ISSN: 2224-0616
Int. J. Agril. Res. Innov. Tech. 13(2): 41-48, Dec 2023
DOI: https://doi.org/10.3329/ijarit.v13i2.70853
OPEN ACCESS
Available online at https://ijarit.online
https://www.banglajol.info/index.php/IJARIT

Profitability analysis of cut flower cultivation in Bangladesh: Constraints and opportunities

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Received 6 August 2023, Revised 15 December 2023, Accepted 25 December 2023, Published online 31 December 2023

A B S T R A C T

Bangladesh has immense potential for cut flower production and export to the world market. Although the export earnings from cut flower cultivation are gradually increasing in our country, production and profitability are hindered by some constraints. The present study was undertaken in Jashore (Jhikargachha) and Dhaka (Savar) districts to examine the financial profitability, constraints, and opportunities of cut-flower cultivation in Bangladesh. A total of 120 cut flower cultivating farmers were selected for interview in 2019, taking 60 sample farmers from each location. Multi-stage random sampling method was followed to collect primary data. For profitability analysis, two cut flowers, namely gladiolus and rose, were selected for the study. The result indicates that per hectare total cost, net return, and benefit-cost ratio (BCR) were Tk. 687439, Tk. 261509 and 1.38, respectively, for gladiolus cultivation. On the other hand, net present value (NPV), internal rate of return (IRR), and BCR of rose cultivation were Tk. 2325762, 146%, and 1.46, respectively, indicating that rose production is highly profitable to the farmers of the study areas. Despite such potentialities, cut flower cultivation was constrained by the requirement of high initial investment, lack of modern varieties, lack of credit facility, lack of storage facility, attack by pests & diseases, and uncertain market price. However, there is a huge scope to increase cut flower production by removing constraints in Bangladesh that can boost up livelihoods, incomes, and living conditions of rural people.

Keywords: Cut flower, Gladiolus, Rose, BCR, IRR

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Cite this article as: Kaysar, M.I., Islam, M.S., Hoq, M.S., Mukta, S.P. and Kausar, A.K.M.G. 2023. Profitability analysis of cut flower cultivation in Bangladesh: Constraints and opportunities. *Int. J. Agril. Res. Innov. Tech.* 13(2): 41-48. https://doi.org/10.3329/ijarit.v13i2.70853

Introduction

The fertile land and favorable climate conditions are suitable for flower production in Bangladesh. Flower production was initially begun in the late seventies in our country by some innovative farmers on a small-scale, but rapid commercial production was initiated in the mid-eighties, especially in the Jashore district (Jahan, 2009). Commercially grown most common flower species in Bangladesh are rose (*Rosa indica*), tuberose (*Polianthes tuberosa*), marigold (Tagetes *erecta*, *T. patula*) and gladiolus (*Gladiolus* spp.). Currently, around 10000 hectares of land are under cut flower cultivation, and approximately 5000 promising farmers are cultivating flowers and foliage as their sole livelihood (Ahmed *et al.*, 2021; Jahan, 2009). More than 0.15 million people in Bangladesh are engaged in the floriculture business directly or indirectly (Rakibuzzaman *et al.*, 2018). Flowers are usually used in various social functions such as weddings, worshipping, interior decoration, religious functions, birthday parties, and welcoming friends, or relatives as a symbol of beauty.

Bangladesh has a competitive advantage in flower production due to the availability of nursery plants and seeds, easy production technology, competitive prices, and export potentialities (Ahmed *et al.*, 2021; Mou, 2012). The current size of the flower market is around Tk. 10 billion and flower is being grown across the country (Laboni *et al.*, 2019). Bangladesh exports various kinds of flowers and floral products to different developed countries like Italy, the United States, Portugal, Saudi Arabia, Singapore, Japan, Britain, Germany, and France etc. (Laboni *et al.*, 2019).

The trade of flowers was worth approximately €15bn (£10.6bn) globally in 2015 (Ahmed *et al.*, 2021). Bangladesh also exported cut flowers and foliage worth USD 0.8 million in FY 2021-22 (EPM, 2023). Despite high potentialities, production and export are constrained by some barriers such as the lack of storage facilities, the inappropriate temperature in the airplane (10°C), the lack of modern seedlings, the lack of credit facilities, and uncertain market prices, etc. (Jahan, 2009; Laboni *et al.*, 2019).

Floriculture appeared as a winsome business because many farmers converted to floriculture from other crops for higher benefits (Mou, 2012; Rakibuzzaman *et al.*, 2018). As a result, it not only generates employment opportunities for many, especially poor women but also enlarges the scope to export. However, due to various production problems and lack of government support, cut flower producers face losses, which can narrow the potentiality of flower exports (Chowdhury and Khan, 2015). So, realizing the above importance a study was undertaken in two different locations of Bangladesh to examine the financial profitability and constraints of cut-flower production in Bangladesh to derive some policy recommendations supporting cut-flower production.

Materials and Methods

Two cut flowers, namely rose and gladiolus were selected for analyzing the profitability of cut flower cultivation. Based on area coverage, two Upazila from two districts, namely Jhikargachha Upazila from Jashore district and Savar Upazila from Dhaka district were selected for the study. A multistage random method was followed to collect data. A total of 120 farmers were selected for interview, taking 60 farmers from each location. Secondary data have been collected from the Bangladesh Bureau of Statistics (BBS), Hortex Foundation, Export Promotion Bureau (EPB), national & international journals, articles, and earlier research reports.

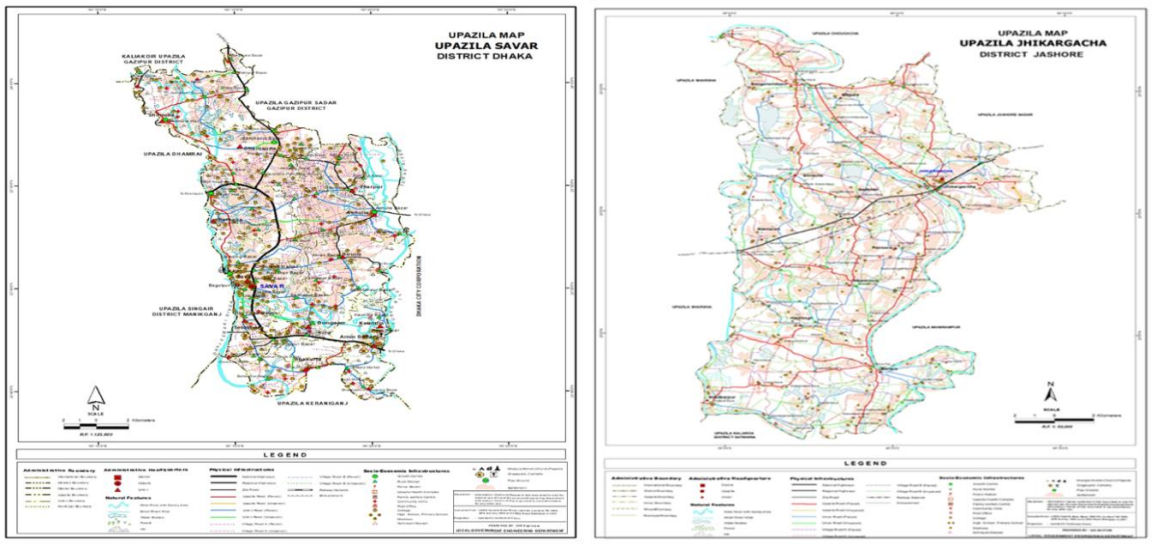

Fig. 1. Map of the study areas.

A mostly tabular method of analysis was followed to achieve the objectives of the study. The profit function and project analysis were used in the study. The profit equation was used to estimate the profitability of gladiolus flower cultivation (Islam *et al.*, 2016; Miah *et al.*, 2019). The net return of gladiolus cultivation was estimated as follows:

$$\pi_{ijk} = P_{ijk}\, Q_{ijk} - \left(TVC_{ijk} + TFC_{ijk}\right) \ldots\ldots\ldots\ldots (1)$$

Where, π = Net return from ith flower per hectare; P_{ijk}= Per unit price of ith flower (Tk. unit^{-1}); Q_{ijk}= Quantity of ith flower (unit ha^{-1}); TVC_{ijk} = Total variable cost of ith crops (Tk ha^{-1}); TFC_{ijk}= Total fixed cost of ith crops (Tk ha^{-1}); i (1..2)= number of flower; j (1..2)= number of location and k (1.....120) = number of farmers.

Data were categorized according to the year for the rose. The age of the rose garden was classified as 1st year, 2nd year, 3rd year, 4th year, 5th year, 6th-9th year, and 10th-12th year. In presenting the results, tabular methods of analysis were used using descriptive statistics. The NPV, BCR and IRR have been calculated in the case of rose cultivation with the help of the following formula (Kaysar *et al.*, 2017; Kaysar *et al.*, 2019):

$$NPV = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$BCR = \sum_{t=1}^{t=n} \frac{\frac{B_t}{(1+i)^t}}{\frac{C_t}{(1+i)^t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where, B_t = Total benefit (Tk/ha) in tth year; C_t = Total cost (Tk/ha) in tth year; t = Number of year and i = interest (discount) rate.

$$IRR = L + \frac{NPV\ at\ L}{NPV\ at\ L - NPV\ at\ H} \times (H - L) \ldots\ldots (4)$$

Where L represents a lower discount rate and H represents a higher discount rate.

Results and Discussion

Production practices of cut flower cultivation

The most appropriate planting time of gladiolus and rose was October to December and mid-February to April in the study areas, respectively (Table 1). Farmers cultivated exotic varieties of gladiolus like Pink, Kolmi, Beguni, Sada, and Halod varieties. In case of roses, the farmers cultivated Lingkon and Mirinda varieties for grafting on the rootstock. Both rose and gladiolus farmers had little knowledge about modern flower varieties. The plant-to-plant distance for gladiolus and rose cultivation was found to be 6 inches and 13-15 inches, respectively, while line-to-line spacing was found to be 6-9 inches and 13-18 inches, respectively (Table 1). The average no. of seedlings required for gladiolus and rose cultivation was 800-1000 and 130-136 decimal^{-1}, respectively, in the study areas. The average no. of weeding ranges 6-10 times in all areas. The irrigation requirement was higher for rose cultivation compared to gladiolus cultivation (Table 1).

Table 1. Production practices of cut flower cultivation by the farmers.

Parameter	Gladiolus		Rose	
	Jashore (Jhikargachha)	Dhaka (Savar)	Jashore (Jhikargachha)	Dhaka (Savar)
Variety used	Pink, Kolmi, Beguni, Sada, Halod	Pink, Kolmi, Sada, Halod	Lingkon	Mirinda
Planting time	October-December	October-January	Mid Feb-Mid April	March-April
Spacing				
Plant to plant (inch)	6″	6″	13″-14″	13″-15″
Line to line (inch)	6″	9″	15″-18″	15″-18″
No. of seedlings decimal^{-1}	800-1000	800-1000	123-130	130-136
Age of seedling (months)	9-10	9-10	2.5-4.0	2.5-6.0
No. of weeding year^{-1}	6-7	7-8	12	10
No. of irrigation year^{-1}	8-9	8-9	20	18

Profitability analysis of gladiolus cultivation

The result indicates that, on average, 393 man-days ha^{-1} of human labour were applied by gladiolus farmers, but it varied from district to district (Table 2). Farmers used 212485 corms as a seed per hectare in all areas. The gladiolus farmers applied per hectare 6612.5 kg cow-dung and 23 kg oilcake as an organic fertilizer in all the selected areas. The farmers of Dhaka district used more cow-dung (7382 kg ha^{-1}) relative to Jashore (5843 kg ha^{-1}) district. The farmers applied Urea, TSP, DAP, MOP, and Gypsum fertilizers at the rate of 267 kg ha^{-1}, 806 kg ha^{-1}, 97 kg ha^{-1}, 151 kg ha^{-1}, and 124 kg ha^{-1}, respectively, but mostly in an unbalanced way (Table 2). Proper agronomic management practices like those that balanced fertilizer application can enhance rose and gladiolus yields in the study areas. There are lot of evidence that balanced fertilizer application practices can improve both crop yields and farming profitability (Islam *et al.*, 2022a; Islam *et al.*, 2022b).

Table 2. Input use pattern (ha^{-1}) of gladiolus cultivation.

Particulars	Jashore (Jhikargachha)	Dhaka (Savar)	All area
Human Labour (man-days)	372	416	394
Own labour	164	193	179
Hired labour	208	223	216
Seed (Corm)	220467	203933	212485
Organic fertilizer (kg)			
Cow-dung	5843	7382	6612.5
Oilcake	45	--	23
Inorganic fertilizer (kg)			
Urea	333	196	267
TSP	793	820	806
DAP	156	33	97
MOP	178	122	151
Gypsum	137	109	124

However, the results show that the total production cost of gladiolus was Tk. 687439 ha^{-1} in which the TVC was Tk. 670598 ha^{-1} and the TFC was Tk. 16841 ha^{-1} (Table 3). The total production cost of Savar farmers (Tk. 716064 ha^{-1}) was found to be higher relative to the farmers of the Jashore district (Tk. 659609 ha^{-1}) due to they used comparatively lower inputs than farmers of the Dhaka district. Among different cost items, the results implied that seed cost was the highest (Tk. 460126 ha^{-1}), followed by human labour (Tk. 107592 ha^{-1}), fertilizer (Tk. 55577 ha^{-1}) and irrigation (Tk. 20592 ha^{-1}) (Table 3).

Table 3. Per hectare cost of gladiolus cultivation (Tk. ha^{-1}).

Particulars	Jashore (Jhikargachha)	Dhaka (Savar)	All Area
A. Total variable cost (TVC)	644639	697352	670598
Land preparation	12187	10577	11410
Human labour	92215	124067	107592
Own labour	40542	57258	48612
Hired labour	51674	66808	58980
Seed	456372	464147	460126
Organic fertilizer			
Cow-dung	14876	30002	22178
Oilcake	1449	--	750
Inorganic fertilizer			
Urea	6287	3573	4977
TSP	19392	21096	20215
DAP	4988	1127	3124
MOP	3025	2223	2706
Gypsum	1295	1065	1627
Irrigation	17867	23512	20592
Insecticide/Pesticide	9879	10770	10309
Interest in operating capital	4806	5191	4992
B. Total fixed cost (TFC)			
Land use cost	14970	18712	16841
Total Cost	659609	716064	687439

The returns came from gladiolus cultivation in two ways: as a flower (stick) and as a seed (corm). The yield of the gladiolus flower was around 179350 stick ha^{-1}, whereas, in the case of corm yield, it was found at 146335 corm ha^{-1}. On average, the gross return, gross margin, and net return of gladiolus cultivation was Tk. 948948 ha^{-1}, Tk. 278350 ha^{-1} and Tk. 261509 ha^{-1}, respectively, whereas the average BCR was estimated at 1.38 in all selected areas. The highest BCR (1.45) was found in the Jashore district (Table 4).

Table 4. Per hectare yield, gross return, and net return of gladiolus cultivation.

Particular	unit	Jashore (Jhikargachha)	Dhaka (Savar)	All area
Yield as a flower (stick)	no. ha^{-1}	187397	171304	179350
Yield as seed (corm)	no. ha^{-1}	149918	142753	146335
Average sale price flower	Tk. stick^{-1}	3.5	4.0	3.8
Average sale price corm	Tk. corm^{-1}	2.0	1.8	1.9
Gross return	Tk. ha^{-1}	955726	942170	948948
Total variable cost	Tk. ha^{-1}	644639	697352	670598
Gross margin	Tk. ha^{-1}	311087	244818	278350
Total cost	Tk. ha^{-1}	659609	716064	687439
Net return	Tk. ha^{-1}	296117	226105	261509
Benefit-cost ratio (BCR)		1.45	1.32	1.38

Profitability analysis of rose cultivation

The results show that, on average 1165 man-days ha^{-1} human labour was required for rose cultivation (Table 5). Farmers used an average of 6264.1 kg ha^{-1} cow-dung. The highest 7567 kg ha^{-1} cow-dung was used during the 1st year of gardening, whereas the lowest 5293 kg ha^{-1} was used in the 3rd year of gardening. On average, farmers used 775 kg ha^{-1} of oilcake in rose cultivation. Similar to gladiolus, the rose farmers applied 319 kg ha^{-1}, 936 kg ha^{-1}, 51 kg ha^{-1}, 177 kg ha^{-1}, and 172 kg ha^{-1} of Urea, TSP, DAP, MOP, and Gypsum, respectively, without following scientific recommendations (Table 5).

Table 5. Input use pattern (ha^{-1}) of rose cultivation.

Particular	Year							
	1st	2nd	3rd	4th	5th	6th -9th	10th -12th	All year
Human Labour (man-days)	1191	1142	1093	1188	1117	1252	1172	1165
Own labour (man-days)	496	515	533	466	411	486	444	479
Hired labour (man-days)	695	627	560	722	706	766	728	686
Seedling (cutting) (no.)	31481	--	--	--	--	--	--	--
Organic fertilizer (kg)								
Cow-dung	7567	6430	5293	7070	5939	5800	5750	6264.1
Oilcake	856	881	907	904	748	--	1130	775
Inorganic fertilizer (kg)								
Urea	386	409	431	216	297	124	368	319
TSP	1156	1016	875	1041	922	823	717	936
DAP	20	69	118	--	--	150	--	51
MoP	170	158	146	115	300	124	225	177
Gypsum	200	240	281	--	300	185	--	172

Different cost items like human labour, seedlings, organic fertilizer, inorganic fertilizer, pesticides, irrigation, bamboo sticks, rope, net, etc., were included to estimate the total production cost of rose cultivation (Table 6). Land use cost was added as a fixed cost. The seedling cost was required only for the first year, and it was highest (Tk. 377786 ha^{-1}) among different cost items. Among various cost items, human labour cost was the highest cost in the subsequent years. The average per hectare total cost was Tk. 634975 in all study areas. The highest cost (Tk. 980986 ha^{-1}) was observed in the 1st year garden due to the high cost of seedlings (Table 6).

Table 6. Per hectare total cost of rose cultivation (Tk. ha^{-1}) in the study areas.

Particular	Year							
	1st	2nd	3rd	4th	5th	6th -9th	10th -12th	All year
A. Total variable cost	913486	504395	502480	522149	497674	506847	525294	567475
Land preparation	7875	--	--	--	--	--	--	7875
Human labour	327498	313968	300438	326700	307175	344300	322163	320320
Own labour	136483	141529	146575	128150	113025	133650	122100	131644
Hired labour	191015	172439	153863	198550	194150	210650	200063	188676
Seed	377776	--	--	--	--	--	--	--
Organic fertilizer								
Cow-dung	46053	41144	36234	29656	31951	36960	46200	38314
Oilcake	27398	28203	29008	28928	23936	--	36160	24805
Inorganic fertilizer								
Urea	8110	8581	9051	4536	6237	2480	7718	6673
TSP	30064	26407	22750	27053	23972	21398	18651	24328
DAP	626	2193	3760	--	--	4800	--	1626
Mop	2890	2682	2474	1955	5100	1984	3825	2987
Gypsum	2004	2405	2805	--	3000	1665	--	1697
Irrigation	24781	35886	46991	48105	46424	44460	37250	40557
Insecticide/Pesticide	36887	42928	48970	55216	49879	48800	53329	48001
Bamboo stick	17796	--	--	--	--	--	--	2542
Net and rope	3729	--	--	--	--	--	--	533
Interest in operating capital	27405	15132	15074	15664	14930	15205	15759	17024
B. Total fixed cost								
Land use cost	67500	67500	67500	67500	67500	67500	67500	67500
C. Total Cost (A+B)	980986	571895	569980	589649	565174	574347	592794	634975

From Table 7, it is apparent that the highest yield (1133316 stem ha^{-1}) was found in the 2nd year garden, which started to decline from the 3rd to the subsequent year. Gross return was estimated as yield multiplied by the price of a rose stem. The price varied from area to area and season to season. The average gross return was obtained at Tk. 863479 ha^{-1} in which the highest gross return was found in 2nd year (Tk. 1246648 ha^{-1}) and the lowest in 1st year (Tk. 554066 ha^{-1}). The average net return was found (Tk. 314852 ha^{-1}) similarly highest in the 5th year (Tk. 674752 ha^{-1}). The negative net return was found in 1st year (Tk. -426921 ha^{-1}) due to high initial investment.

Table 7. Per hectare yield and return of rose cultivation in the study areas.

Particular	Year							
	1st	2nd	3rd	4th	5th	6th -9th	10th -12th	All year
Yield (stem ha^{-1})	503696	1133316	1101835	944430	912949	787025	661101	863479
Gross return	554066	1246648	1212019	1038873	1004244	865728	727211	949827
Total variable cost	913486	504395	502480	522149	497674	506847	525294	567475
Gross margin	-359421	742252	709539	516724	506570	358881	201917	382352
Total cost	980986	571895	569980	589649	565174	574347	592794	634975
Net return	-426921	674752	642039	449224	439070	291381	134417	314852

In the study, the best discount factor was considered at 6.5% (See appendix Table A1 and A2). The discounted gross cost and benefit of present worth at a 6.5% rate of interest was Tk. 5094902 ha^{-1} and Tk.7420663 ha^{-1}, respectively. The estimated average net present worth of rose cultivation at a 6.5% discount rate was Tk. 2325762 ha^{-1} in the selected locations. On the other hand, the estimated BCR was 1.46 at a 6.5% rate of interest, which indicates that rose farmers are getting higher profits compared to gladiolus farmers. In the rose cultivation project, the IRR was 146%, which was greater than the opportunity cost of capital. Therefore, it is acceptable and highly profitable (See Appendix Table A1 and A2). Similar types of results are also reported by Jahan (2009) while examining the financial analysis of cut flower production. Cultivation of flowers can provide almost 3-5 times and 1.5-2.0 times higher profits compared to rice and vegetables, respectively, in Bangladesh (Mou, 2012).

Constraints of cut flower cultivation

The results show that about 86% of farmers reported that cut-flower cultivation required a huge amount of initial investment, which might be 6-7 times higher than cereal crops (Table 8). Another 80% suffered a lack of improved variety of seed/seedlings. They used different imported exotic varieties of seed due to the unavailability of improved verity. The pest and diseases attack (75%), lack of credit facility (75%), lack of training facilities (75%), damage during rainy and foggy weather (62%), and lack of high technology-oriented floriculture (67%) were the major production problems reported by the farmers. The farmers also faced some marketing problems, such as the absence of cold storage facilities at the production point (85%), uncertain market price (80%), and seasonal demand (79%) (Table 8). Effective extension services like training, demonstration, etc. can improve farmers' scientific knowledge regarding flower production dramatically, which ultimately can boost flower production (Islam *et al.*, 2023; Jahan, 2009). In addition, Govt. of Bangladesh should take the initiative to develop storage facilities in the cut flower growing areas so that farmers can store unsold flowers in cold storage to keep the flowers alive (Mou, 2012).

Table 8. Farmers' responses about constraints of cut flower cultivation.

Constraint	Jashore (Jhikargachha)	Dhaka (Savar)	All Area (%)
Production constraints (%)			
High initial investment requirement	84	88	86
Absence of improved variety	82	78	80
Lack of credit facility	76	74	75
Pest and disease attack	76	74	75
Damage during rainy and foggy weather	64	60	62
Lack of high technology-oriented floriculture	62	72	67
Lack of training facility	76	74	75
Marketing constraints (%)			
Uncertain market price	82	78	80
Seasonal demand	74	84	79
Absence of cold storage	82	88	85
Limited buyers	66	62	64
Dominance of market intermediaries	74	84	79
Social and other constraints (%)			
Thief and animal problems	62	72	67
Spoilage	66	62	64

Conclusion and Policy Recommendation

There is a high market demand for increasing diversified use of various flowers in Bangladesh. It is clear from our study that cut flower production is more profitable than other cereal crops, though it requires high investment initially. The profit margin is comparatively high for rose cultivation relative to gladiolus cultivation. Many new farmers are getting involved in flower cultivation, and it is being promoted gradually in our country. Lack of storage facilities, lack of modern varieties, lack of credit & training facilities, and uncertain market prices are hindering cut flower production. Following policy recommendations should be taken by the Govt. of Bangladesh to improve cut flower cultivation covering the above constraints.

i. Cold storage facilities should be developed at the production point, as cut flowers are highly perishable.
ii. Flower-growing farmers need to be informed about modern flower production technologies like fertilizer, HYV seed, irrigation water, the new variety of flowers, flower caps, packaging materials, etc., through training programs and demonstration.
iii. Market information should be easily accessible to the farmers so that farmers can be aware of uncertain market prices. To ensure better prices, a contract growing system should be encouraged for the farmers.
iv. Cut flower cultivation should be supported by the Govt. of Bangladesh to coordinate the public-private partnership (PPP).
v. Institutional credit facilities should be made easily available for cut flower farmers.

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Appendix

A1. Financial analysis of rose cultivation

Year	Gross cost	Goss benefit	Discount factor at 6.5%	Present worth of cost at 6.5%	Present worth of benefit at 6.5%
1	980986	554066	0.939	921114	520249
2	571895	1246648	0.882	504217	1099118
3	569980	1212019	0.828	471857	1003368
4	589649	1038873	0.777	458348	807540
5	565174	1004244	0.730	412510	732978
6	574347	865728	0.685	393620	593313
7	574347	865728	0.644	369596	557101
8	574347	865728	0.604	347038	523100
9	574347	865728	0.567	325858	491173
10	592794	727211	0.533	315797	387404
11	592794	727211	0.500	296523	363760
12	592794	727211	0.470	278425	341559
Total				5094902	7420664
BCR=1.46					

A2. Financial analysis of rose cultivation

Year	Incremental benefit	Lower discount at 145%	Higher discount at 150%	NPV at 145%	NPV at 150%
1	-426921	0.408	0.400	-174253	-170768
2	674752	0.167	0.160	112412	107960
3	642039	0.068	0.064	43658	41090
4	449224	0.028	0.026	12468	11500
5	439070	0.011	0.010	4974	4496
6	291381	0.005	0.004	1347	1193
7	291381	0.002	0.002	550	477
8	291381	0.001	0.001	224	191
9	291381	0.000	0.000	92	76
10	134417	0.000	0.000	17	14
11	134417	0.000	0.000	7	6
12	134417	0.000	0.000	3	2
Total				1499	-3761
IRR=146%					