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**COMPARATIVE PROGRESS OF DEVELOPMENT DURING  
PRE AND POST LIBERATION PERIOD IN  
BANGLADESH TEA INDUSTRY**

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**ABSTRACT**

The yield of Bangladesh tea during post liberation period increased significantly from 746 kg/ha in 1974 to 1057 kg/ha in 1993 with an average linear rate of 1.15 percent per annum as against 0.04 percent in pre-liberation period. The rate of increase in yield during post-liberation period is significantly higher than that in pre-liberation period. In spite of significantly lower growth rate of area under tea in post-liberation period compared to pre-liberation period the annual production in post-liberation period increased from 32.16 mkg in 1974 to 50.60 mkg in 1993 with an average linear rate of 2.16 percent per annum as against 1.90 percent in pre-liberation period. Higher rate of growth in tea industry in post-liberation period might be due to technological revolution in tea culture in the form of adoption and introduction of high yielding vegetative clones, intensive cultivation of tea, higher efficiency of management and increase in technical knowledge of planters, etc. which imparted a fresh momentum to the growth of tea plantation in Bangladesh.

**I. INTRODUCTION**

Bangladesh entered in an important phase of development in tea industry and it has passed more than two decades. Time has come to assess the progress made in tea industry. The growth rates of area, production and productivity of tea in Bangladesh will help facilitate reading and interpreting time series data. It provides a guideline of future action in the perspective of the past.

In pre-liberation period a 3% mandatory extension programme was launched starting from 1960, and more than 11000 hectares of additional land was brought under tea plantation upto 1970 (BCS, 1961). Since no higher yielding and improved quality clone was discovered by Bangladesh Tea Research Institute in that period, it was not possible to introduce clones in the said extended area. On the contrary, a 2% extension programme was implemented in postliberation period over 12 years starting from 1980 with the financial assistance from British ODA, EEC and GOB (BCS, 1980). Bangladesh Tea Research Institute has discovered so far 10 high yielding and improved quality clones in post-liberation period. These clones were introduced in half of the extended 4377 hectares of land brought under 2% extension programme and about 2200 hectares of clonal area will start to give full benefits after the year 2000.

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Tea is a perennial crop. It is a highly and labour intensive industry (Misra, 1986). Tea plantation is very expensive and it takes more than two lacs taka to bring one hectare of land under new plantation. Thus, finance is the main constraint to bring new area under tea. Moreover, availability of suitable land for tea plantation is another constraint. Only 12000 hectares out of 114567 hectares of grant area is available for extension of tea plantation (PDU, BTB, 1993) in the existing tea industry.

The descriptive summary measure would enable us to raise questions relating to the underlying factors responsible for such performances and might serve as a basis for future policy decision. Keeping this view in mind the present study is a modest attempt to a) analyse the trends in annual production, area and yield of tea and b) examine the relative progress of magnitude in annual production, area and yield of tea.

## II. METHODOLOGY

Data on area and production of tea from 1947 to 1993 were collected from the various issues of Annual Reports of Bangladeshyio Cha Sangsad and International Tea Committee (ITC). The Bangladesh tea industry was severely affected in 1971 due to liberation war, the effect of which continued further for the following two years 1972 and 1973. Therefore, the data of these two years have not been considered in the process of analysis.

The data cover two distinct set periods relating to pre-liberation period (1947-1970) and post-liberation period (1974-1993) of Bangladesh on the plantation area, annual production and yield of tea. Let us denote the area function or production function or yield function by

$$Y_1 = a_1 + b_1 x_1 + u_1 \text{ (pre-liberation period)} \quad (1)$$

$$Y_2 = a_2 + b_2 x_2 + u_2 \text{ (Post-liberation period)} \quad (2)$$

where Y denotes the area or production or yield, x is the time and  $u_1$  and  $u_2$  are error terms.

This study is aimed at investigating whether there is any change or shift in area function or production function or yield function between the two periods. Such a change is referred to as a structural change (Johnston 1991). This structural change may be due to change in the intercepts or the slopes or both the intercepts and slopes.

There are several methods of computation of growth rates to estimate the magnitude of the development in respect of area, production and yield. For simple interpretation of the data analysis the linear trend has been used for estimation of the growth rate by taking time (x) as independent variable and the index numbers of three years moving average of area or production or yield as dependent variables.

A linear equation of the following types

$$Y_1 = a_1 + b_1 x_1 \text{ (Pre-liberation period)} \quad (1)$$

$$Y_2 = a_2 + b_2 x_2 \text{ (Post-liberation period)} \quad (2)$$

have been fitted by Ordinary Least Square (OLS) method with the origin at the respective base year

where,  $Y_1$  and  $Y_2$  are the index numbers of three years moving average of area or production or yield for pre-liberation and post-liberation period respectively,

$a_1$  and  $a_2$  are corresponding intercepts,

$b_1$  and  $b_2$  are the corresponding slopes or linear growth rate,

$X_1$  stands for 0,1, ... .. 21 against the year 1948, 1949 .....1969 and

$X_2$  stands for 0,1, ..... 17 against the year 1975, 1976, .... 1992.

The following three null hypotheses are tested:

- a) No structural change
- b) Common regression slope or linear growth rate, and
- c) Common intercepts

The F statistic calculated by applying appropriate sums of square will test the null hypothesis and provide us the answer to our objectives.

### III. ANALYSIS OF RESULTS

During post-liberation period tea yield has evidenced a significant upward move from 746 Kg/ha in 1974 to 1057 Kg/ha in 1993, whereas in pre-liberation period that has increased from 622 Kg/ha in 1947 to 735 kg/ha in 1970 (Appendix A). The trend of annual tea production during pre-liberation period increased from 18.88 mkg in 1947 to 31.38 mkg in 1970 i.e. 66 percent increase. Similarly during post-liberation period tea production moved upward from 32.16 mkg in 1974 to 50.60 mkg in 1993 i.e. 57 percent increase. The area under tea plantation has increased about 40% during pre-liberation period as against 11% during post-liberation period.

The Indices and trend values of area, production and yield both in pre and post-liberation period have been presented in appendix B. The curves (Fig 1,2 & 3) showing the trend lines and indices of area, annual production and yield during pre-and post-liberation period substantiate the fact that Bangladesh Tea Industry achieved continuously spectacular growth in the study period.

The growth rates of area, annual production and yield in both pre and post-liberation periods of Bangladesh tea industry arrived at by fitting linear trend function to the corresponding index numbers are given in Table 1. It is evident that both in pre and post-liberation period area, annual production and yield except in pre-liberation period have shown significant annual growth trend.

The average linear growth rates of yield during post and pre-liberation period are 1.15 and 0.04 percent respectively (Table 1), the difference of which has been found to be highly significant (Table 2).

The average linear growth rates of annual production during post and pre-liberation period are 2.16 and 1.90 percent per annum respectively, the difference of which has been found to be insignificant at 5% level. The average linear growth rate of area during pre and post-liberation

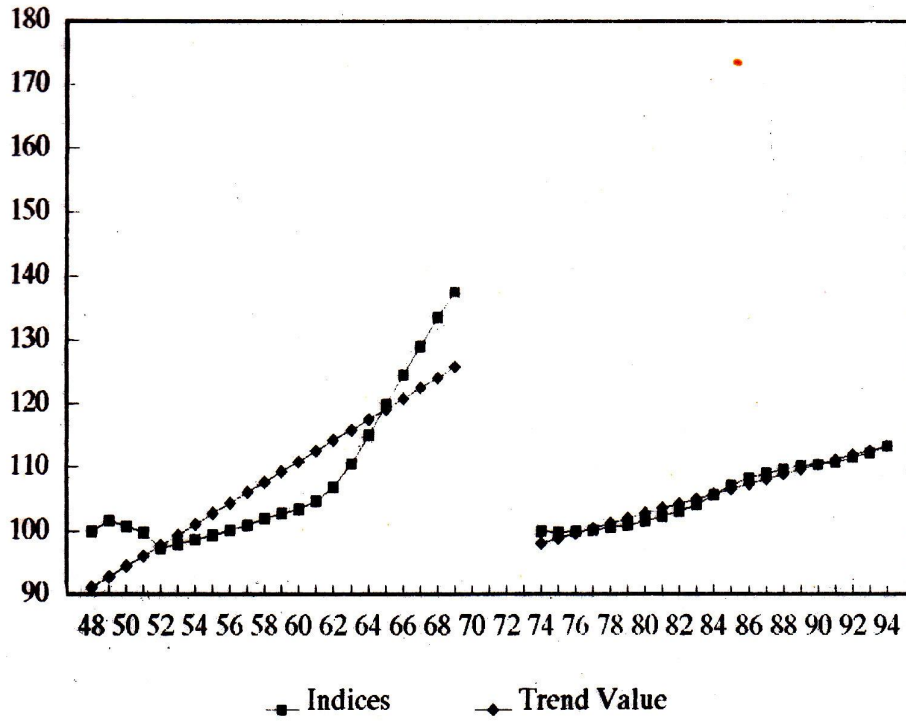


Fig. 1. Tea Area Trend in Pre and Post-Liberation Periods

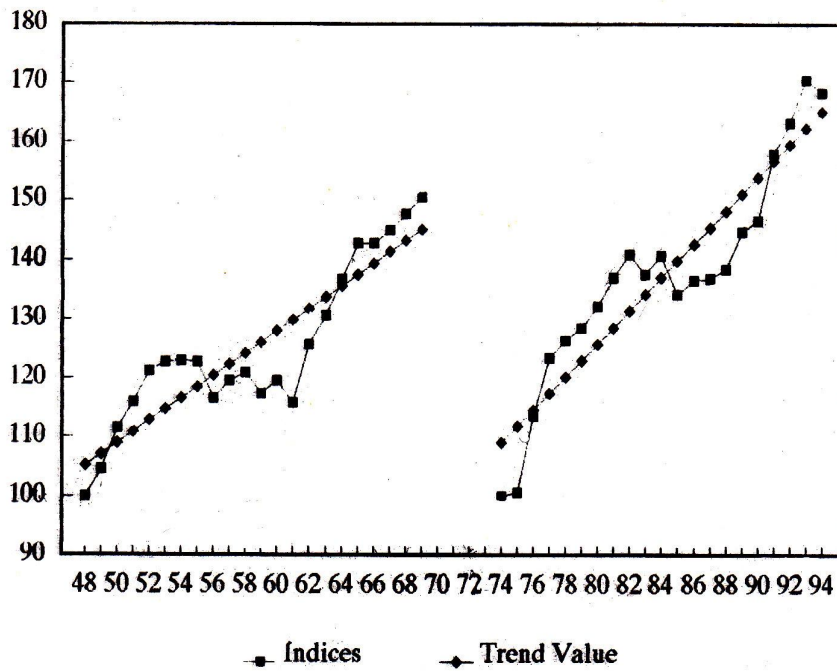


Fig. 2. Tea Production Trend in Pre and Post-Liberation Periods

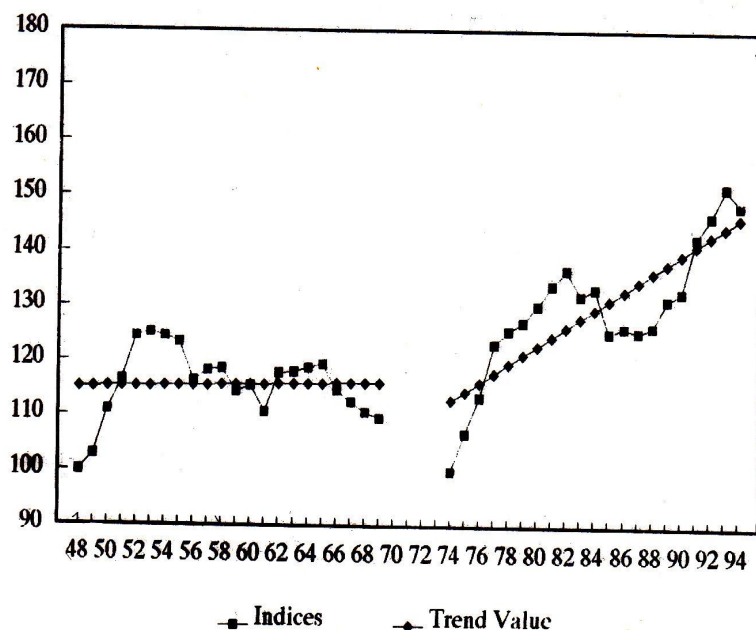


Fig. 3. Tea Productivity Trend in Pre and Post-Liberation Periods

**Table 1. Test of area, production and yield growth of Bangladesh tea during pre-liberation and post-liberation period.**

Dependent variable		Intercept	Trend variable	R <sup>2</sup>	Estimator
<b>Area</b>	: Pre-liberation	91.23	1.64 (7.57) HS	0.74	OLS
	Post-liberation	98.63	0.79 (20.64) HS	0.96	OLS
<b>Annul production</b>	: Pre-liberation	105.20	1.90 (9.01) HS	0.80	OLS
	Post-liberation	108.93	2.16 (8.41) HS	0.82	OLS
<b>Yield</b>	: Pre-liberation	115.22	0.04 (0.17)	0.0014	OLS
	Post-liberation	110.81	1.15 (4.01) HS	0.50	OLS

Note: The figure in parenthesis refers to value of t. HS-Highly significant at 1% error level.

period are 1.64 and 0.79 percent per annum respectively, the difference of which is statistically significant. The reason for low productivity growth rate (0.04%) in pre-liberation period is that the annual production growth rate (1.90%) is marginally higher than the area growth rate (1.64%)

Table 2 shows the calculated and tabulated F values under the assumed three null hypotheses. It is evident that there is a structural change between the two periods in respect of area, annual production and yield. The structural change in respect of plantation area is due to different regression slopes and not due to intercepts. On the contrary, the structural change in respect of annual production in the two periods is due to different intercepts and not regression slopes. The structural change that has been occurred significantly during post-and pre-liberation periods in respect of yield is caused by both different slopes and different intercepts.

**Table 2. Calculated and tabulated F value under the null hypotheses.**

Parameter	F. values					
	No Structural Change		Common Regression Slope		Common Intercepts	
	Calculated Fc	Tabulated F 0.95 (2,36)	Calculated Fc	Tableted F 0.95 (1,36)	Calculated Fc	Tabulated F 0.95 (1,38)
Area	4.7	3.26	9.11	4.11	0.24	4.10
Production	5.32	3.26	1.66	4.11	8.83	4.10
Yield	8.51	3.26	9.13	4.11	6.47	4.10

#### IV. CONCLUSION

In spite of significant lower growth rate of area in post-liberation period, the production as well as yield growth rates in post-liberation period are higher compared to pre-liberation period. This is evidently a good sign for future prospect and sustainability of Bangladesh tea industry. This progress might have been achieved due to technological development in tea culture and rationalisation of the tea production process in post-liberation period in different ways. Among these factors of changes, the development and introduction of high yielding and better quality vegetative clones, intensive cultivation of tea, increase in scientific knowledge of tea planters and higher efficiency of management deserve special mention.

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*(The following table is a reproduction of the data from the source document, which is extremely faint and difficult to read. It appears to be a multi-column table with years and numerical values.)*

Year	Value 1	Value 2	Value 3	Value 4
1971	10.00	10.00	10.00	10.00
1972	11.00	11.00	11.00	11.00
1973	12.00	12.00	12.00	12.00
1974	13.00	13.00	13.00	13.00
1975	14.00	14.00	14.00	14.00
1976	15.00	15.00	15.00	15.00
1977	16.00	16.00	16.00	16.00
1978	17.00	17.00	17.00	17.00
1979	18.00	18.00	18.00	18.00
1980	19.00	19.00	19.00	19.00
1981	20.00	20.00	20.00	20.00
1982	21.00	21.00	21.00	21.00
1983	22.00	22.00	22.00	22.00
1984	23.00	23.00	23.00	23.00
1985	24.00	24.00	24.00	24.00
1986	25.00	25.00	25.00	25.00
1987	26.00	26.00	26.00	26.00
1988	27.00	27.00	27.00	27.00
1989	28.00	28.00	28.00	28.00
1990	29.00	29.00	29.00	29.00
1991	30.00	30.00	30.00	30.00
1992	31.00	31.00	31.00	31.00
1993	32.00	32.00	32.00	32.00
1994	33.00	33.00	33.00	33.00
1995	34.00	34.00	34.00	34.00
1996	35.00	35.00	35.00	35.00
1997	36.00	36.00	36.00	36.00
1998	37.00	37.00	37.00	37.00
1999	38.00	38.00	38.00	38.00
2000	39.00	39.00	39.00	39.00
2001	40.00	40.00	40.00	40.00
2002	41.00	41.00	41.00	41.00
2003	42.00	42.00	42.00	42.00
2004	43.00	43.00	43.00	43.00
2005	44.00	44.00	44.00	44.00
2006	45.00	45.00	45.00	45.00
2007	46.00	46.00	46.00	46.00
2008	47.00	47.00	47.00	47.00
2009	48.00	48.00	48.00	48.00
2010	49.00	49.00	49.00	49.00
2011	50.00	50.00	50.00	50.00
2012	51.00	51.00	51.00	51.00
2013	52.00	52.00	52.00	52.00
2014	53.00	53.00	53.00	53.00
2015	54.00	54.00	54.00	54.00
2016	55.00	55.00	55.00	55.00
2017	56.00	56.00	56.00	56.00
2018	57.00	57.00	57.00	57.00
2019	58.00	58.00	58.00	58.00
2020	59.00	59.00	59.00	59.00
2021	60.00	60.00	60.00	60.00



## APPENDIX-A

**Year wise Area, Annual Production and Yield of Bangladesh Tea**

Year	Area (ha)	Annual Production (Mkg)	Yield (Kg/ha)
<b>Pre-Liberation Period</b>			
1947	30353	18.88	622
1948	30377	19.86	654
1949	30500	21.09	689
1950	31877	21.69	680
1951	29507	23.91	810
1952	29651	23.71	800
1953	29695	24.83	839
1954	30094	24.78	823
1955	30262	23.82	787
1956	30374	24.78	816
1957	30732	21.09	686
1958	31029	25.55	823
1959	31287	25.65	820
1960	31406	18.97	604
1961	31689	26.78	845
1962	32323	23.42	725
1963	33494	24.96	745
1964	35005	29.67	848
1965	36486	27.07	742
1966	37778	28.55	756
1967	39292	29.70	756
1968	40604	28.39	699
1969	41935	30.16	719
1970	42688	31.38	735
<b>Liberation period</b>			
1971	43398	12.45	287
<b>Post-Liberation Period</b>			
1972	43205	23.84	552
1973	43147	27.55	639
1974	43096	32.16	746
1975	43059	29.09	676
1976	43012	33.50	779
1977	43143	38.14	884
1978	43345	37.92	875
1979	43511	36.13	830
1980	43732	40.04	916
1981	43970	41.29	939
1982	44546	40.39	907
1983	44683	43.43	972
1984	45330	38.21	843
1985	46463	43.40	934
1986	46703	37.59	805
1987	46858	40.31	860
1988	47378	43.58	920
1989	47439	39.08	824
1990	47650	45.89	963
1991	47677	45.23	949
1992	47888	49.13	1026
1993	47888	50.60	1057

Source : Bangladeshyio Cha Sangsad and International Tea Committee

## APPENDIX-B

## Indices of Area, Annual Production and Yield of Bangladesh Tea

Year	Area(ha)		Production		Yield	
	Index	Trend Value	Index	Trend Value	Index	Trend Value
<b>Pre-Liberation Period</b>						
1948	100.00	91.22	100.00	105.20	100.00	115.17
1949	101.66	92.86	104.69	107.10	102.95	115.21
1950	100.70	94.50	111.47	109.00	110.89	115.25
1951	99.77	96.14	115.99	110.90	116.54	115.29
1952	97.38	97.78	121.24	112.80	124.48	115.34
1953	98.03	99.42	122.69	114.70	125.14	115.38
1954	98.70	101.06	122.87	116.60	124.48	115.42
1955	99.44	102.70	122.78	118.50	123.46	115.44
1956	100.14	104.34	116.60	120.40	116.49	115.47
1957	100.98	105.98	119.49	122.30	118.32	155.55
1958	101.98	107.62	120.95	124.20	118.52	115.60
1959	102.72	109.26	117.41	126.10	114.35	115.64
1960	103.44	110.90	119.47	128.00	115.47	115.68
1961	104.58	112.54	114.75	129.90	110.64	115.71
1962	106.87	114.18	125.76	131.80	117.81	115.77
1963	110.50	115.82	130.60	133.70	117.96	115.81
1964	115.06	117.46	136.71	135.60	118.83	115.85
1965	119.76	119.10	142.72	137.50	119.39	115.90
1966	124.46	120.74	142.77	139.40	114.71	115.94
1967	128.97	122.38	144.98	141.30	112.52	115.98
1968	133.53	124.02	147.68	143.20	110.64	116.03
1969	137.25	125.66	150.49	145.10	109.57	116.07
<b>Post-Liberation Period</b>						
1975	100.00	98.64	100.00	108.93	100.00	110.81
1976	100.03	99.43	106.30	111.09	106.22	111.96
1977	100.25	100.22	115.61	113.25	115.25	113.12
1978	100.64	101.01	118.39	115.41	117.57	114.27
1979	101.10	101.79	120.39	117.58	119.02	115.42
1980	101.58	102.58	123.95	119.74	121.93	116.54
1981	102.38	103.37	128.45	121.90	125.43	117.73
1982	103.12	104.16	132.03	124.07	127.97	118.89
1983	104.17	105.74	128.78	126.23	123.61	120.04
1984	105.65	105.80	131.95	128.39	124.84	121.19
1985	107.22	106.53	125.79	130.56	117.26	122.35
1986	108.40	107.31	128.01	132.72	118.03	123.55
1987	109.11	108.10	128.20	134.88	117.39	124.65
1988	109.68	108.89	129.77	137.05	118.26	125.81
1989	110.29	109.68	135.66	119.23	122.93	126.96
1990	110.52	110.47	137.40	141.37	124.25	128.12
1991	110.87	111.26	148.01	143.53	133.42	129.27
1992	111.06	112.05	152.98	145.70	137.69	130.42

Source : Bangladeshio Cha Sangsad and International Tea Committee.