 1994
	5	16	-	-	8	27	-	0	-	39	39	
Lady's finger	4	-	18	8	8	-	13	14	8	32	20	Baten 1994
	5	20	-	-	21	33	-	0	-	26	40	
Pointed gourd	3	-	45	-	33	0	11	-	-	11	66	Sabur 1990
Pumpkin	3	-	23	-	54	0	13	-	-	10	41	Sabur 1990
Pumpkin	4	-	19	6	8	-	17	13	8	30	12	Baten 1994
	5	25	-	-	28	26	-	-	-	20	37	
Radish	3	-	30	-	38	0	22	-	-	9	40	Sabur 1990
Tomato	6	1	18	-	23	12	21	-	-	25	31	Sabur 1990
	3	-	36	-	31	0	26	-	-	7	48	

- implies that the intermediary did not play a role in the marketing channel, these data was not available or not applicable.

\* For channels corresponding to each number, see page 50.

The absolute profit obtained by traders varies from 310 BDT/t in pumpkin to 13250 BDT/t for cauliflower, which increases with the increase in vegetable prices, but decreases in percentage term. Profits as a percentage of investment by traders also vary for different vegetables, ranging from 8 to 151%. Traders' returns on investment were found to be more than 100% for cauliflower, cabbage, and pumpkin when sold in a longer channel, and returns were found to be low for pointed gourd (Table 17).

### Marketing Constraints

Only a few studies on marketing constraints are available. The monopoly of traders in marketing, unstable prices, defective weighing, lack of marketplaces, high market tolls, low prices, and lack of good facilities at marketplaces are cited as major marketing problems faced by growers (Baten 1994; Sabur 1990). On the other hand, traders' problems include lack of capital, space, and information, price instability, problems in transport and in obtaining licenses, post-harvest infestation, and uncertain electricity supply (Ahmed et al. 1990b; Ullah et al. 1994). Baten (1994) reported that most Arathdars cited availability of capital and supply as the main factors affecting their volume of business, and Beparis cited price and vegetable supply as main determining factors affecting business volume. While retailers are concerned with demand and capital.

Table 17. Spread between producers' price and consumers' price, and traders' profit for selected vegetables

Vegetable	Marketing channel	Grower price (BDT/t)	Consumers price (BDT/t)	Producer share (%)	Marketing cost (BDT/t)	Profit of traders (BDT/t)	Investment by traders (BDT/t)	Profit (%) of investment	Reference
Bitter gourd	5	3210	6010	53	1070	1730	4270	41	Baten 1994
Cabbage	-	3120	11770	27	2440	6210	5560	112	Ahmed et al. 1990b
Cauliflower	-	5220	22040	24	3570	13250	8790	151	Ahmed et al. 1990b
Eggplant	6	560	4000	14	2050	1390	2610	53	Sabur 1990
	3	1630	5500	30	2230	640	3860	16	
Eggplant	4	1760	7730	23	2410	3560	4170	85	Baten 1994
	5	1780	4590	39	930	1870	2710	69	
Lady's finger	4	1470	7340	20	2420	3440	3900	88	Baten 1994
	5	1460	3650	40	890	1290	2350	55	
Pointed gourd	-	8570	12320	70	2050	1700	10620	16	Ullah et al. 1994
Pumpkin	4	870	7570	11	2680	4020	3550	113	Baten 1994
	5	830	2240	37	760	650	1590	41	
Pointed gourd	3	7820	11930	66	3200	910	11020	8	Sabur 1990
Pumpkin	3	940	2270	41	1020	310	1960	16	Sabur 1990
Radish	3	1730	4330	40	1770	820	3500	23	Sabur 1990
Radish	-	2380	8060	30	1890	3790	4270	89	Ahmed et al. 1990b
Tomato	6	3750	12000	31	3500	4750	7250	65	Sabur 1990
	3	5670	11910	48	4180	2060	9860	21	
Tomato	-	9250	19080	48	3570	6260	12820	49	Ahmed et al. 1990b

\* For channels corresponding to each number, see page number 50.

- implies that information is not available

## International Trade

Bangladesh began to export fruit and vegetables in 1973–74; the value of exports that year was very small, at 1.4 million BDT. During the 1980s, exports took off, reaching 530.5 million BDT in 1987, before plummeting to one-fifth of that value in 1991. In the early 1990s, vegetable exports picked up again (Table 18). Among agricultural export items, vegetables have played an increasingly important role. The main vegetables exported by air include string beans, bitter gourd, lady's finger, teasle gourd, eggplant, snake gourd, ribbed gourd, bottle gourd, pointed gourd, Indian spinach, cucumber, tomato, arum, and red amaranth. Bangladesh does not import vegetables, although unofficial imports through the porous Indian border is unrecorded.

Table 18. Bangladesh exports of vegetables, 1979–93

Year	Quantity (t)	Value ( million BDT)
1979	287	7.2
1980	343	10.3
1981	519	14.6
1982	1056	28.1
1983	1686	56.7
1984	1940	77.1
1985	2533	108.5
1986	8466	404.8
1987	10577	530.5
1988	8686	461.8
1989	5031	298.8
1990	4860	315.2
1991	2675	117.5
1992	4950	197.9
1993	7679	307.2

Source : GOB (various issues).

Export marketing is linked to the domestic marketing system. Fresh vegetables are generally collected by exporters from the Dhaka markets through different marketing channels. After procurement, they are stored, graded, packed in bamboo baskets or paper cartons (used boxes of imported goods) and transported to the airport for shipment. Some exporters collect vegetables directly from Kashimpur, Rupganj in Dhaka, Jessore, Kushtia, Rajshahi, Comilla, and Chittagong.

## Supply and Demand

### Per Capita Availability

Per capita availability of vegetables in Bangladesh since independence, estimated from the vegetable production data after adjusting for international trade, has varied between 28 and 34 g/head/day—far below the recommended level of 200 g/capita/day (Ali and Tsou 1997). The positive trend in annual growth in availability between 1972 and 1993 was negligible at 0.25%. The annual growth in the availability was higher between 1983 and 1993 (0.28%) than during 1972 and 1982 (0.19%).

### Consumption by Rural and Urban Groups

The Household Expenditure Survey (HES) of 1988–89 estimated an average per capita monthly expenditure on food of 1672 BDT, or 65.4% of total consumption expenditure; this is lower than the 1973–74 value of 75.7% (GOB 1990).

The percentage distribution of monthly expenditures on major food items shows that cereals account for 50.6%, meat and fish products 12.6%, pulses 3.6%, vegetables 8.8%, milk and milk products

2.8%, edible oil 3.6%, condiments and spices 6.0%, fruit 1.1%, sugar and brown-sugar cake 1.7%, beverages 1.1%, and miscellaneous food 8.1%. During the period from 1973–74 to 1988–89, expenditures on cereals, edible oil, and spices decreased gradually, and expenditures on meat and fish products, vegetables, and miscellaneous food items increased considerably. The level of consumption of almost all food items is generally lower in rural areas compared to urban areas, except for rice, wheat, eggs, and pulses.

About 8.8% of household income is spent on vegetables. Consumers in rural areas in all income groups spend a slightly lower proportion of their income on vegetables than do consumers in urban areas, except in the lowest household income group (<750 BDT/month) which spends a relatively higher portion of total household income on vegetables (results not reported here).

National per capita monthly consumption of vegetables, including potato and banana, varies from 4.3 kg in the lowest income group to 6.7 kg in the highest income group (Table 19). Similar trends are observed for rural and urban areas. Except for the lowest income group in rural areas, rural dwellers consume less vegetables than urban dwellers in the corresponding income group. Some income groups in rural areas consume more 'other vegetables' (perhaps vegetables from home gardens) than the corresponding groups in urban areas.

Table 19. Monthly per capita consumption of vegetables (kg) by monthly household income groups, 1988–89

Household income group (BDT)	Percent of households	Total food (kg)	Vegetable consumption (kg)				
			Total vegetables	Leafy vegetables	Potato	Banana, papaya & eggplant	All others
< 750	3.80	16.81	4.30	1.65	0.57	0.53	1.56
750-999	6.30	20.34	4.49	1.27	0.78	0.70	1.75
1000-1249	8.53	21.74	4.77	1.24	0.96	0.74	1.84
1250-1499	9.05	23.18	4.77	1.16	0.99	0.62	2.00
1500-1999	17.66	25.56	5.37	1.26	1.00	1.02	2.09
2000-2499	14.36	26.46	5.02	1.05	1.07	0.75	2.15
2500-2999	9.85	26.95	5.04	0.99	1.20	0.78	2.07
3000-3999	13.02	29.68	5.25	1.01	1.34	0.75	2.16
4000-4999	6.53	29.81	5.65	1.13	1.40	0.88	2.26
5000-5999	3.42	32.13	5.55	1.01	1.59	0.80	2.15
6000-6999	2.23	33.76	5.85	1.04	1.52	0.83	2.45
7000-7999	1.39	38.01	6.02	1.00	1.72	0.87	2.43
8000-8999	0.95	34.68	6.47	1.25	1.48	0.71	3.03
9000-9999	0.69	35.99	6.67	1.25	2.11	0.88	2.43
10000-12499	0.80	30.39	5.54	1.16	1.61	0.75	2.02
12500+	1.35	41.79	6.70	1.27	1.62	0.82	3.00
All Groups		27.64	5.26	1.12	1.20	0.80	2.14

Contd. Table 19.

Household income group (BDT)	Percent of households	Total food (kg)	Vegetable consumption (kg)				
			Total vegetables	Leafy vegetables	Potato	Banana, papaya & eggplant	All others
<b>URBAN</b>							
< 750	0.80	18.17	4.02	0.87	0.91	0.70	1.54
750-999	1.87	19.36	4.61	1.56	1.19	0.66	1.20
1000-1249	2.61	21.92	5.50	1.43	1.34	0.92	1.81
1250-1499	3.84	23.29	4.99	1.09	1.32	0.79	1.80
1500-1999	13.04	26.49	5.69	1.53	1.40	0.88	1.89
2000-2499	13.52	26.50	5.31	1.21	1.39	0.74	1.98
2500-2999	10.90	29.45	5.97	1.18	1.67	0.83	2.28
3000-3999	18.76	28.83	6.00	1.27	1.71	0.81	2.21
4000-4999	10.63	31.76	6.29	1.27	1.83	0.87	2.32
5000-5999	6.62	31.55	6.11	1.43	1.54	0.76	2.38
6000-6999	4.43	36.35	6.60	1.47	1.93	0.82	2.39
7000-7999	2.29	39.48	8.60	2.08	2.25	0.93	3.34
8000-8999	2.13	33.93	6.11	1.19	1.68	0.61	2.63
9000-9999	1.87	43.03	7.99	1.87	2.12	0.90	3.09
10000-12499	2.77	36.95	7.44	1.89	1.96	0.84	2.75
12500+	3.84	48.88	7.92	2.22	1.95	0.93	2.83
All Groups		31.27	6.20	1.42	1.67	0.82	2.29
<b>RURAL</b>							
< 750	4.23	16.79	4.31	1.66	0.56	0.53	1.56
750-999	6.94	20.37	4.49	1.26	0.76	0.70	1.77
1000-1249	9.38	21.74	4.75	1.23	0.95	0.73	1.84
1250-1499	9.80	23.18	4.76	1.17	0.97	0.61	2.00
1500-1999	18.32	25.47	5.34	1.23	0.96	1.03	2.11
2000-2499	14.48	26.45	4.99	1.03	1.03	0.75	2.17
2500-2999	9.70	26.61	4.91	0.96	1.14	0.77	2.04
3000-3999	12.19	29.84	5.11	0.96	1.27	0.74	2.15
4000-4999	5.94	29.40	5.52	1.10	1.30	0.88	2.24
5000-5999	2.97	32.29	5.40	0.90	1.60	0.82	2.09
6000-6999	1.91	33.05	5.64	0.92	1.41	0.84	2.46
7000-7999	1.26	37.70	5.48	0.77	1.61	0.86	2.23
8000-8999	0.78	34.90	6.58	1.26	1.43	0.74	3.15
9000-9999	0.52	33.58	6.21	1.03	2.11	0.87	2.20
10000-12499	0.52	27.22	4.62	0.81	1.44	0.71	1.67
12500+	0.99	38.38	6.12	0.81	1.46	0.77	3.08
All Groups		27.11	5.13	1.08	1.13	0.80	2.12

Source: GOB (1990).

## Seasonality in Vegetable Consumption

Monthly consumption and production data were not available. Therefore, the index of seasonality in vegetable consumption was estimated from vegetable arrivals in Dhaka markets (Fig. 4). Vegetable consumption was highest during March–May when overall vegetable prices were low, and lowest in October when overall vegetable prices were high. The highest availability of vegetables was double the lowest availability. Therefore, average vegetable consumption estimates based on the annual vegetable availability overlook the strong seasonality in vegetable supply.

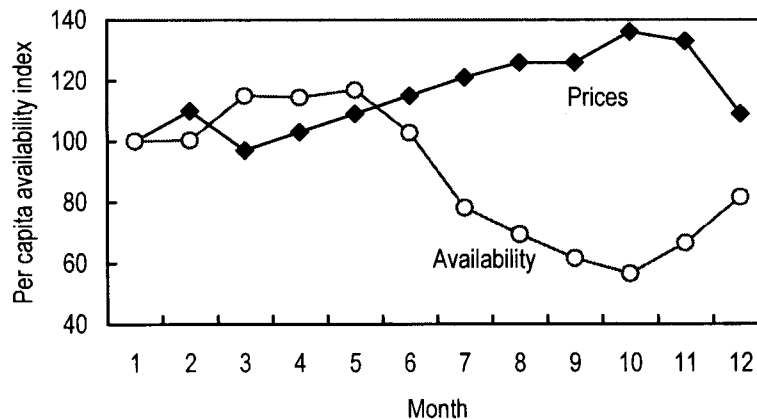


Fig. 4. Seasonality in vegetable price and availability in Dhaka markets, average 1991-93

## Income and Expenditure Elasticities of Vegetables

Information on price and income elasticities for different vegetables is not available from HES, with the exception of potato for which elasticities were estimated for 1983–84, 1985–86, and 1988–89. Income and expenditure elasticities of demand for potato for all three periods were lower in urban areas (0.46–0.58 and 0.61–0.67, respectively) than in rural areas (0.74–0.89 and 0.92–1.0, respectively). Income elasticities of demand for potato have increased in urban areas over time, while corresponding elasticities in rural areas have shown a decline.

## Government Policies

### Research and Development

There is a growing awareness of the role of vegetable production in the national agricultural economy and in human health. Vegetable research has been encouraged through bilateral and multilateral collaboration with international agencies. Bangladesh is an active member of the South Asian Vegetable Research Network (AVRDC 1992) and the regional FAO/UNDP vegetable development project, RAS/89/041. Through these networks and projects, Bangladesh receives improved technologies for vegetables from other countries and assistance in developing its own research facilities. Several improved and off-season varieties of tomato, cabbage, and cauliflower have already been developed by BARI. Moreover, a homestead vegetable production model in a 6 x 6 m<sup>2</sup> area has been developed for small farm households, and has been widely accepted throughout the country. Non-governmental organization (NGO) workers are being trained in vegetable production,

preservation and processing in the villages.

### **Improved Domestic Vegetable Marketing**

Direct government intervention in vegetable marketing is minimal. Buying and selling of vegetables is almost entirely in the hands of producers, private traders, and a small number of agricultural cooperatives.

Through the Agriculture Product Markets Regulation Act, passed in 1964 and amended in 1985, the Department of Agricultural Marketing (DAM) tries to regulate marketing charges, Arathdars' commissions, and other fees involved in vegetable marketing. Under the Act, some markets are designated as important, and in these the District Market Advisory Committee makes recommendations to set the market charges. Market functionaries are given licenses upon payment of the required fees. Efforts are being made by DAM to increase domestic consumption of vegetables, particularly potatoes, through motivational posters, booklets, food displays, and other means.

The government's main area of involvement in potato marketing has been in financing the construction of cold storage facilities. The Department of Industries has provided import licenses at reduced rates for equipment and material for such facilities, and capital and commercial loans are advanced to the investors through banks. The aim is a strong cold storage industry that will improve potato marketing and ultimately ensure fair prices to growers.

### **Incentives for Vegetable Exports**

To cope with declining foreign exchange earnings from traditional commodities, such as jute, efforts are being made to boost exports of non-traditional items, including fruit and vegetables. For planned development and expansion of export trade of fruit and vegetables to other countries, the government regularly announces its export policy, and sets vegetable export targets. The following are some of the features of the 1991–92 export policy:

1. The establishment of "export villages" in selected areas to increase production of export-oriented vegetables;
2. Intensification of the search for export markets for vegetables in Western Europe and Japan;
3. Increase in the air cargo capacity of Biman, the national air carrier;
4. Encouragement in the use of improved packing materials and guaranteeing their availability in order to maintain freshness and quality of fruits and vegetables.

In addition, the Export Promotion Bureau (EPB), in cooperation with the Bangladesh Agricultural Development Corporation (BADC), has started a program for growing vegetables and fruits on selected farms (for example, in Aulokhola, Kashimpur, Hathihara, and Enayatpur). Under the Crop Diversification Programme, contract growing of potato is being tried. One cold storage facility with a 120-t capacity has been set up at Dhaka airport for air cargo of perishable commodities. The overall objective of these policies is to improve links between exporters and growers and to guarantee growers a legitimate price for their produce.

The government has taken various steps to enhance overall exports, including vegetables. These steps include:

- sending export delegates on market identification missions
- hiring consultants to recommend improved grading and packaging methods
- setting up trade fairs in other countries
- establishing a Sectoral Task Force to monitor progress in exports
- organizing meetings between exporters, customs and Biman officials, and traders.

### **Provision of Quality Seeds**

The government recognized the importance of good quality seeds of high-yielding varieties suited to different ecological conditions. To ensure the production, processing, preservation, and distribution of good quality seed to farmers, the government has implemented a National Seed Policy through which private traders, as well as government agencies, are encouraged to produce and distribute quality seeds.

Reliable data on the quantity of vegetable seeds (except for potato) imported from abroad and produced locally by private seed companies are not available. However, of the present requirements for vegetable seed in Bangladesh—around 1000 t—the Department of Agricultural Extension (DAE) and private traders together supply only 36% (360 t) (Mondol 1994). The remaining 640 t of seeds are farmers' own, and these are usually of low quality, particularly with respect to genetic purity. Low-quality seed is a major cause of low vegetable yields in Bangladesh. On the other hand, adoption of improved varieties in recent years has substantially raised the yields of certain crops, such as tomato, eggplant, and cabbage.

Seeds of cabbage, kohlrabi, turnip, spinach, beet, and carrot are not produced in the country, and must be imported. Varieties of cabbage, carrot, and turnip, suitable for local seed production, have been identified, but these do not yet cover a substantial area.

## **Vegetable Research and Development**

### **Achievements of Past Economic Research**

The Agricultural Economics Division of BARI was created in 1978. Research on the socioeconomics and marketing of selected vegetable crops was started only during the late 1980s because the division was preoccupied with cereal crops. The Agricultural Economics Department of the Bangladesh Agricultural Institute (BAI), in collaboration with the Bangladesh Agricultural Research Council (BARC) and the Agricultural Economics and Rural Sociology faculty of Bangladesh Agricultural University (BAU), has conducted a few research activities related to the economics and marketing of vegetables.

The Agricultural Economics Division has completed research on certain economic issues relating to selected vegetables, including tomato, eggplant, cauliflower, cabbage, radish, hyacinth bean, bitter

gourd, teasle gourd, pointed gourd, mukhikachu, and panikachu. Marketing research has been carried out on tomato, cabbage, cauliflower, radish, and pointed gourd. BAI conducted research on the economics and marketing of eggplant, pointed gourd, radish, tomato, and pumpkin, and BAU did marketing research on eggplant, lady's finger, pumpkin, and bitter gourd.

The above-mentioned studies indicate that the production of vegetables is profitable compared to many other crops. The production of vegetables and their marketing is labor-intensive and creates ample employment opportunities. Homestead vegetable production will also increase the employment opportunities of women.

Vegetable economics studies have identified the constraints to higher vegetable production and productivity. Major constraints include seasonality, lack of improved varieties, shortage/non-availability of quality seeds, absence of appropriate management practices, lack of improved technologies, high cost of inputs, incidence of pests and diseases, lack of irrigation, lack of credit facilities, lack of extension services, high post-harvest losses, and poor marketing facilities.

The main vegetable marketing agents and channels have been identified and marketing margins quantified. Major vegetable marketing constraints have also been identified.

### **Needs and Priorities for Future Research**

Mondol (1994) mentions the following strategies which could be adopted to improve production and marketing of vegetables in Bangladesh.

#### ***Production***

- Improved varieties of vegetables, with resistance to major diseases and pests and tolerance to salinity, drought, and waterlogging, need to be developed. There is a particular need for tomato and eggplant varieties with resistance to bacterial wilt, lady's finger varieties resistant to yellow vein mosaic virus, and varieties of cucurbits resistant to powdery mildew.
- It is also necessary to concentrate on the generation of F<sub>1</sub> hybrids and heat-tolerant varieties of cabbage and cauliflower. The present program for breeding tomato varieties for heat-tolerance should be speeded up.
- Development of varieties of existing vegetables that can be sown at different times would help to reduce the seasonality problem.
- Strategies for the improvement of production should put emphasis on management practices and crop rotations which allow: timely cultivation, control of pests and diseases, and management of soil fertility.
- Technologies are needed to enhance and popularize vegetable production in homesteads.
- A seed corporation should be established with responsibility for production and distribution of quality seeds of recommended varieties of vegetables and potato. The private sector should also be encouraged to produce quality seeds of the recommended varieties.

### **Marketing**

- The transport system should be improved by introducing refrigerated transport facilities and motorized boats to carry vegetables to distant markets. Improvements are also needed in the present handling, packaging, and marketing intelligence systems.
- Suitable storage technologies should be established at village and market levels.
- Establishment of suitable processing plants near cities is also necessary. Both the private and public sector should be involved in setting up these plants.
- Institutional credit should be provided to growers to help them purchase necessary inputs, and to private entrepreneurs to establish processing plants.
- Vegetable producers should be provided with market information on the price and supply situation on a regular basis, to enable them to bargain with traders more effectively.

### **Socioeconomic Research**

The following aspects of socioeconomic research should be explored:

- The causes of decreasing or stagnant productivity in vegetable cultivation.
- Optimum utilization of resources and inputs in different ecoregions.
- Domestic resource costs of major vegetables.
- Vegetable export potential to different countries.
- Relationship between health and vegetable consumption.
- The impact of improved technologies along with the constraints to technology transfer.
- Feasibility of management practices for vegetable cultivation in the summer season.
- Causes of unstable vegetable prices.
- Economic assessment of the potential for the processing of vegetables.
- Compatibility and economic viability of homestead gardens.

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