An Integrated Analysis of Production, Marketing, and Value Addition in Rose and Gerbera Cultivation and Distribution

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DOI: https://dx.doi.org/10.47772/IJRISS.2024.805123

Received: 30 April 2024; Accepted: 16 May 2024; Published: 18 June 2024

ABSTRACT

This comprehensive study offers an integrated investigation of various elements of rose and gerbera farming, marketing, and value-added operations. First, by evaluating the Cobb-Douglas production function's coefficients and associated statistics, the production aspect is examined. which reveals strong relationships between inputs such as labour, seedlings, fertilisers, and output yield. Second, the marketing channels used in the distribution of rose and gerbera flowers are identified, with eight separate channels ranging from direct farmer-to-consumer transactions to multi-tiered networks comprising local and Dhaka wholesalers. Third, examine average marketing expenditures for performers or agents in each channel, including expenses for baskets, packing, transportation, storage, waste loss, commission, and other costs. Finally, the net value addition for each agent across various channels is derived by subtracting the selling price from the total marketing costs. The findings shed light on the intricacies of rose and gerbera cultivation and distribution, assisting stakeholders in optimising production methods, marketing approaches, and resource allocation to boost floriculture profits and efficiency in the floriculture industry.

Key word: Cutflower, Marketing channel, Cobb-Douglas production function, Value chain mapping, Rose, Gerbera

INTRODUCTION

As an increasingly globalized market, the worldwide economic importance of cut flower industry rose significantly in recent years. Due to the growing demand of cut flower along with its thriving capture of market share in global trade, both the amount of production per unit of area and their market value are now to be taken with salient gravity. The global cut flower market is expected to reach USD 45.5 billion by 2027 with a CAGR of 4.6% from 2022 to 2027. (Markets and Markets, 2023). Worldwide, cut flowers were the 344th most traded product in 2021, with $10.5 billion in global trade, representing 0.05% of total world trade and ranking 953rd in the Product Complexity Index (OEC, 2023). In Bangladesh, over 100,000 people are employed directly or indirectly by commercial floriculture, which is practiced by 10,000–12,000 farm

families on a production base of approximately 10,000 hectares, of which 70% is dedicated to the production of flowers with the value of exports TK 3840 million, while the local market turnover is approximately TK 4000 million (FAO, 2011). For FY2020–21, Bangladesh produced 32,120 tonnes of flowers on 3,930 hectares, up 12% from 931 hectares in FY 2009–10 (BBS, 2023). Among the major cut flowers produced extensively in the world, rose and gerbera hold significant portion of the floriculture industry (Gudin, 1999 and Rahman et al., 2013). Roses are a popular cut flower for commerce and are grown all around the world; it belongs to the *Rosaceae* family and genus Rosa. (Rusanov, K., et al 2009). Roses are widely grown in Asia for their cut flower industry, although fewer species are native to Europe, North America, and northwest Africa (Xia, Y et al., 2006, Debener, T., & Linde, M. 2009 and Liorzou, M et al., 2016). As for the scenario of Bangladesh in rose production, in the years 2021-22, total production of rose was 22140.14 metric tons and the area under production was 608.09 acres and it is evident that roses predominate in domestic output; at about 22,000 tons, over two-thirds (67%) were roses (BBS, 2023 and Dhaka Tribune, 2023). Whereas the gerbera is a native of tropical Asia and Africa and belongs to the *Asteraceae* (Compositae) family and genus Gerbera which currently includes 45 species (Pasini et al., 2016; Xu et al., 2018 and Hossain, S. A. 2018). Gerbera is a highly appealing crop of cut flowers used for commercial purposes, and it is sold in large quantities to international florists (Faust & Dole, 2021and Reinten, E. Y et al., 2011). After tuberose, different varieties of roses, gladiolus, and marigold, gerbera is a popular flower in Bangladesh (Reza, M. 2013). Although the demand for this profitable flower is raising daily, gerbera farming in Bangladesh is currently limited to Jashore and to a lesser extent Chuadanga, Savar, Gazipur and Mymensingh (Mamun et al., 2020). The profitability of cultivating rose, and gerbera as commercial flowers differs due the difference in cost of production and their respective prices (Haque et al., 2013 and Mou, 2012). Furthermore, different factors including irrigation, fertilizer, pesticide, human labour etc., found to have different effects on the production of these two commercially viable flowers in our country (Aegerter et al., 2003). Rose and gerbera cultivation boost farmers' income and quality of life. To maximise production in this sector, yield-influencing elements and value chain dynamics must be identified, which lead to self-employment, and poverty reduction. Policy interventions can be customised. This study advances rose and gerbera culture and establishes the framework for future research. The generated data benefits flower growers, traders, and exporters. Understanding growers' socio-demographic profiles, profitability, production parameters, distribution methods, value addition, and grower and value chain actor restrictions are the goals. This study provides farm-level data on input utilisation, pricing, expenses, returns, productivity, and value chain dynamics. It advises development agencies and governments on improving rural livelihoods in Bangladesh.

METHODOLOGY

Study Area and Data Source

Bangladesh's Jashore and Dhaka districts were chosen as the study's area. Over a 625-hectare area in Jashore's 35 villages, 42 domestic and foreign flower varieties are cultivated for commercial purposes. Initially, a list of gerbera and rose growers was prepared. Then, 200 flower farmers in all—100 of whom were gerbera farmers and the other 100 of whom were rose farmers—were chosen at random to provide data. 70 flower market supply chain participants transport flowers from Jashore to Dhaka was also interviewed.

Profitability Analysis: Analysis of costs and returns is the prevailing approach utilized to ascertain profitability. In this study profitability of flower cultivation was calculated by the following method.

GM = TR – VC

Where, GM = Gross margin, TR = Total revenue, VC = Variable cost

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

NI = TR – TC

Where, NI = Net income, TR = Total revenue, TC = Total cost BCR = TR / TC

Where, BCR = Undiscounted benefit cost ratio, TR = Total revenue, TC = Total cost (Variable cost + Fixed cost)

Average return per taka spent on production is a key profitability indicator.

Analytical Technique

Cobb Douglas production function determined flower production input-output relationship and significant variables.

To solve it using OLS, the function was logarithmically modified.

$LnY = a + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + b_5 lnX_5 + Ui$

Where,

Y = Yield (Stick /ha);

X_1 = Human Labor (Man-days /ha);

X_2 = Seedlings (Numbe r/ha);

X_3 = Fertilizers (Kg /ha);

X_4 = Insecticides (kg /ha);

X_5 = Irrigation (Liter /ha); a = Intercept;

b_1, b_2, b_3, b_4, b_5 = coefficients of the variables to estimate. Ui = Error term.

Marketing Cost of Value Chain Actors

Marketing expenditures involve expenses for promoting flower shipment from farmers to customers. Marketing costs include transportation, loading, unloading, storage, market fees, commissions, and packaging. This data came from surveys and interviews.

Net Value Addition

The gap between sell and buy prices adds value. The use of gross margin analysis is based on the belief that actor's priorities return over cost. The following equation will evaluate the value created by specific actors. Additionally, value addition will evaluate consumer and farmer prices.

VA = SP-PP.

Where, VA=Value addition, SP= Sale price, PP= Purchase Price

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

To determine net value addition, subtract marketing expenditures from value addition.
Net value addition = VA-MC.

Where, VA = Value addition, MC= Marketing cost

RESULTS

Per-hectare Rose and Gerbera Cultivation Cost

The cost of cultivation of rose and gerbera as per hectare under these two crops with respect to various items of expenditure was calculated and it is presented in Table 1. Analyses were conducted on the variable costs associated with rose and gerbera cultivation per hectare, including labor, land preparation, seedlings, fertilizers, and so forth. The total cost of roses amounted to Tk. 327,019, with the most expensive component being seedlings. The principal reason for the increased total cost of Tk. 538,479 in Gerberas was seedlings. In comparison to the cultivation of roses, gerbera cultivation exhibited a higher cost per hectare.

Profitability of Rose and Gerbera Cultivation

Table 2 shows rose and gerbera profitability. Like any business, rose and gerbera cultivation profitability depends on production and cost. Per hectare of farming, rose and gerbera returns were calculated using the value of each flower stick. Rose farming had a gross return, net return, and gross margin of Tk. 902484, Tk. 575465, and Tk. 648214, whereas gerbera farming had Tk. 2116800, 1578321, and 1646766. For rose culture, the complete cost and cash cost benefit cost ratios were 2.76 and 3.55, and for gerbera cultivation, 3.93 and 4.50. Table 2 shows that rose and gerbera farming were profitable, but gerbera was more profitable.

Table 1. Per-hectare rose and gerbera cultivation cost

Cost items	**Units**	**Amount (Unit /ha)**		**Price (Tk. /Unit)**		**Cost (Tk. /ha)**		**Percent of cost (%)**	
		Rose	**Gerbera**	**Rose**	**Gerbera**	**Rose**	**Gerbera**	**Rose**	**Gerbera**
Variable cost items								**Percent of total variable cost (%)**	
Human labor	Man-days	70	65	475	475	33250	30875	13.08	6.57
Land preparation	Tk.					2120	3550	0.83	0.76
Seedling	No.	6397	6000	10	36	63970	216000	25.16	45.95
Organic manure	Kg.	1728	1817	1	1	1728	1817	0.68	0.39
Urea	Kg.	1545	1635	16	16	24720	26160	9.72	5.56
TSP	Kg.	1100	1136	25	25	27500	28400	10.82	6.04
MoP	Kg.	555	615	16	16	8880	9840	3.49	2.09
Insecticides	Brail	384	356	125	125	48000	44500	18.88	9.47
Irrigation	Tk.					33153	43652	13.04	9.29
Poly House							45000		9.57
Interest on operating cost						10949	20240	4.31	4.31
Fixed cost items								Percent of total fixed cost (%)	

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

Land use cost						72749	68445	100	100
Total Cost items								Percent of total cost (%)	
Total variable cost						254270	470034	77.75	87.29
Total fixed cost						72749	68445	22.25	12.71
Total cost						327019	538479	100	100

Table 2. The profitability of cultivating gerberas and roses

Items			**Total (Tk. /hectare)**	
			Rose	**Gerbera**
Gross returns			902484	2116800
Yield(stick/ha)		Price(tk./stick)		
Rose	530873	**1.7**		
Gerbera	216000	**9.8**		
Total variable costs			254270	470034
Total Fixed Cost			72749	68445
Total costs			327019	538479
Net return			575465	1578321
Gross margin			648214	1646766
Benefit-cost ratio (Full cost basis)			2.76	3.93
Benefit-cost ratio (Cash cost basis)			3.55	4.50

Factors Influencing Gerbera and Rose Cultivation Yields

The Cobb-Douglas production function study showed that inputs had a major effect on the growth of gerberas and roses. Table 3 shows calculated Cobb-Douglas production function co-efficient and statistics.

The study of the Cobb-Douglas production function showed that inputs had a noteworthy impact on the growth of gerberas and roses. The production of roses was positively impacted by human labor (0.226), seedlings (0.124), urea (0.186), and irrigation (0.035); MOP (0.102), pesticides (0.050), and TSP (0.115) had less pronounced but still significant effects. Organic manure had no discernible effect. The yield of gerberas was positively impacted by seedlings (1.049) and TSP (0.628), although organic manure (0.438) demonstrated significance at the 10% level. Insecticides, urea, and human labor had no discernible effects. Strong explanatory power was indicated by the coefficients of determination (R2), which were 0.97 for gerberas and 0.81 for roses. The coefficients for roses and gerberas added up to 1.04 and 1.93, respectively, indicating that both crops showed rising returns to scale. The yield variation was shown to be strongly dependent on the included factors, as indicated by the F-values of 76.96 for roses and 475.7 for gerberas, which were significant at the 1% level.

Table 3. Estimated Cobb-Douglas Production Function Coefficients and Statistics

	Rose			**Gerbera**		
Explanatory variables	**Co-efficient**	**Standard error**	**T-value**	**Co-efficient**	**Standard error**	**T- value**
Intercept	13.071***	3.449	3.79	4.546***	1.561	2.91
Human labour (X_1)	0.226***	0.088	2.58	-0.063NS	0.047	-1.35
Seedling (X_2)	0.124***	0.035	3.54	1.049***	0.106	9.93
Organic manure (X_3)	0.203NS	0.327	0.62	0.438*	0.247	1.77
Urea (X_4)	0.186***	0.049	3.79	-0.100NS	0.203	-0.49
TSP (X_5)	0.115*	0.072	1.60	0.628***	0.231	2.72
MOP (X_6)	0.102**	0.048	2.14	0.051NS	0.121	0.42
Insecticides (X_7)	0.050**	0.025	1.98	-0.272NS	0.137	-1.50
Irrigation (X_8)	0.035***	0.010	3.39	0.201NS	0.197	1.02
R^2	0.81				0.97	
Adjusted R^2	0.80				0.96	
Return to scale	1.04				1.93	
F-value	76.96***				475.7***	

Note: *** Significant at 1%; ** Significant at 5%; * Significant at 10%; and NS: Not Significant.

Value Chain Mapping and Actor Distribution in Rose and Gerbera Marketing

The value chain for cut flowers (Rose and Gerbera) includes input suppliers, farmers, wholesalers, forias, contact farming agents, Dhaka wholesale market, retailers, and consumers (Figure 1). This value chain chart clarifies links and integration.

The following major channels were involved in rose and gerbera marketing:

Channel i: Farmer → local consumer

Channel ii: Farmer → local retailer → local consumer

Channel iii: Farmer → local wholesaler → local retailer → local consumer

Channel iv: Farmer → local wholesaler → Dhaka wholesaler → retailer→ consumer

Channel v: Farmer → contact farming agent → Dhaka wholesaler (Shahbag and Agargoan) → retailer → consumer

Channel vi: Farmer → foria → contact farming agent → Dhaka wholesaler (Shahbag and Agargoan) → retailer → consumer

Channel vii: Farmer → foria → local wholesaler → Dhaka wholesaler (Shahbag and Agargoan) → retailer → consumer

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

Channel viii: Farmer → foria → Contact farming agent → local wholesaler → Dhaka wholesaler (Shahbag and Agargoan) → retailer → consumer

Channel ix: Farmer → Dhaka wholesaler (Shahbag and Agargoan) → retailer → consumer

Marketing Cost of Rose and Gerbera

The average marketing expenses accrued by participants in the rose and gerbera value chains are detailed in Table 5. Dhaka wholesalers and retailers incurred the greatest prices for roses, at Tk 68.2 and Tk 59.7, respectively. 29 taka were expended by farmers on marketing expenses. Gerberas were once more most expensive for wholesalers and retailers in Dhaka, at Tk 73.2 and Tk 70.7, respectively. 37.2 Tk was expended by farmers on marketing expenses.

Net Value Addition of Rose and Gerbera

The net value addition (Tk. 159.4/100 rose) for roses sold to local consumers (Channel i) was the highest, while the lowest (Tk. 39.4/100 rose) was obtained when roses were sold to contact agricultural agents (Channel v) and to forias in Channel vii. The gerberas that were sold directly to local consumers resulted in the greatest net value addition (Tk 470.5/100 gerbera), whereas the gerberas that were sold to contact agricultural agents (Channel v and forias in Channel vii) generated the least (Tk 113.5/100 gerbera). When selling to end consumers (Channel ix), retailers achieved the greatest net value addition for both roses (Tk. 120.3/100 rose) and gerberas (Tk. 949.3/100 gerbera).

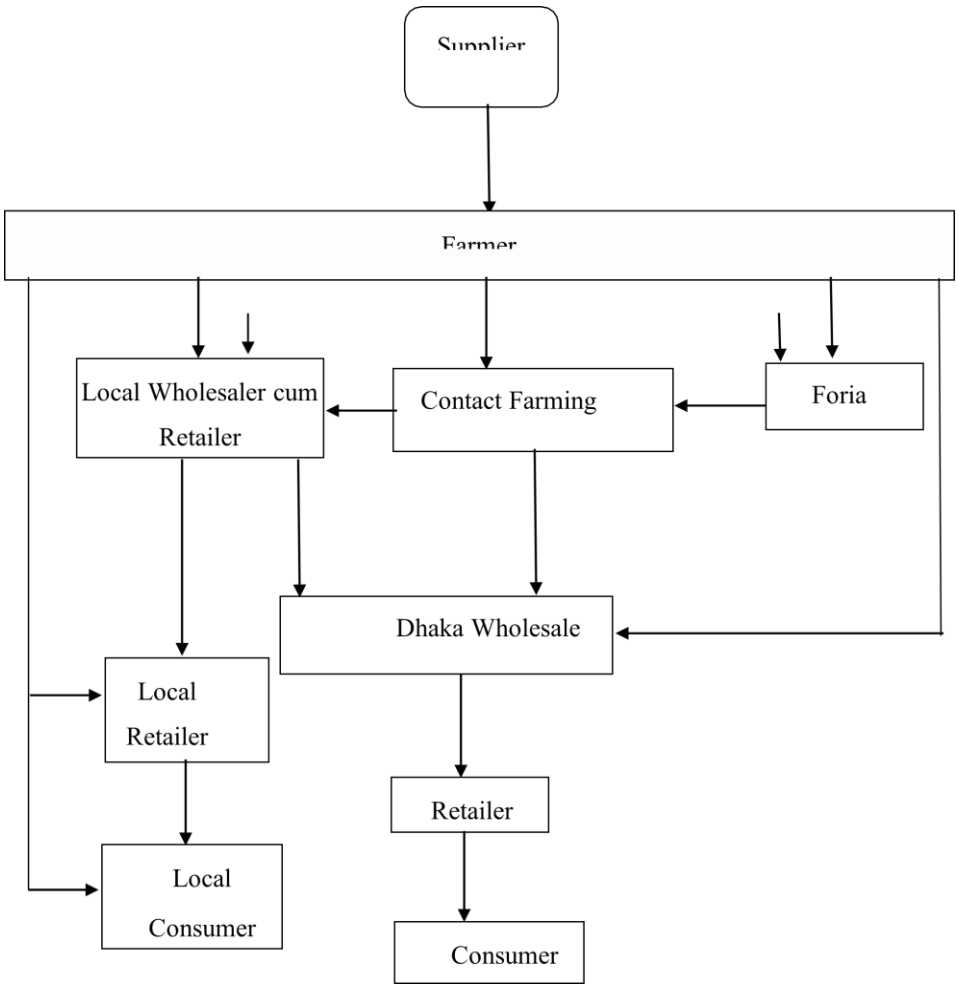

Figure 1. Cut flower (Rose and Gerbera) value chain map and actor dispersion.

Table 5. The average cost of marketing roses and gerberas for various actors (Tk./100 Sticks)

Cost Items of Marketing	**Actors**						
	Farmer	**Foria**	**Contact Farming Agent**	**Local Wholesaler**	**Local Retailer**	**Dhaka Wholesaler**	**Retailer**
Rose							
Basket	8	5	7	7	7	5	5
Packing	2				5	4.8	8.5
Transport		5			6	12.5	8
Telephone cost		10	10			2.7	
Storage	4					4.8	
Wastage loss	15			7	2.5	5	3.2
Commission			3.5		4.4	10	4.5
Shop rent				5	10	23.4	30.5
Other cost		5					
Total cost	**29**	**25**	**20.5**	**19**	**34.9**	**68.2**	**59.7**
Gerbera							
Basket	8	6	7	7	7	8	5
Packing	5				8	4.8	8.5
Transport		5	10		6	12.5	8
Telephone cost		10	10			2.9	6
Storage	5.5	6	5	5.6		4.8	5
Wastage loss	16.7			6.5	4.5	6.8	3.2
Commission		3.5	3.5		5.4	10	4.5
Shop rent				8	10	23.4	30.5
Other cost	2		1				
Total cost	**37.2**	**30.5**	**36.5**	**27.1**	**40.9**	**73.2**	**70.7**

Table 6. Net value addition of roses in several channels

Agents		**Rose Marketing Channel**								
		i	ii	iii	iv	v	vi	vii	viii	ix
Farmer	Purchase price	61.60	61.60	61.60	61.60	61.60	61.60	61.60	61.60	61.60
	Selling price	250	150	145	145	130	160	130	160	200
	Value Addition	188.4	88.4	83.4	83.4	68.4	98.4	68.4	98.4	138.4
	Marketing cost	29	29	29	29	29	29	29	29	29
	Net Value Addition	159.4	59.4	54.4	54.4	39.4	69.4	39.4	69.4	109.4
Foria	Purchase price						160	130	160	
	Selling price						250	170	250	
	Value Addition						90	40	90	
	Marketing cost						25	25	25	

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

	Net Value Addition					65	15	65		
Contact Farming Agent	Purchase price					130	250	170	250	
	Selling price					200	300	240	300	
	Value Addition					70	50	70	50	
	Marketing cost					20.5	20.5	20.5	20.5	
	Net Value Addition					49.5	29.5	49.5	29.5	
Local Wholesaler	Purchase price			145	145			240		
	Selling price			250	300			300		
	Value Addition			105	155			60		
	Marketing cost			19	19			19		
	Net Value Addition			86	136			41		
Local Retailer	Purchase price		150	250						
	Selling price		225	300						
	Value Addition		75	50						
	Marketing cost		34.9	34.9						
	Net Value Addition		40.1	15.1						
Dhaka Wholesaler	Purchase price				300	200	300	300	300	200
	Selling price				400	300	400	380	400	320
	Value Addition				100	100	100	100	100	120
	Marketing cost				67.2	67.2	67.2	67.2	67.2	67.2
	Net Value Addition				32.8	32.8	32.8	12.8	32.8	52.8
Retailer	Purchase price				400	300	400	380	400	320
	Selling price				470	450	500	500	500	450
	Value Addition				70	150	100	180	100	130
	Marketing cost				59.7	59.7	59.7	59.7	59.7	59.7
	Net Value Addition				10.3	90.3	40.3	120.3	40.3	50.3
	Total Net Value Addition	159.4	99.5	155.6	233.5	212	237	263	237	232.5

Table 7. Net value addition of gerbera in several channels

Agents		**Gerbera Marketing Channel**								
		i	ii	iii	iv	v	vi	vii	viii	ix
Farmer	Purchase price	249.3	249.3	249.3	249.3	249.3	249.3	249.3	249.3	249.3
	Selling price	750	500	450	450	400	460	400	460	700
	Value Addition	450.7	249.7	200.7	200.7	150.7	210.7	150.7	210.7	500.7
	Marketing cost	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2	37.2
	Net Value Addition	470.5	213.5	163.5	163.5	113.5	173.5	113.5	173.5	413.5
Foria	Purchase price						460	400	460	
	Selling price						580	510	570	
	Value Addition						120	110	130	
	Marketing cost						30.5	30.5	30.5	

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue V May 2024

	Net Value Addition						89.5	79.5	99.5	
Contact Farming Agent	Purchase price					400	580	510	570	
	Selling price					600	700	640	700	
	Value Addition					200	120	150	130	
	Marketing cost					36.5	36.5	36.5	36.5	
	Net Value Addition					163.5	83.5	113.5	93.5	
Local Wholesaler	Purchase price			450	450			640		
	Selling price			650	700			800		
	Value Addition			200	250			160		
	Marketing cost			27.1	27.1			27.1		
	Net Value Addition			172.9	222.9			132.9		
Local Retailer	Purchase price		500	650						
	Selling price		700	800						
	Value Addition		200	150						
	Marketing cost		40.9	40.9						
	Net Value Addition		159.1	109.1						
Dhaka Wholesaler	Purchase price				700	600	700	800	700	700
	Selling price				900	900	925	980	850	950
	Value Addition				200	300	225	180	150	250
	Marketing cost				73.2	73.2	73.2	73.2	73.2	73.2
	Net Value Addition				126.8	226.8	151.8	106.8	76.8	176.8
Retailer	Purchase price				900	900	925	980	850	950
	Selling price				1200	1500	1300	2000	1700	1550
	Value				300	600	375	1020	850	600
	Marketing cost				70.7	70.7	70.7	70.7	70.7	70.7
	Net Value Addition				229.3	529.3	304.3	949.3	779.3	529.3
	Total Net Value Addition	470.5	372.6	445.5	742.5	1033.1	802.2	1517	1222.6	1119.6

DISCUSSION

The Cobb-Douglas model showed that human labour, seedlings, and other inputs affected rose and gerbera yields. Profitability and value chain analysis revealed Bangladesh's detailed rose and gerbera agriculture profitability dynamics.

Benefit-cost ratios (BCRs) for rose and gerbera cultivation were shown to be favorable in previous research conducted in the districts of Jashore and Mymensingh (Haque et al., 2013 and Mou, 2012). Our analysis, which displays BCRs of 3.93/4.50 for gerberas and 2.76/3.55 for roses on full/cash-cost bases, is consistent

with these conclusions. Growing gerberas was consistently more profitable, which was consistent with patterns found in earlier studies (Aegerter et al., 2003 and Hajong et al., 2022).

This study showed various inputs that significantly affect rose and gerbera yield. Skill-oriented labour management and organisation choice are associated to cut rose cultivation (van 't Ooster et al., 2015). A prior study indicated that seedling density and plant material significantly affected rose yield (Pessala, T. A. P. A. N. I. 1977). Inorganic fertilisers like urea, TSP, and MOP have been studied on rose types in several countries (García-Castro & Restrepo-Díaz, 2013; Al-Sayed et al., 2019; Kumar et al., 2017; Hamedi et al., 2022). One study found that pesticides increase rose yield in Ecuador (Idrovo-Novillo et al., 2019). In diverse climates, irrigation frequencies and procedures affected rose production quantity and quality (Kittas et al., 2004; Katsoulas et al., 2006; Fascella, 2010). Our study also indicated that rose output was positively and significantly associated with human work, seedling, urea, TSP, MOP, pesticides, and irrigation. This study also reveals that seedling, organic manure, and TSP affect gerbera yield. Exotic potted gerbera varieties were studied in Bangladesh for growth and yield (Uddin et al., 2012). Rashid, M. H. (2020) investigated how TSP in final land preparation affects gerbera production potential in Bangladesh. A prior study examined gerbera flower output after organic manure treatment (Longchar, A., & Keditsu, R. 2013).

This study's value chain analysis shows nine rose and gerbera marketing channels with various actors and marketing cost structures, comparable with other Bangladeshi research. A prior study examined Bangladesh's flower industry value chain and rose and gerbera market share (Rakibuzzaman, M et al., 2018). In this study, we examined rose and gerbera net value addition. Qualitative interviews with Bangladeshi farmers could add depth to these findings and inspire more research.

CONCLUSION

In conclusion, using Cobb-Douglas modelling in conjunction with profitability and value chain analysis, our research offers a thorough insight of the intricate dynamics of gerbera and rose production in Bangladesh. We determined that important variables affecting yields included labour, fertilisers, irrigation, and seedlings. Higher benefit-cost ratios indicate that gerbera growing is generally more profitable than rose cultivation. The floriculture industry's complex distribution network emphasises how crucial it is to make well-informed decisions and implement calculated interventions in order to maximise production and marketing techniques. Notwithstanding certain limitations, such as the study's concentration on just two districts and the exclusion of certain elements like inflation, the results are consistent with other national studies. Notably, by utilising nationally representative data, the study presents a novel viewpoint on the cultivation of roses and gerberas in Bangladesh. Policymakers and other stakeholders can use this insightful data to create efficient intervention plans that will benefit farmers and consumers alike.

Acknowledgements: The authors thank National Science and Technology (NST) for funding and enumerators and farmers for their assistance.

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