



Strategies and barriers for year-round fruits production in Bangladesh: a literature-based analysis

Md. Jahidul Amin^{1*} and Md. Selim Hossain²

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ABSTRACT

Bangladesh, an agrarian country with rich agro-ecological diversity, which has substantial potential for expanding fruit production to meet rising nutritional and economic demands. Although more than 100 fruit species are grown nationwide, production is highly seasonal, with nearly 56% of fruits harvested between May and August, resulting in supply gaps, increased imports, and significant post-harvest losses estimated at 26–41%. Per capita fruit intake remains far below the recommended level, reflecting both insufficient availability and inefficiencies in post-harvest handling. This review synthesizes existing literature, national statistics, and global experiences to identify strategic pathways for ensuring sustainable, year-round fruit production in Bangladesh. Key factors limiting continuous production include climatic stresses, lack of suitable off-season varieties, inadequate protected cultivation, poor pollination management, weak extension services, and limited cold-chain infrastructure. The study highlights a set of integrated strategies—crop zoning, varietal improvement, protected cultivation, intercropping systems, precision irrigation and fertigation, and enhanced post-harvest management—that can significantly extend the production window and reduce losses. Successful implementation of these strategies requires coordinated government support, farmer training, research investment, and development of storage and processing facilities. Strengthening market linkages and promoting high-value, climate-resilient fruit varieties can further improve farmer incomes and reduce dependency on imports. The findings emphasize that a holistic, technology-driven, and policy-supported approach is essential to achieve consistent fruit availability, improve national nutrition, and ensure the long-term sustainability of Bangladesh's fruit sector.

Keywords: Year-round fruit production, Off-season cultivation, Protected cultivation, Varietal improvement, Post-harvest management, Nutrition security

¹Professor, Department of Agriculture, Rabindra Maitree University, Kushtia-7000, Bangladesh

²Field Officer, Seed Certification Agency, Kushtia, Bangladesh

*Corresponding author's email: jahidulamin1963@gmail.com (Md. Jahidul Amin)

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Introduction

Bangladesh possesses diverse agro-ecological zones, fertile soils, and a subtropical climate that collectively support a wide range of fruit species. Fruits such as mango, jackfruit, banana, litchi, guava, papaya, pineapple, and emerging exotic species contribute substantially to agricultural GDP, dietary diversity, and rural employment. Despite this richness, fruit production in Bangladesh is predominantly seasonal, and nearly 56% of

total output is harvested during four months between May and August. This seasonality results in supply deficits for the remaining months, leading to high consumer prices, significant post-harvest losses, and dependence on costly imports.

Bangladesh's per capita fruit consumption remains far below WHO-recommended levels, indicating nutritional gaps linked to limited availability. Although BARI, DAE,

and other institutions have introduced improved fruit varieties, climate-resilient cultivars, and production-enhancing technologies, large-scale adoption by farmers remains insufficient due to inadequate extension services, lack of training, poor access to inputs, and limited infrastructure, such as cold storage and processing facilities. Globally, several countries have successfully addressed seasonal fruit shortages. India has adopted regional crop zoning and hybrid varieties to extend harvest periods; China utilizes greenhouse technologies, precision farming, and cold-chain systems; and Thailand has strengthened post-harvest processing and export-oriented fruit production. These international experiences demonstrate the importance of integrating technology, research, and policy support. Bangladesh can benefit from similar approaches. Protected cultivation, staggered planting, pruning, and hormonal regulation, diversification of varieties, and improved post-harvest value chains can significantly expand the fruit production window. Government initiatives, particularly the DAE's "Year-Round Fruit Production for Nutrition Improvement" project, have made progress, but further scaling is required to achieve nationwide impact.

Final Project Completion Report (PCR) for a government initiative spanning up to 2025 is scheduled for official compilation and formal publication in 2025–2026. Project key achievements in FY2014-15 to 2025 are:

- National fruit output surged from approximately 10.608 million tonnes in FY14-15 to 15.033 million tonnes by 2025 (Table 2).
- Previously limited to the summer months, varieties like guava, papaya, and pineapple are now produced and accessible year-round.
- Farmers adopted exotic and high-yielding varieties such as off-season Katimon mangoes, LED-lit dragon fruit, and improved Thai guava.
- Increased domestic yield helped slash the country's reliance on fruit imports by 36%—dropping from 822,000 tonnes in 2022 to 525,000 tonnes in 2025 (DAE, 2026).

In this context, achieving year-round fruit availability is essential not only for food and nutritional security but also for enhancing

farmer profitability, stabilizing market supply, reducing reliance on imports, and promoting export competitiveness. This review aims to evaluate existing challenges and outline integrated strategies suited to Bangladesh's climatic and socio-economic conditions to ensure sustainable, year-round fruit production.

Materials and Methods

This study is based entirely on secondary data collected from published research articles, government reports, theses, and statistical yearbooks relevant to fruit production in Bangladesh. Special emphasis was placed on analyzing seasonal fruit availability across different months, highlighting the dominance of mango, jackfruit, banana, guava, papaya, and pineapple during the peak harvest season (May–August), and the relative scarcity in the remaining months. Off-season fruits in Bangladesh primarily comprise year-round cultivars of staple crops (guava, banana, papaya), newly adopted off-season varieties of high-value summer crops (Katimon mango, BARI kathal-3, watermelon), and technologically manipulated exotic fruits (photoperiod- regulated dragon fruits).

Data on post-harvest losses were primarily drawn from the Bangladesh Agricultural Research Institute (BARI) and the Ministry of Agriculture, which report average losses ranging between 26-41%, depending on fruit type and handling practices (BARI, 2020a; MoA, 2023). These figures were cross-verified with FAO estimates to ensure consistency and reliability (BARI and FAO, 2018).

The time frame of the analysis spans from 2008–2009 to 2023–2024, covering fifteen years of fruit production statistics compiled by the Department of Agricultural Extension (DAE) and the Bangladesh Bureau of Statistics (BBS) (BBS, 2017; BBS, 2023). This period was selected to capture long-term trends in fruit cultivation area, production volume, and seasonal distribution, as well as to evaluate the impact of government-led initiatives such as the "Year-Round Fruit Production for Nutrition Improvement" project.

Information was compiled, tabulated, and presented using descriptive analysis, figures, and tables to evaluate strategies for year-round fruit production. Comparative references were also made to global practices in India, China, and Thailand to contextualize Bangladesh's progress and challenges.

Results and Discussion

Global fruit production leaders (2023)

Global fresh fruit production in 2023 reached nearly 951.9 million metric tonnes, up from approximately 576.7 million in

2000—highlighting rapid growth in the sector (Statista, 2023). According to Report Linker data, the top 10 fruit-producing countries in 2023, along with their estimated production volumes, are:

Table 1. Top ten fruit production countries in the world (2023).

Rank	Country	Fruit Production (million metric tonnes)
1	China	267.78
2	India	114.44
3	Brazil	40.15
4	Mexico	25.43
5	United States	23.59
6	Indonesia	22.84
7	Spain	18.95
8	Philippines	17.34
9	Italy	17.08
10	Iran	16.39

(Source: ReportLinker, 2023)

These countries together dominate global fruit production, benefiting from large arable land areas and favorable climates. The Trade Policy and Strategy Office (TPSO) estimates that total fruit production in Thailand for 2024 will reach 6.76 million tonnes, reflecting a 2% increase over 2023 (Fructidor, 2024). Another source, citing the Malaysian Agriculture Ministry, indicates a notably higher figure: 1.827 million tonnes of fruit produced in the previous year (implying either 2022 or 2023) (FreshPlaza, 2023).

Fruits of Bangladesh

Fruits are high-value crops in Bangladesh, contributing to nutrition, rural incomes, and diversification away from cereal monoculture. Major fruits (mango, jackfruit, banana, pineapple, guava, papaya, and citrus) occupy a substantial area and show rising production trends in recent years. Yet production remains strongly seasonal — e.g., mango and jackfruit peak in specific months — causing price swings, unmet off-season demand, and lost income opportunities. Year-round production would stabilize incomes, supply urban markets, and support exports. This paper reviews current area/production patterns and presents practical strategies that fit Bangladesh's agro-ecological zones and smallholder structure.

The fruit production scenario of Bangladesh in 2022-23 was 15.033 million metric

tonnes in an area of 765000 hectares (7.707% of total cultivable land) (Table 2) (DAE). May to August produce 56% of total production, and the remaining 8 months produce only 44% (Fig. 3). A statement from Bangladesh's Agriculture Ministry (2022–2023) pointed out that post-harvest losses now account for 26–41% of fruit production, significantly hindering efforts to increase per-capita fruit intake (The Financial Express, 13 August 2025). The net amount of fruit available for consumption after accounting for post-harvest losses is 3.91–6.16 million tonnes. Post-harvest management should be prioritized to reduce losses after harvest. Fruit intake per capita is 85g (FAO, 2022) against the requirement for a minimum of 200g, which indicates a 115g deficit (National Guideline, 2020). According to the Bangladesh Bureau of Statistics, fruit production in Bangladesh in 2020-2021, 2021-2022, and 2022-2023 was 5.1387, 5.336, and 5.6588 million metric tonnes, respectively (Table 3). (Source: Yearbook of Agricultural Statistics-2023, Page No. 209)

Abounding with varieties of seasonal fruits, Bangladesh has achieved a remarkable growth in fruit production in the past few years. According to the Food and Agriculture Organization (FAO) of the United Nations, fruit production has increased by 45 percent on average annually for the last 18 consecutive years. In total, the number of edible fruit types is 130 (Roy, 2019). Now,

10-12 fruits, including mango, jackfruit, banana, guava, pineapple, papaya, watermelon, litchi, coconut, dragon fruit, and various types of limes, are grown commercially. About 5 million tonnes of fruits are grown in less than 1 percent of the total crop lands in the country. Almost 63

percent of the total production is mango, jackfruit, and banana. More than 20 types of fruits, such as strawberry, dragon fruit, malta, soursop, mangosteen, rambutan, persimmon, avocado, peach, cherry, and so on, were introduced in the local market in the past decade.

Table 2. Fruit Production in Bangladesh (2008-2009 to 2023-2024).

Financial Year	Area (ha)	Production (MMT)
2008-2009	935918	10.341
2009-2010	725902	10.453
2010-2011	637540	10.521
2011-2012	657535	10.304
2012-2013	658875	10.569
2013-2014	678145	9.972
2014-2015	693235	10.608
2015-2016	720263	11.031
2016-2017	715941	12.096
2017-2018	724028	12.113
2018-2019	727198	12.152
2019-2020	729280	12.389
2020-2021	729130	12.202
2021-2022	733988	14.331
2022-2023	765539	15.033
2023-2024	757496	14.81

(Source: [DAE, 2024](#))

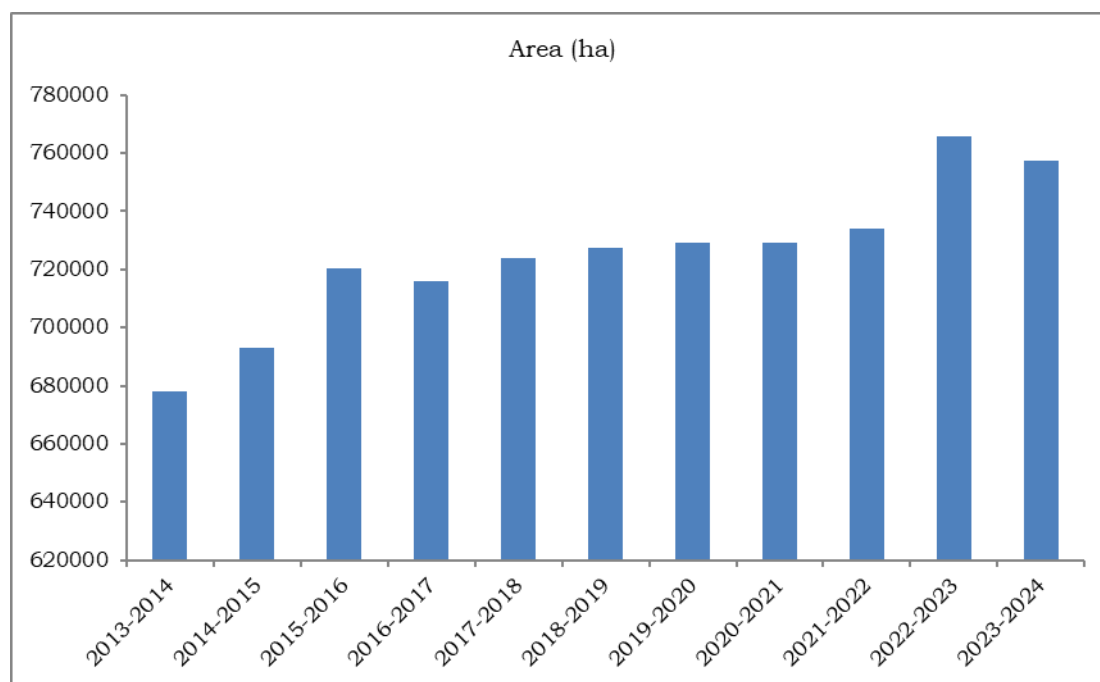


Fig. 1. Fruit Cultivation in Bangladesh (2013-2014 to 2023-2024)
(Source: [DAE, 2024](#))

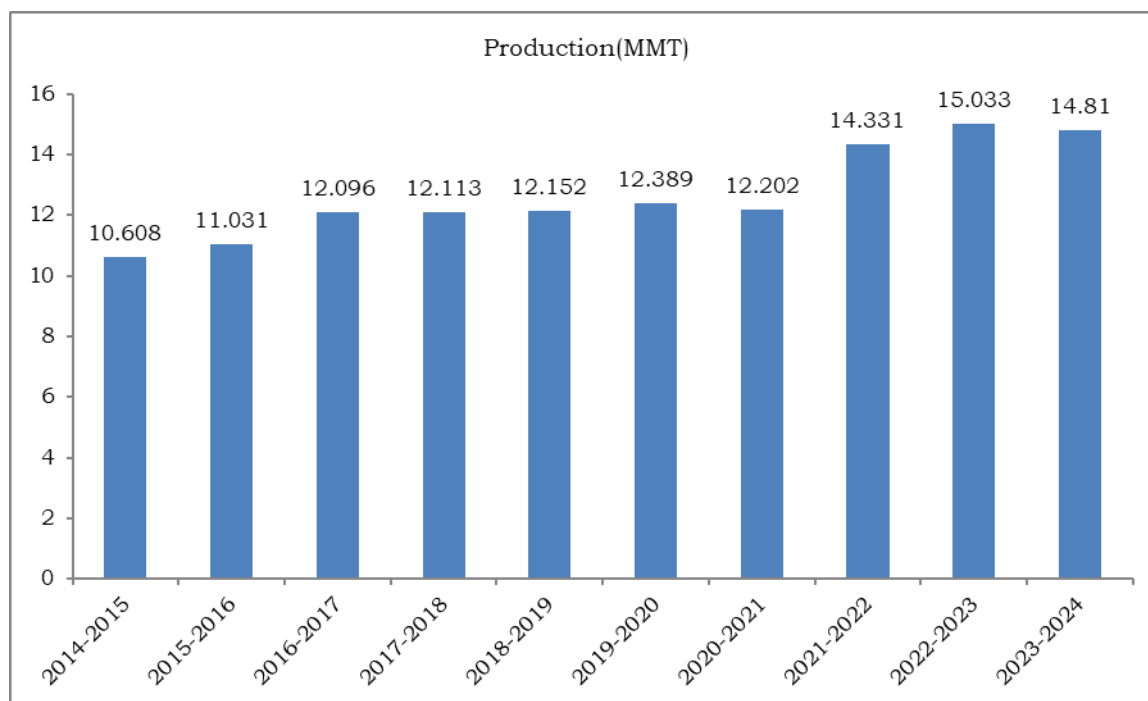


Fig. 2. Fruit Production in Bangladesh (2014-2015 to 2023-2024)
(Source: [DAE, 2024](#))

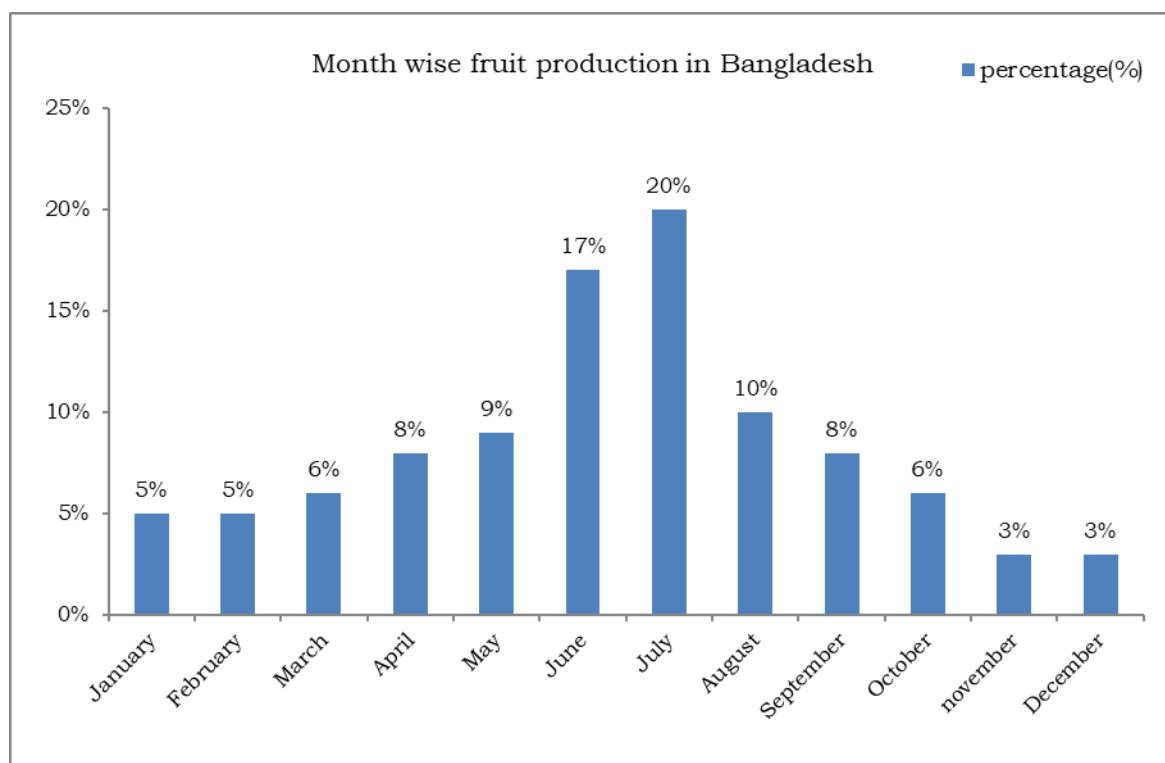


Fig. 3. Month-wise fruit production in Bangladesh.
(Source: [DAE, 2024](#))

Table 3. Area and production of fruit crops in Bangladesh (2020-2021 to 2022-2023).

Sl. No.	Fruits Crops	2020-2021 Area (acre)	2020-2021 Production (MT)	2021-2022 Area (acre)	2021-2022 Production (MT)	2022-2023 Area (acre)	2022-2023 Production (MT)
a. Major Fruits							
1	Banana	122192.19	8261151.76	28640.26	183438.79	122603.38	840362.67
2	Mango	286823.00	1214597.00	299054	1207466.00	473460.00	1482937.04
3	Pine Apple	34246.66	208141.88	33581.87	206164.51	32463.36	196735.74
4	Jackfruit	44630.00	1097001.00	69161.00	1049890.00	75842.04	1062302.28
5	Papaya	8414.00	125758.00	12299.79	147350.66	17981.81	145316.82
6	Water Melon	40860.73	345955.44	57865.05	550367.03	58757.44	555838.14
7	Green Coconut	62576.00	442708.00	61083.89	458855.24	55260.28	457088.21
8	Litchi	17279.99	87183.80	20388.53	92958.41	21759.53	104708.34
9	Guava	58618.00	243957.00	44742.00	244857.00	45386.94	256105.56
10	Jujube	38652.00	107958.00	40436.82	94877.40	17357.80	96844.29
Total		714292.57	12134411.88	667253.21	4236225.04	920872.58	5198239.09
b. Minor Fruits							
1	Lime & Lemon	162242.69	81604.48	30248.22	95411.89	33087.57	99930.87
2	Pomelo	13969.98	78665.82	13982.12	76364.63	12800.07	71785.28
3	Melon (Bangi)	10097.15	47420.17	10264.00	49572.78	10422.49	50812.73
4	Tamarind	6279.99	9552.60	6377.03	10238.79	5872.06	10844.28
5	Star Apple	6649.34	12767.32	6147.49	13363.18	5952.58	13110.41
6	Black Berry	13751.01	56928.21	13357.29	54135.88	12626.15	53943.93
7	Ata	1533.50	5470.53	1525.03	5149.13	1550.62	5034.93
8	Dauwa	74.00	1629.50	74.21	1632.23	69.72	1464.68
9	Lotkon	407.45	2409.60	456.71	2657.00	470.25	2746.00
10	Karambola	4198.80	14307.39	3961.10	14931.57	3832.83	145591.88
11	Wood Apple	17995.18	30009.00	17975.34	29305.75	18335.92	30441.23
12	Green Coconut	62576.00	442708.00	61083.89	458855.24	55260.28	457088.21
13	Olive	5205.25	18848.36	5101.22	18496.40	4794.43	18825.97
14	Hog Palm	11417.00	42527.00	11737.00	43801.12	11261.25	43880.78
15	Amloki	1627.17	2820.42	1638.84	2609.36	1456.41	2434.90
16	Chalta	5106.77	10154.05	3376.84	10679.98	3186.75	10210.44
17	Dalim	670.64	1411.39	790.40	1442.64	815.94	1548.79
18	Karamcha	27.00	166.65	60.19	155.12	64.38	159.80
19	Safeda	1683.00	6573.45	1635.52	6468.34	1661.43	6808.56
20	Sarifa	840.42	2229.42	810.90	1663.03	787.20	1768.63
21	Water Fruit	405.80	1899.35	453.20	2027.03	475.34	2304.88
Total		326758.14	870102.71	191056.54	898961.09	184783.67	1030737.18
c. Promising Foreign Fruits							
1	Dragon Fruit	349.69	1138.70	717.53	3153.84	1135.40	5959.29
2	Malta	13256.00	6501.71	4456.23	10269.14	4184.23	8886.00
Total		13605.69	7640.41	5173.76	13422.98	5319.63	14845.29
Grand Total		994042.25	5138703	804653.59	5336203.58	1058239.79	5658854
		402446.07 ha	5.13870 MMT	363804.05 ha	5.336203 MMT	428437.16 ha	5.658854 MMT

(Source: [BBS, 2023](#))

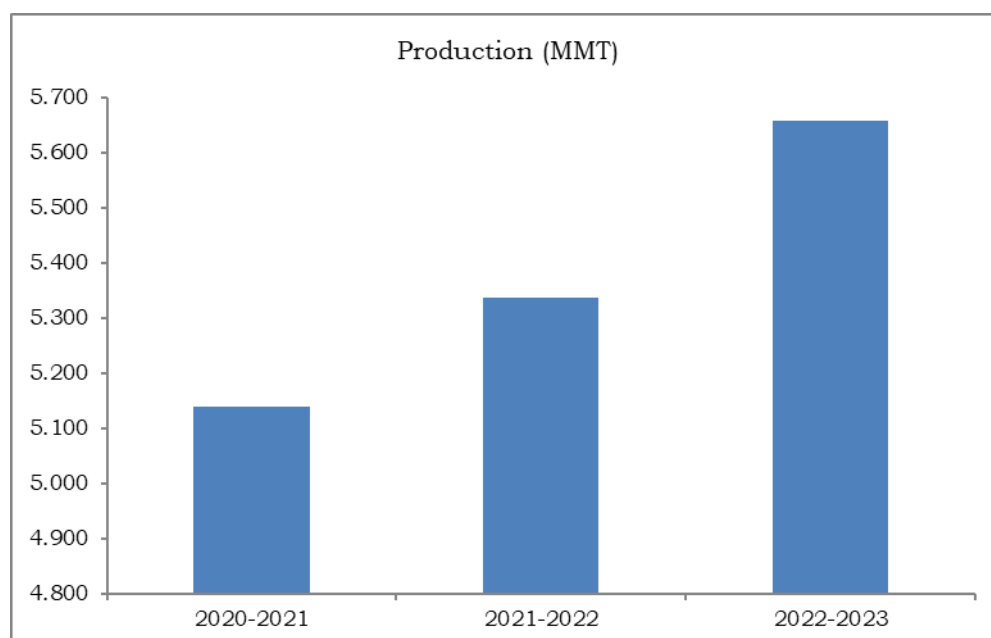


Fig. 4. Fruit Production in Bangladesh (2020-2021, 2021-2022 and 2022-2023)
(Source: [BBS, 2023](#))

The analysis reveals a steady increase in fruit production over the past decade, with notable growth after 2016. The rising trend reflects improved varietal development, expanded orchard establishment, and government-led programs promoting fruit cultivation. However, production remains concentrated in specific seasons, causing annual shortages. Post-harvest losses estimated at 26-41% pose a major barrier to year-round availability. Improved storage, cold-chain systems, and processing industries are essential to minimize these losses.

Adopting early, mid, and late-maturing varieties can significantly extend the harvesting window. Protected cultivation technologies, including poly-houses and net-houses, offer opportunities for off-season production of high-value fruits such as papaya, strawberry, and dragon fruit. Intercropping systems, such as integrating banana, pineapple, and papaya, can ensure continuous income while establishing long-term orchards. Climate-smart practices, including drip irrigation, fertigation, mulching, and integrated pest management (IPM), can enhance productivity and resilience. Successful implementation requires strong extension services, farmer training, financial incentives, and improved policy support. Investments in rural collection centers, cold storage, and digital market linkages are necessary to ensure a

stable supply chain and support year-round fruit availability.

Barriers to year-round fruit production in Bangladesh

Climate and Environmental Constraints

- Seasonal Weather Extremes- High temperatures in heavy monsoon rains and cold waves in winter limit continuous flowering and fruiting for many species.
- Flood and Waterlogging – Damage root systems and cause crop failure in low-lying areas.
- Cyclones and Storms – Common in coastal regions, causing severe damage to perennial fruit trees.
- Soil Salinity – Particularly in coastal zones, it reduces fruit yield and quality.
- Pest and Disease Outbreaks- Seasonal peaks of fruit flies, mealy bugs, fungal infections, etc.

Technical and Agronomic Barriers

- Unavailability of suitable varieties – Few high-yielding, climate-resilient, off-season varieties are available for mango, guava, litchi, etc., but other fruit varieties are unavailable for year-round cultivation.
- Insufficient research on year-round fruit production, poor adoption, and staggered planting to adjust harvest time.

- Limited adoption of protected cultivation- greenhouses, net-houses, and rain shelters are rare outside research.
- Poor pollination management- Lack of managed bee pollination during off-season flowering.
- Lack of skilled manpower- Technology was hampered due to a lack of skilled manpower.

Socio-Economic and Institutional Barriers

- High production cost- Off-season production often requires irrigation, fertilizers, and pest control investment beyond the farmer's capacity.
- Low farmer awareness- Limited knowledge about techniques like grafting, mulching, and micronutrient modification.
- Credit and financing issues- Limited access to affordable loans for fruit orchard establishment and maintenance.
- Market price fluctuation- Off-season fruits sometimes face poor demand if consumers are not accustomed to them.

Post-harvest and Infrastructure

- Poor cold chain facilities- Limited refrigerated transport and storage means off-season harvests can't be stored for market timing.
- Inadequate processing industries- Low capacity to turn fruits into value-added products.
- Weak supply chain coordination- Delays and handling losses in getting products from the orchard to the consumer.

Policy and Extension Gaps

- Limited government incentives- Subsidies or supports for off-season fruit production are not widespread.

- Weak extension services- Farmers often lack hands-on training and demonstration plots for year-round production methods.
- Slow varietal release process- New varieties from research stations take years to reach farmers.

Strategies for year-round fruit production in Bangladesh

Crop Diversification and Zoning

- Select fruits based on agro-ecological zones (e.g., mango in Rajshahi, pineapple in Sylhet, citrus in Mymensingh, coconut in coastal areas).
- Diversify orchards with early, mid, and late-maturing varieties to ensure continuous availability.

Varietal Improvement and Extended Harvesting

- Introduce early- and late-season varieties of mango, litchi, banana, and guava to extend the harvesting window.
- Use off-season cultivation techniques (grafting, pruning, hormonal treatment, bagging, mulching).
- Promote high-yielding and climate-resilient fruit varieties developed by BARI.

Protected Cultivation and Climate-Smart Practices

- Use polyhouse/greenhouse technology for papaya, strawberry, and dragon fruit.
- Drip irrigation, mulching, and fertigation to maintain yield during dry seasons.
- Climate-adaptive management to minimize risks of cyclones, drought, and salinity.

Table 4. BARI Recommended Fruit Intercropping Patterns (General Guidelines).

Main Fruit Crop (Young)	Intercrop Fruit/Short-term Crop	Spacing/Pattern Recommended
Mango (e.g., BARI Aam-3)	Papaya, Pineapple, Banana	2-3 rows in between mango rows
Litchi	Papaya, Banana, Pineapple	1-2 rows depending on tree age
Citrus (Malta/Mandarin)	Pineapple, Papaya	Paired row system
Pineapple (Main)	Papaya, Mukhikachu	100% Pineapple + 66% Papaya
Banana	Papaya, Pineapple	In the early stages of banana.

(Source: [BARI, 2020b](#))

Intercropping and Multi-storied Orchard Systems

- Multi-storied fruit orchards (coconut → banana/papaya → pineapple/ginger) optimize land use and provide seasonal harvests.

Improved Post-Harvest and Storage Facilities

- Establish cold storage chains for perishable fruits (mango, litchi, guava).
- Promote processing industries (juice, jam, dried fruit) to reduce post-harvest loss.
- Community-based storage hubs at the rural level.

Extension and Farmer Training

- Capacity building through farmer field schools (FFS).
- Training on pruning, grafting, IPM (Integrated Pest Management), and GAP (Good Agricultural Practices).

Policy and Institutional Support

- Government subsidies/incentives for fruit orchard establishment.
- Public-private partnerships for export-oriented fruit production.
- Strengthening market linkages and digital platforms for farmer-to-consumer sales.

Research and Innovation

- Strengthen BARI, BFRI, and universities to research new fruit varieties and off-season production techniques.
- Promote tissue culture and biotechnology (e.g., banana, papaya).

Conclusion

Year-round fruit production in Bangladesh is achievable through integrated strategies combining varietal improvement, protected cultivation, crop zoning, climate-smart technologies, and improved post-harvest management. Ensuring continuous fruit availability will enhance nutrition, reduce imports, stabilize markets, and improve rural livelihoods. Comprehensive policy support, investment in cold-chain infrastructure, and stronger research-extension partnerships are essential to sustain the momentum in fruit production growth.

Recommendations

- Crop diversification and crop zoning.
- Promote early- and late-maturing varieties for extended harvesting.
 - Expand protected cultivation using low-cost structures.
- Intercropping and multi-storied orchard system.
 - Strengthen farmer training in pruning,

- grafting, and IPM.
- Invest in cold-chain infrastructure and rural processing centers.
- Enhance collaboration among research institutes, extension agencies, and private sector actors.
- Strengthen research and innovation.

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