

# POST HARVEST LOSSES AND MARKETING TECHNOLOGIES OF AGRICULTURAL PRODUCTS IN BANGLADESH

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## ABSTRACT

*Studies were conducted post harvest losses and marketing technologies of agricultural products in Bangladesh with the major objectives to identify the major deterrents of post harvest factors and to determine the harvest needs of the products for better market profit along with its prioritization. The research works were done using structured technical investigative questionnaire and Focus Group Discussions (FGD). The areas covered were Dinajpur (AEZ 1), Natore (AEZ5), Kustia (AEZ 11), and Tangail-Modhupur (AEZ 28) in Bangladesh, considering diversity of agricultural production. The major findings show that absence of specific post harvest dependent agribusiness policy for government departments but it was a must for looking after agricultural products marketing in Bangladesh. The response in these matters of agribusiness development is similar giving emphasis on improving regulatory environments, creating a contact point for agribusiness administration within MOA, establishing Agro-export processing zones, organizing agribusiness groups and association activities, enhancing research, development of agro-technologies and participation of rural People ensuring income generation. Priority should be given to technologies suitable for small-scale agribusiness entrepreneurs and produces/processors. The financial institutes, Banks and employment programs should give all type support for agribusiness in an integrated way. The domestic market should have more easy terms with government, giving priority to exporters for import. The contribution of Agribusiness in the national GDP/AGR and other indexes should be spelled out as needed on the basis of which the national priority/privileges should be determined. Further studies in this respect were strongly recommended.*

**Key words:** Agricultural markets, agricultural technology, farmers, livelihood.

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## 1. INTRODUCTION

Adoption of modern technologies such as use of fertilizers, High Yielding Variety (HYV) seed, irrigation and pesticides has made the country near self-efficient in food grains production. Their livelihood improvement program depends, directly or indirectly, upon production, employment and income from agriculture. Importantly, there is an increasing recognition that agribusiness concept leads commercial agriculture through production processing, storage and marketing of agro-commodities for trade, industry and export. Against this backdrop, GOB has undertaken the proposed project ‘Bangladesh Agribusiness Development Project’ financed by the Asian Development Bank (ADB) to be executed by Ministry of Agriculture (MOA) through Department of Agricultural Marketing (DAM) in cooperation with Ministry of Fisheries and Livestock (MOFL), Ministry of Commerce (MOC) and their line agencies those have contact with the farmers and farmers’ association, farm producers-market linkages, agribusiness entrepreneurs having profitable enterprise or industries for providing technical supports in the form of production inputs, technology, human resources development through skills development training, seminars/workshops, exchange of visits, advisory services, etc. thus establishing an effective agribusiness system in the country (Reardon, et al.,1999; Goletti, et al. 2001). The future growth will require a stimulation of commercial value adding activities based on agriculture sector to generate employment needed to reduce poverty from the country. It has been shown that (BER, 2006; Rahman, 2003; Ahmed, 2002’ and IADP DANIDA, 2000). According to the estimate of BSCIC there are about 523 thousands of small agribusiness enterprises in the country involving about 82% of the total labour force, mostly unemployed, but their service may be made more income-oriented developing the agribusiness status. While during the 1990s agriculture grew by about 37%, agribusiness grew by about 66%. This is about 5.2% annual growths over a decade. Even though it is high comparing to the agricultural growth rate of 3.2%, the growth of agribusiness is still insufficient to generate employment and income required for poverty reduction.

Harvesting of Fresh Produce and Maturity: Quality of fresh fruits and vegetables cannot be improved after harvest. Therefore they must be harvested at the proper stage and size and at peak quality. Immature or over-mature produce may not last as long in storage as that picked at proper maturity. Harvesting at correct maturity stage allows optimum flavor and colour development during ripening. Fruits harvested early do not attain proper ripening. Farmers have their own ways of assessing maturity and this varies from crop to crop. Basically they take into account the colour, size, shape, texture, hardness or softness, smell, taste (sweetness, sourness or bitterness), resonance (sound when tapped). In addition, recording the time period after flowering can also help determine the correct harvesting maturity.

Right time for Harvest: Harvesting when the weather conditions are suitable and at the right time of the day improve product quality and durability. Harvesting during the right time of the day - for most commodities early morning or late evening is the best time for harvest. Harvest should be completed during the coolest time of the day, usually in the morning.

**Table 1** Maturity indices scored by 60-80 percent respondent

Crops	Harvest Indices
Banana	Angularity of fingers and sizes and shapes of finger sections.
Mango	Dark-green mature fruits, cheeks have filled out.
Papaya	Harvested as per change in color from deep to light green light.
Pineapple	Increase in weight, soluble solids and acidity.
Jackfruit	Optimum stage of harvest in 90-110 days after flowering.
Citrus fruits	Citrus fruits based on juice content.
Litchi	Observing the changes in fruit colour

**Cleaning and Washing for Fresh Market and storage:** Reception, checking, recording, sorting, cleaning or washing, fungicide treatment and size- grading, packing and dispatch. These are normally carried out in a packing house. The reception area of the packing house should be organized so that the produce moves through the packing operations in the order of receipt - first in, first out. There are no effective antibacterial agents available for treating water used to wash the produce. Hypochlorites or by chlorine water must be added to wash water (150 - 200 ppm). However, its effectiveness in stagnant or re-circulated water cannot be guaranteed as it is quickly inactivated by organic matter such as debris in the water. Washed produce should be spread out in a single layer in the shade and exposed to good ventilation to aid rapid drying. The storage of horticultural crops has become increasingly necessary today in fresh produce distribution and marketing. Urban markets have facilities to handle limited quantities of produce each day. Excess produce delivered to the market must be stored properly in order to be available in good quality the following day or days and tackle unwanted marketing fluctuations. A large harvest of a certain crop in a certain region can become available to consumer over several days or several weeks rather. When there is glut that can lead to wastage and also low sales prices. Post-harvest Loss Assessment: Post-harvest losses occur at harvest and different stages of the supply chain. Many factors contribute to the post-harvest loss. The extent of the loss would vary widely depending on the type commodity, pre-harvest practices, the manner in which the produce is handled after harvest and also environmental conditions in the location (Keesing, and Lall 1992. Post-harvest loss assessment trials must be carried out separately for each commodity and at different stages of the marketing chain. The accumulative loss may be determined by taking the loss occurred at each stage of marketing chain. Many loss assessment studies have focused the losses that occur at one or several points of post-harvest operations and are therefore incomplete. In the context the present research was conducted with major objective to: identify the major deterrents of post harvest factors and to determine the harvest needs of the products for better market profit along with its prioritization.

## 2. OBJECTIVES OF THE STUDY

The specific objectives of the study are as follows:

- To identify the major deterrents of post harvest factors
- To determine the harvest needs of the products for better market profit along with its prioritization

## 3. METHODS AND MATERIALS

Exploratory interactive Survey methods having direct multi-sector interview with intensive discussion and uniform standard scoring.

**The major variables Sites were:** Four districts in Bangladesh. The name of the districts were Dinajpur, Natore, Kustia and Tangail.

The respondents were Farmer, Agricultural Officers, Agri-businessman and Public representatives. The crop variables were Fruits, vegetables, cereals and industrial crops.

**Statistical Analysis:** Statistical Analysis was done by using Statistical Package for Social Sciences (SPSS) and others as needed.

### Questionnaire Guidelines: Identity of the Respondent

Name with Designation-----Address District and Upazila----- Dinajpur: Natore: Kustia: Tangail. Profession-----Farmer/Agricultural Officer/Agri-businessman/ Public representatives  
 1. Types of supports most important for Agribusiness development in Bangladesh? Give tick mark to any 2 as priority 1 and priority 2 (P1/P2) of the following options. Integrated agri-business education ii. Eximport legislation iii. Agribusiness federations iv. Commercial agri-policies v. Financial Facilities vi. Business risk mitigation insurance support.

**1. Types of supports are the most important for Market development in Bangladesh?** Give tick mark to any 2 as priority 1 and priority 2 (P1/P2) of the following options.

- Homestead storage ii. Product chain values iii. Banking and instant loan facilities iv. Costing and pricing control v. Localized processing vi. Market federations
- Types of supports are the most important for sustainable agro- market development in Bangladesh? Give tick mark to any 2 as priority 1 and priority 2 (P1/P2) of the following options. i. Agr-business education ii. Agri-business training iii. Agri-business Cooperatives iv. Agricultural standard commodity legislation v. Farmer and human right recognition vi. Gender neutral farming systems

## 4. RESULTS AND DISCUSSION

Harvesting when the weather conditions are suitable and at the right time of the day improve product quality and durability. Harvesting during the right time of the day - for most commodities early morning or late evening is the best time for harvest. Harvest should be completed during the coolest time of the day, usually in the morning.

The Maturity indices used in the studies done here were determined from a separate work done along with and the given in the Table 2.

**Table 2** Maturity indices scored by 60-80 percent FGD respondents

Crops	Harvest Indices
Banana	Angularity of fingers and sizes and shapes of finger sections.
Mango	Dark-green mature fruits, cheeks have filled out.
Papaya	Harvested as per change in color from deep to light green light.
Pineapple	Increase in weight, soluble solids and acidity.
Jackfruit	Optimum stage of harvest in 90-110 days after flowering.
Citrus fruits	Citrus fruits based on juice content.
Litchi	Observing the changes in fruit color

### Cleaning and washing for fresh market and storage

Reception, checking, recording, sorting, cleaning or washing, fungicide treatment and size-grading, packing and dispatch. These are normally carried out in a packing house. The reception area of the packing house should be organized so that the produce moves through the packing operations in the order of receipt - first in, first out. There are no effective antibacterial agents available for treating water used to wash the produce.

## Post-harvest Loss Assessment

Post-harvest losses occur at harvest and different stages of the supply chain. Many factors contribute to the post-harvest loss. The extent of the loss would vary widely depending on the type commodity, pre-harvest practices, the manner in which the produce is handled after harvest and also environmental conditions in the location. Post-harvest loss assessment trials must be carried out separately for each commodity and at different stages of the marketing chain. The accumulative loss may be determined by taking the loss occurred at each stage of marketing chain. Many loss assessment studies have focused the losses that occur at one or several points of post-harvest operations and are therefore incomplete.

The results obtained from the present studies are given here in the Tables 1 to 9 and the Figs 1 to 8.

## Types of supports most important for agribusiness development

The findings on the types of supports found most important and significant for agribusiness development are given in the Table 3-5 and Figures 1-2.

**Table 3** Supports important for agribusiness development

Parameters	Dinajpur	Natore	Kustia	Tangail	Mean
Integrated agri-business education	81	47	52	63	61
Export-import legislation	38	31	48	53	43
Agribusiness federations	75	47	82	66	68
Commercial agri-policies	59	41	87	56	61
Financial Facilities	76	72	93	89	83
Business risk mitigation insurance support	59	42	68	62	58
Mean	65	47	72	65	62

Types of supports most important for Agribusiness development included financial facilities as highest. But as AEZ Kustia High Ganges Floodplain was found to be most potential for the purpose.

**Table 4** Types of supports are the most important for market development in Bangladesh

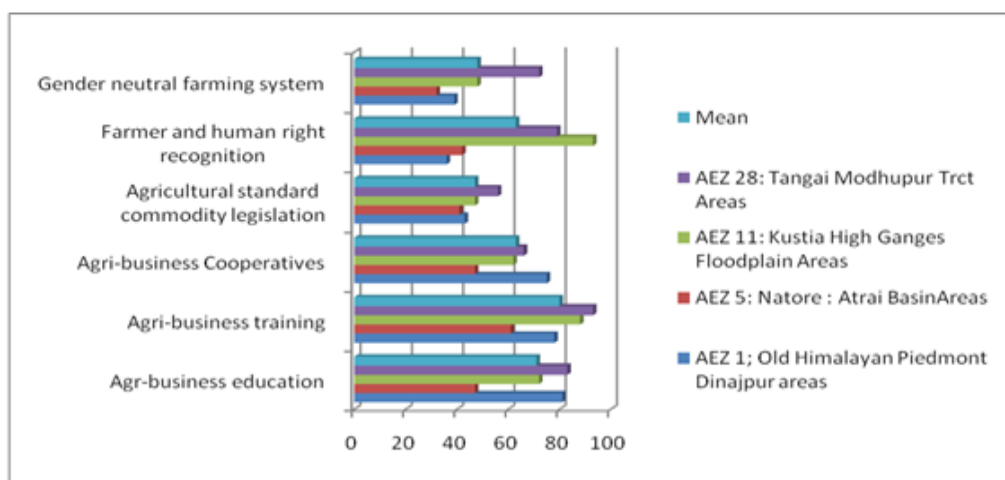
Parameters	Dinajpur	Natore	Kustia	Tangail	Mean
Homestead storage	81	87	92	63	81
Product chain values	78	81	88	53	75
Banking instant loan	75	47	62	66	63
Costing and pricing	59	41	87	56	61
Localized processing	36	42	93	39	53
Market federations	59	42	48	52	50
Mean	65	57	78	55	64

Types of supports most important for Market development included Homestead storage as highest. But as AEZ Kustia High Ganges Floodplain was found to be most potential for the purpose.

**Table 5** Types of supports are the most important for sustainable agro- market development in Bangladesh

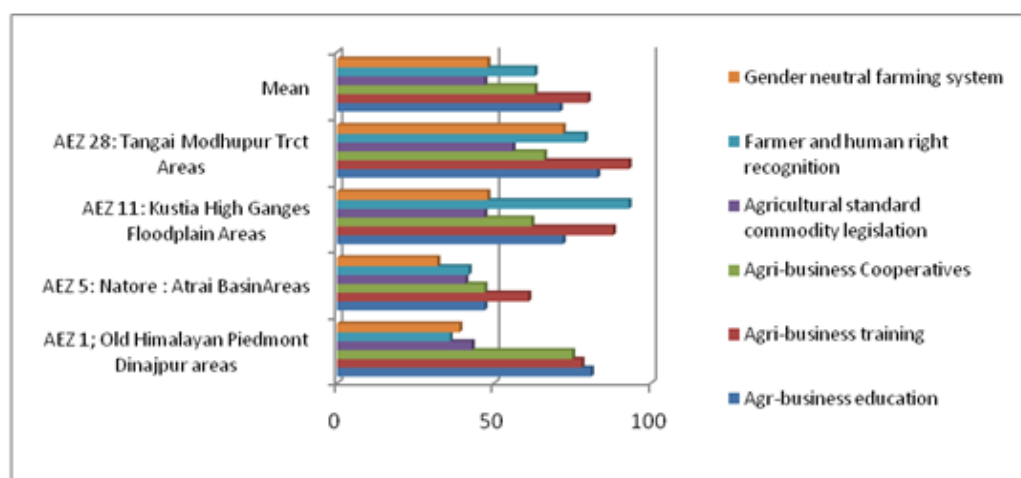
Parameters	Dinajpur AEZ 1	Natore AEZ 5	Kustia AEZ 11	Tangail AEZ 28	Mean
Agri-business education	81	47	72	83	71
Agri-business training	78	61	88	93	80
Agri-business Cooperatives	75	47	62	66	63
Agric standard commodity legislation	43	41	47	56	47
Farmer and human right recognition	36	42	93	79	63
Gender neutral farming system	39	32	48	72	48
Mean	59	45	68	75	62

Types of supports most important for Sustainable Agro-Market development included Agri-business training as highest. But as AEZ Kustia High Ganges Floodplain was found to be most potential for the purpose.



**Figure 1** Types of supports are the most important for sustainable agro- market development in Bangladesh as per systems

Types of supports most important for Sustainable Agro-Market development included Agri-business training as highest. But as AEZ Kustia High Ganges Floodplain was found to be most potential for the purpose.



**Figure 2** Types of supports are the most important for sustainable agro- market development in Bangladesh as per AEZ

Types of supports are the most important for sustainable agro- market development in Bangladesh as per AEZ has shown in the above graph in details.

- Prices of Agro-commodities should controlled by a national level techno-legal committee.
- Price of commodities should not vary more than 10% within a period of 3-5 years.
- Agro technologies field adoption must have patent information.
- Subsidies should be friendly with agribusiness state policies.
- Agribusiness should deal with categorized farmers.
- The domestic market should have easy terms with government.

### Cumulative losses at various levels in different fruits, vegetables, spices and flowers

The results found on the Cumulative losses at various levels in different fruits, vegetables and spices are sequentially given in the Tables 6-10 and Figs 3-7.

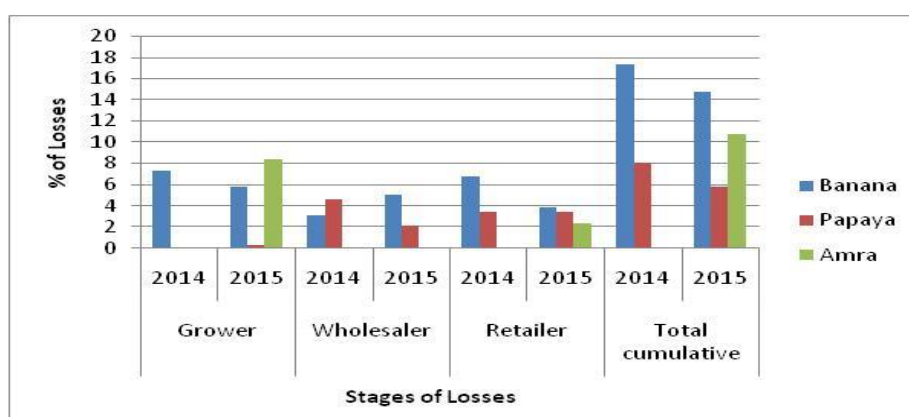
#### Fruits

Cumulative losses at various levels in different fruits re-given in the Table 6 and Fig 3.

**Table 6** Cumulative losses at various levels in different fruits and total cumulative losses

Fruit	Percent cumulative losses							
	Grower		Wholesaler		Retailer		Total cumulative	
	2014	2015	2014	2015	2014	2015	2014	2015
Banana	7.29	5.84	3.16	5.02	6.82	3.82	17.32	14.69
Papaya	0.00	0.29	4.64	2.10	3.42	3.45	8.06	5.83
Amra		8.35		0.10		2.33		10.78

From the above Table 9, it is inferred clearly that the losses in fruits reduced at all levels in fruits except at the wholesale level in Banana and almost remained same level at the retailer's level in case of Papaya. The losses were not high in case of Amra at level of the wholesaler and overall total cumulative losses were around 10.78 percent. However, total cumulative losses were by the large reduced in case of both Banana and Papaya in 2015 as compared in 2014.



**Figure 3** Cumulative losses at various levels in different fruits during both the survey period (2014 and 2015)

From the above graph, from the result it was found that the losses in fruits reduced at all levels in fruits except at the wholesale level in Banana and almost remained same level at the

retailer’s level in case of Papaya. The losses were not high in case of Amra at level of the wholesaler and overall total cumulative losses were around 10.78 percent. However, total cumulative losses were by the large reduced in case of both Banana and Papaya in 2015 as compared in 2014.

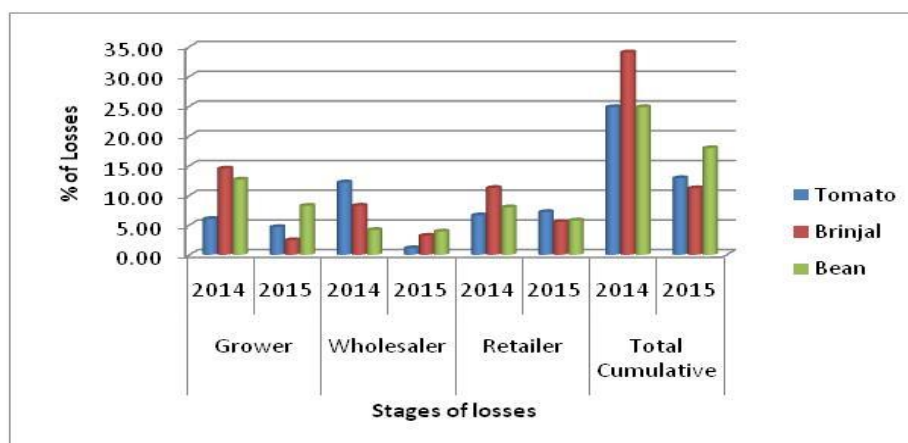
**Vegetables**

Cumulative losses at various levels in different vegetables are given in the Table 7 and Fig 4.

**Table 7** Cumulative losses at various levels in different vegetables and cumulative losses

Name of vegetables	Percent cumulative losses							
	Grower		Wholesaler		Retailer		Total cumulative	
	2014	2015	2014	2015	2014	2015	2014	2015
Tomato	6.04	4.68	12.18	1.12	6.66	7.20	24.84	12.90
Brinjal	14.52	2.46	8.27	3.22	11.25	5.54	34.04	11.20
Bean	12.66	8.26	4.18	3.92	8.00	5.77	24.84	17.95

Data presented above in Table 10 the percent losses in case of all vegetables i.e. Tomato, Brinjal and Bean were reduced in 2014 as compared to data collected in 2013 irrespective of the level of grower, wholesaler and retailer except not reduced at retailer’s level in case of Tomato. However, the total cumulative losses of all Vegetables were reduced in 2015 as compared to data collected in 2014.



**Figure 4** Cumulative losses at various levels in different vegetables during both the survey period (2014 and 2015)

Data presented above in the above graph. From the result it was found that the percent losses in case of all vegetables i.e. Tomato, Brinjal and Bean were reduced in 2014 as compared to data collected in 2013 irrespective of the level of grower, wholesaler and retailer except not reduced at retailer’s level in case of Tomato. However, the total cumulative losses of all Vegetables were reduced in 2015 as compared to data collected in 2014.

**Spices**

Cumulative losses at various levels in different spices are given in the Table 8 and Fig 5.

**Table 8** Cumulative losses % in different spices and cumulative losses

Name of spices	Percent cumulative losses							
	Grower		Wholesaler		Retailer		Total cumulative	
	2014	2015	2014	2015	2014	2015	2014	2015
Onion	10.05	9.95	9.02	0.72	8.15	3.10	27.56	13.77
Chili		3.55		1.30		7.95		12.80



Data presented in Table 11 above clearly reveals the cumulative losses in onion spice were reduced at all the levels in 2015 as compared to data collected in 2014. Similarly, the cumulative loss was also reduced considerably to the level of 13.77 percent in 2015 as compared to data collected in 2014. The overall losses in case of chillies were around only 12.80 percent. Overall the losses were remained same at grower’s level but reduced at both wholesaler and retailer level.



**Figure 5** Cumulative losses in spices during both the survey period (2014 and 2015)

Data presented in graph above clearly reveals the cumulative losses in onion spice were reduced at all the levels in 2015 as compared to data collected in 2014. Similarly, the cumulative loss was also reduced considerably to the level of 13.77 percent in 2015 as compared to data collected in 2014. The overall losses in case of chillies were around only 12.80 percent. Overall the losses were remained same at grower’s level but reduced at both wholesaler and retailer level.

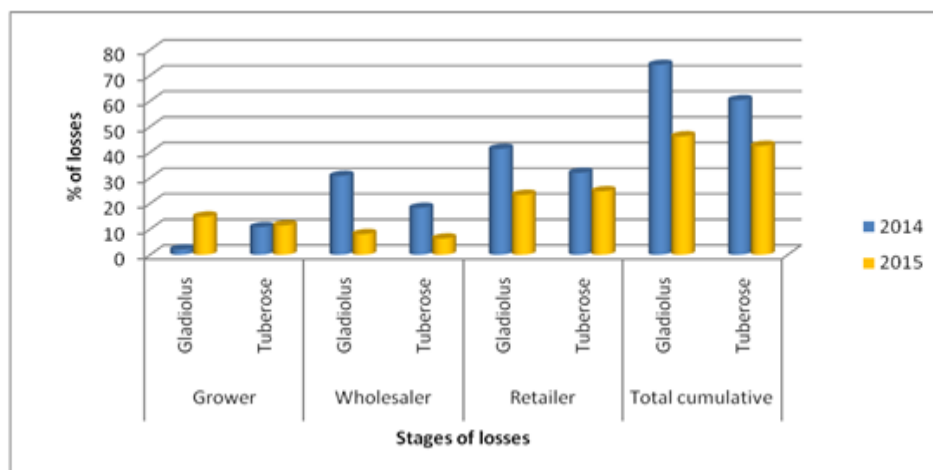
**Flowers**

Cumulative losses at various levels in different flowers are given in the Table 9-10 and Fig 6.

**Table 9** Cumulative losses% flowers (2014 and 2015)

Flower	Percent cumulative losses							
	Grower		Wholesaler		Retailer		Total cumulative	
	2014	2015	2014	2015	2014	2015	2014	2015
Gladiolus	2.02	14.83	30.71	8.00	41.25	23.32	74.06	46.15
Tuberose	10.74	11.42	18.24	6.28	31.92	24.73	60.33	42.44

Data presented in above Table 12, the overall cumulative losses at grower, wholesaler and retailer level were reduced in both the flower. However, there was drastic reduction in total cumulative losses in both the flowers group in 2015 as compared to data collected in 2014. This was mainly due to reduction in losses at wholesaler and retailer level considerably.



**Figure 6** Cumulative losses in different flowers (2014 and 2015)

Data presented in above graph, the overall cumulative losses at grower, wholesaler and retailer level were reduced in both the flower. However, there was drastic reduction in total cumulative losses in both the flowers group in 2015 as compared to data collected in 2014. This was mainly due to reduction in losses at wholesaler and retailer level considerably.

Data collected in 2014 on post harvest losses of fruits included Mango (25.19 %), Banana (20.12%), Guava (17.32%) and Papaya (8.06%). Thus, the variation of losses ranged from 8.06% in Papaya to 25.19% in Mango and average loss of all the fruits was 14.87 %. However, data collected in 2015 was only in case of Papaya (5.83%), Banana (14.69%) and newer fruit Amara (10.18%) which was not covered in 2014 data. Thus, the variation of losses ranged from 5.83% in Papaya to 14.69% in Banana and average loss of two fruits covered both 2014 and 2015 data was 10.26 % and considering all these fruits (3) in 2015 was 10.43%. When data was compared both in 2015 and 2014 in fruits by and large the losses were less at individual fruit level and also the variation in losses among fruit and the average loss (10.43%) in 2015 data as compared to data collected in 2014 (14.87%).

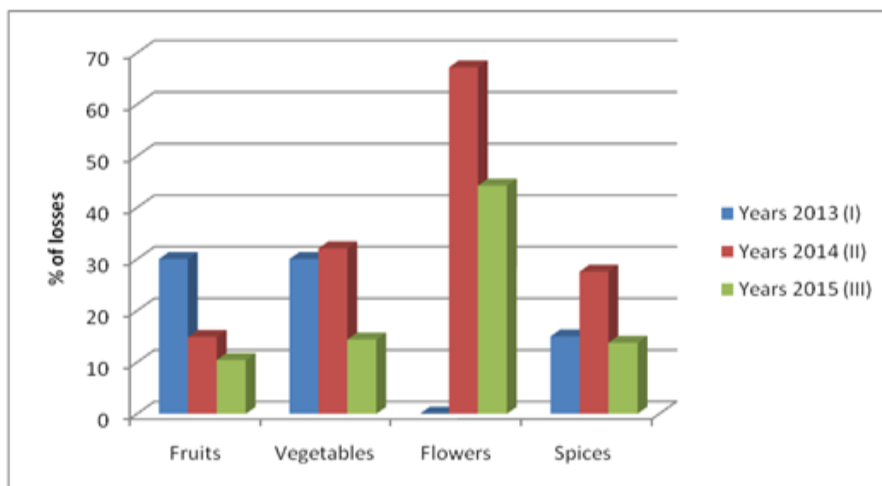
Data collected in 2014 on post harvest losses of vegetables included Bitter gourd (43.18), pointed gourd (36.61%), Brinjal (24.86%) and Country bean (24.84%). Thus, the variation of losses ranged from 24.84 % in Country bean to 43.18 % in Bitter gourd and average loss of all the vegetables was 32.7%. However, data collected in 2015 was only in case of Brinjal (11.22%), Tomato (13.01) and Bean (17.95%). Thus, the variation of losses ranged from 11.22 % in Brinjal to 17.95 % in Country bean and average loss of all there vegetables covered in 2015 was only 14.39%.

When the data on losses was compared both in 2015 and 2014 in vegetables, by and large the losses were less at individuation vegetable (3) level and also the variation on (11.22 to 17.95%) among vegetables and the average loss in 2015 (14.29%) as compared data collected in 2014 (32.7%).

**Table 10** Cumulative losses (percent) in fruits, vegetables, flowers and spices

Crop	Years		
	2013	2014	2015
Fruits	30	14.87	10.43
Vegetables	30	32.07	14.39
Flowers	51.2	67.18	44.23
Spices	15	27.56	13.77

Cumulative losses in percent (%) of fruits, vegetables, flowers and spices were presented in Table 13 above. Data clearly reveals that the cumulative losses in case of fruits were progressively reduced in data collected and published in 2015 and 2014 as compared to baseline data of 2013. However, in case of vegetables the cumulative losses (%) were slightly increased in data collected and published in 2014 and progressively decreased in 2015 as compared to baseline data of 2013. In case of flowers, there was no baseline data collected in 2013. However, the losses (%) reduced progressively in 2015 as compared to data collected and published in 2014. In case of spices, the losses in % were increased in data collected and published in 2014 as compared to baseline data of 2013. However, the losses were reduced in data collected and published in 2015 as compared to baseline data of 2013.



**Figure 7** Cumulative losses% in fruit, vege, flowers and spice (2013, 2014 and 2015)

Cumulative losses in percent (%) of fruits, vegetables, flowers and spices were presented in the graph above. Data clearly reveals that the cumulative losses in case of fruits were progressively reduced in data collected and published in 2015 and 2014 as compared to baseline data of 2013. However, in case of vegetables the cumulative losses (%) were slightly increased in data collected and published in 2014 and progressively decreased in 2015 as compared to baseline data of 2013.

In case of flowers, there was no baseline data collected in 2013. However, the losses (%) reduced progressively in 2015 as compared to data collected and published in 2014.

In case of spices, the losses in % were increased in data collected and published in 2014 as compared to baseline data of 2013. However, the losses were reduced in data collected and published in 2015 as compared to baseline data of 2013.

## 5. SUMMARY AND RECOMMENDATIONS

While Bangladesh has a wide range of but a specific agribusiness policy for government departments is a must for looking after agribusiness for the, by the end of the agriculturist’s. Policies that have specific relevance to agribusiness development include the National Agriculture Policy (NAP), land and soil policies, input-output policies, and eximport policies.

The import of commodities essentially required and correct supplement to domestic agriculture and agribusiness may be free of Value Added Tax (VAT), which provides a further incentive to the sector. The response in these matters of agribusiness development is similar giving emphasis on improving regulatory environments, creating a contact point for

agribusiness administration within MOA, establishing Agro-export processing zones, organizing agribusiness groups and association activities, enhancing research, development of agro-technologies and participation of rural People ensuring income generation. Considering all the findings obtained from the appraisal from different groups, sectors, levels and professionals, the following points will be tried to reflect in the research activities and methodologies.

**Supporting Agribusiness:** Media should give priority to technologies suitable for small-scale agribusiness entrepreneurs and produces/ processors. The information stated media for a commodity promotion should include the financial involvements, its scopes and solutions. Information on agribusiness scopes, systems, facilities, and availability of technical services should state and broadcasted. Grouping of agribusiness associations should have scope for giving common effort for advertisements.

**National Agribusiness:** All agribusiness entrepreneurs need to be linked functionally. The financial institutes, Banks and employment programs should give all type support for agribusiness in an integrated way. Information on agribusiness scopes, systems, facilities, and availability of expert's services for an agro- technology should be included in the recommendation patent or package. The domestic market should have more easy terms with government, giving priority to exporters for import. The contribution of Agribusiness in the national GDP/AGR and other indexes should be spelled out as needed on the basis of which the national priority/privileges should be determined.

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**Prof. Dr. Mohammed Salim Bhuyan** is engaged in research activities throughout his academic career more than 20 years and has published more than 20 international research papers, participating more than 50 international conferences. He is a Research Fellow of Limkokwing University of Creative Technology, Cyberjaya, Malaysia and Professor & Vice President of American Independent University, California, USA and University of Global Village, Barisal, Bangladesh.



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