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Tea Industry of Assam and India: Statistical Analysis and Its Future Trends

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Abstract

Tea is a national drink of India and Indian people consume 70% of country's produced tea which is nearly 9.01 Lakh tones. Govt. of India earned 12.6 billion USD from Tea industry in 2022 and India had exported 195.5 million kgs tea in the year 2021. India had recorded the highest ever production of tea in 2017-18 by producing 1,325.05 million kgs. Assam and Darjeeling Tea are world famous for its unique behaviour and ethnicities. Assam Orthodox Tea has received a tag mark of Geographical Indication (GI). There are more than 850 tea estates and more than 2,500 tea gardens in Assam covering thousandsof acres of land of the state primarily in upper Assam. India is also the largest consumer of black tea and consumes 18% of the total World tea consumption. India is 2nd largest tea producer and Assam accounts for 1/6th of the tea produced in the world and 52% in the country. In this paper, a comparative analysis of tea production in Assam and India is presented along with forecasting of produced tea in the country. To forecast yield production, area and average yield of tea in Assamand India, the ARIMA model is used. Descriptive statistical measures are taken to show differences among Assam and India. ADF test is used here to check the stationarity of the time series data. AIC, BIC and MAPE values are also used to obtain the optimal ARIMA model.

***Key words:** AIC, ARIMA (p,d,q), ADF Test, BIC, MAPE, Tea yield forecasting*

1. Introduction

India ranks second in global tea production just behind China and that is all thanks to Assam. Assam is considered to be the largest single tea growing region in the globe.
India produces 9,00,094 tonnes of tea on average each year. From the huge amounts of tea that the country produces each year, it consumes 70 percent of the total produce [Kishori, 2017 et. al.]. Our country exclusively produces the popular Assam and Darjeeling varieties of tea.

Assam means 'one without equal' and that is really true about its teas. They say 'you haven't woken up fully if you haven't sipped Assam tea'. The strong tea, grown on the rolling plains by the Brahmaputra River that weaves her way through vales and hills, is famous for its smooth malty flavour. A taste crafted by the region's rich loamy soil, unique climate and liberal rainfall. Assam is not just the largest contiguous tea-growing area in the world. It is also a refuge for endangered species like the One-horned Rhino, Red-headed Vulture and the Hillock Gibbon and of course, mind-boggling diversity. It is a land that protects and preserves. Just like the Tocklai Experimental Station, the world's oldest and largest research station of its kind, carries out clonal propagation and constant research so that the strength of the full-bodied liquor is retained. All to make sure that the tea bushes yield high quality tea. Both Orthodox and CTC (Crush/Tear/Curl) varieties of tea are manufactured here. Assam Orthodox Tea is a registered Geographical Indication (GI). The scientific name for the tea plant is Camellia Sinensis. The Assam variety is known as Assamica.

The British discovered wild tea plants in the forests of Assam in 1823 after which the state began producing tea. It is estimated that 17 percent of workers in the state are engaged in tea production.

The story of Assam tea is about being discovered by a Scottish adventurer, Robert Bruce, who noticed tea-like plants growing wild near Rangpur. This was in 1823 and Bruce was on a trading mission. Bruce was reportedly directed by Maniram Dewan to Bessa Gam who was the local Singpho chief. Bessa Gam showed Bruce how local tribesmen brewed tea from leaves of this bush. Bruce made an arrangement with the tribal chief to give him samples of these tea leaves with seeds, as he planned on having them scientifically examined. Robert Bruce passed away a few years later, never having seen this plant being properly classified.

In early 1830, Robert Bruce's brother, Charles, sent a few of these leaves to a botanical garden in Calcutta to be properly examination and it was then that this plant was officially classified as a tea variety and named Camellia Sinensis var. Assamica.

Between 1840 to 1860, the production and cultivation of Assam tea was dominated by the Assam Company, operating from districts in Upper Assam. The workforce was made up of the local Kacharis. The success of the Company shifted with changes in colonial policies, offering plots to tea planters. It led to the boom and expansion of Assam's tea industry during the early 1860s.

The first company that was set up for growing and making this tea was the Assam Tea Company, started in the year 1839. It expanded steadily and by 1862, the business comprised over 160 gardens, all owned by 5 public companies along with 57 private players [Narzary, 2016].

The British East India Company's intervention was recognised through 'experts' who constituted the 1834 Tea Committee and they assessed the commercial potential and scientific nature of the Assam tea. By late 1830s, a market for the Assam Tea began to be evaluated in London and the East India Company's positive feedback led to the inauguration of a lengthy process of withdrawal of agricultural lands and forests to allow significant shares of this province to be converted to tea plantations by the private capital.

The first Indian to start planting of tea was an Assamese nobleman Maniram Dutta Barma, popularly known as Maniram Dewan. He was a Dewan of Assam Company until resigned in 1841 to start his own tea estate. He had two gardens at Jorhat and near Sonari. But the British hanged him in 1858 for taking part in mutiny in 1857. After Maniram Dewan's pioneering efforts, many others mostly Assamese came forward to plant tea.

The Assam tea industry is one of the most enterprising tea-producing regions in the world. Tea estates in Assam collectively produce close to 507 million kg of tea every year, making the state of Assam the world's largest tea-growing region [Mech, 2017]. The terroir of Assam is characterized as having low altitude, rich loamy soil, ample rainfall, and a tropical climate which allows the region to produce some of the best loose-leaf orthodox teas. Only those teas grown and manufactured in tea estates located in the Brahmaputra Valley in the northeast India qualify to be called as Assamteas.

The harvesting of Assam tea is generally done twice each year – the first flush which begins late March and goes on until late May; and the second flush which is usually in June and makes the famous "tippy" tea. The tippy tea from the second flush has a fuller body and is sweeter, therefore considered as superior to the first flush.

There are more than 850 tea estates and more than 2500 tea gardens in Assam covering thousands of acres of land of the state. Assam accounts for $1/6^{th}$ of the tea produced in the world and 52 percent in the country [Laskar, 2015 et. al.].

Tea gardens of Assam are mostly located in Dibrugarh, Tinsukia, Sivasagar, Jorhat, Golaghat Darrang and Sonitpur. Tea grows mainly in the low-lying plains of Barak and Brahmaputra. Teas are grown at elevations ranging from 45 to 60 metres above sea level and Assam's Annual Rainfall is 250 to 380 cm.

Although Assam is mainly known for its black tea, it also produces small quantities of green and white teas. A

full-leaf Assam tea is known for its bright colour, and rich flavour. The low altitude,rich loamy soil conditions, ample rainfall and a unique climate makes the production of some ofthe finest orthodox tea leaves possible. Assam Tea has a rich, deep-amber colour and is famousfor its rich, full-bodied cup. It is known for its brisk, strong and malty character, making it a perfect tea to wake up to. The distinctive second flush orthodox Assam teas are valued for theirrich taste, bright liquors and are considered to be one of the choicest teas in the world. The study is primarily concerned with the tea production, comparative analysis and prospects of tea industry of Assam and India. The objectives of the study are to-

- Make comparative analysis of tea production, area under tea and average yield in Assamand India;
- To study the overall performance of tea production and forecast the production scenario considering the past data pattern;
- Give an idea about the future prospects of tea industry in the state and the country.

2. Review of Literature

In recent time many researchers, institutions, and research centre have carried out many research works upon tea industry of Assam and India and thereby enriched many literatures onit.

As Arya (2013) described that the tea industry in Assam is about 180 years old. This industry plays an important role in the state economy as well as in the national economy. The first Indiantea produced in Assam was sent to United Kingdom for public sale in the year 1838. Subsequently tea cultivation was extended to other parts of the country between 50‟s and 60‟sof the last century. As of today, Assam tea has retained its international standard and commands significant share in the world market. He also pointed out the tea industry in Assam also gave average daily employment to more than six lakh persons in the state, which was around 50 percent of the total average daily number of labour employed by tea industry in the country.

Sonowal (2014) pointed out that the tea industry of Assam is the predominant industrial sector of the state playing an important role in the economy of Assam. It has been contributing substantially to the state income and to the national exchequer as well, in the shape of foreign exchange earnings through its exports every year. It has been contributing its parts to generate employment for skilled and unskilled workers. The tea industry of Assam has also been empowering women by giving them job opportunities.

Sharma (2013) in his paper pointed out that the state government was thinking of registering the small tea gardens with the labour department and the Tea Board had opened a cell at the Assam Agricultural University to train small tea growers with the aim of improving the quality of Assam. A similar training session for small growers would be started at Tocklai Research Station. Again as he pointed out recently a group of tea makers of small tea growers from Assam visited Kangra Valley of Himachal Pradesh to learn about mechanized of plucking andnew methods of pruning tea bushes.

Paramanantham (2006) found in the study that during 2003 the production of tea in India stoodat 878.13 M kg as against 838.47 M kg in 2002 indicating thereby an increase of 39.66 M kg during 2003 over 2002. Increase during the year 2003 was attributed towards the improvementin the production in both the North and South India crop to the extent of 16.53 M kg and 23.12M.kg respectively over 2002.

Minoti (1986) in her study titled “Socio-economic status of the women labourer in thetea gardens of Assam” throws light on the sociological aspect of the women labourers of Assam. Though they extended their hand as earning member of the family, most of them are illiterate.

Borman (1968) highlighted that the tea industry is a labour-intensive industry and the average number of labourers employed in Assam tea plantations is more than 40 lakhs. They consist mostly of the tribes and castes migrated from different part of the country. Various factors seem to have contributed to this large-scale migration. In their original habitats the people has been facing acute poverty because of infertility of soil, crude technology, recurrentflood, drought and famine and the ruthless exploitation by the landlords and money lenders.

Asopa (2007) pointed out that the extremist in Assam is one of the major concerns for thedeclination of the growth of the tea industry.

Saikia (2008) in his study regarding the problems facing by the tea garden worker for their identity and rights. He pointed that tea community in Assam has never received any attention for boosting their development.

Jain (2011) identified some major factors as being responsible for India’s poor performance of tea industry are high input costs, the old age of the bushes, unskilled labour, and lack of infrastructure, poor price realization, legal problems, outdated machinery, high fixed and labour cost, inefficient Tea Board, inability to

compete with other tea producingnations in terms of price, quality, packaging, etc.
Sabhapondit (2011) found that Indian tea industry facing several challenges. Nearly 50 percent of tea bushes in the plantations are more than 50 years old. This factor leads to decline in productivity.
Bhadra (1991) highlighted on her topic "Ethnicity and Inequality among the Workers of the Tea Industry in West Bengal" that in plantation society ethnic identity is generally acquired by birth. Here ascription is the key characteristic that distinguishes ethnic identity. Only religious conversion is possible in some cases, Catholicism was easily accepted as the religion of some of the tribals because it was and still is structurally similar with the indigenous animistic religion. The belief in ancestral spirit was simply replaced by belief of saints who could also be manipulated for assistance through prayer and specific rituals.

3. Sources

To study the status of tea industry in Assam and India primarily secondary data has been used which were collected from different reports, journals, and statements. Time series data from the year 1992-2016 on production, area and average yield has been collected from the followingsources which are mentioned below-

- Tea Statistics published by Tea Board, Kolkata
- Economic Survey, Assam published by the Directorate of Economics and Statistics, Government of Assam.
- Tea Industry and It's Place in Assam's Economy.
- Tea Statistics of Assam India, 2001-2016, NEDFI Databank.

4. Materials and Methods:

The nature of this study is mainly descriptive, quantitative and analytical. Graphical representation of the variables; production, area and productivity are performed. Graphical representation of production is shown with the help of a line graph and for area and productivity bar graph has been used.
To assess the tea production, average yield and cultivated area in Assam and India, we calculate the descriptive measures of central tendencies and dispersion like mean, standard deviation, coefficient of variation, etc. We calculate the descriptive measures follows:

- Mean = $\sum \frac{Y_t}{n}$, Where Y_t is the time series variable which takes different values over a period of time and n is the number of observations.
- Standard Deviation = $\sqrt{\sigma^2}$ where σ^2 is the variance.
- Coefficient of variation = $\frac{\text{Mean}}{\text{Standard Deviation}} \times 100$
- Skewness = $\frac{\mu_3^2}{\mu_2^3}$ where μ_2 and μ_3 are the 2nd and 3rd central moments.
- Kurtosis = $\frac{\mu_4}{\mu_2^2}$ where μ_2 and μ_4 are the 2nd and 4th central moments.

To study the future trends we use the Autoregressive Integrated Moving Average (ARIMA) model. The ARIMA methodology is also known as Box-Jenkins methodology. An ARIMA model is a class of statistical models for analysing and forecasting time series data. This acronymis descriptive, capturing the key aspects of the model itself. Briefly, they are:

- AR: *Auto regression*. A model that uses the dependent relationship between an observation and some number of lagged observations.
- I: *Integrated*. The use of differencing of raw observations in order to make the time seriesstationary.
- MA: *Moving Average*. A model that uses the dependency between an observation and aresidual error from a moving average model applied to lagged observations.

Each of these components are explicitly specified in the model as a parameter. An ARIMA model is characterized by 3 terms: p, d, q, where

- p: The number of lag observations included in the model, also called the lag order or order of the AR term.
- d: The number of times that the raw observations are differenced, also called the degree ofdifferencing.
- q: The size of the moving average window, also called the order of moving average.

It is a forecasting algorithm based on the idea that the information in the past values of the time series can alone be used to predict the future values. As most time series are non- stationary in nature so the first

step of Box-Jenkins model is to convert the non-stationary series to a stationary series through differencing as the ARIMA model refer to only stationary time series. The procedure for ARIMA modelling is shown below:

Autoregressive Process: Let Y_t be a discrete time series variable which takes different values over a period of time. A pure AR model is one where Y_t depends only on its ownlags i.e. Y_t is a function of the 'lags of Y_t'.

$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \in_t$
where Y_t is the response variable at time t; $\alpha, \beta_1, \ldots, \beta_p$ are the coefficients and $\in_t$ is the error term.

Moving average Process: A pure MA model is one where Y_t depends only on the lagged forecast errors.
$Y_t = \alpha + \in_t + \emptyset_1 \in_{t-1} + \emptyset_2 \in_{t-2} + \ldots\ldots + \emptyset_q \in_{t-q}$

where $\emptyset_1, \ldots, \emptyset_q$ are the coefficients of the estimated error term and $\in_t$ is the error term. Combining both the models to form the ARIMA model which is written as –
$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_p Y_{t-p} + \in_t + \emptyset_1 \in_{t-1} + \emptyset_2 \in_{t-1} + \ldots\ldots + \emptyset_q \in_{t-q}$

5. Graphical Representation

5.1 Production

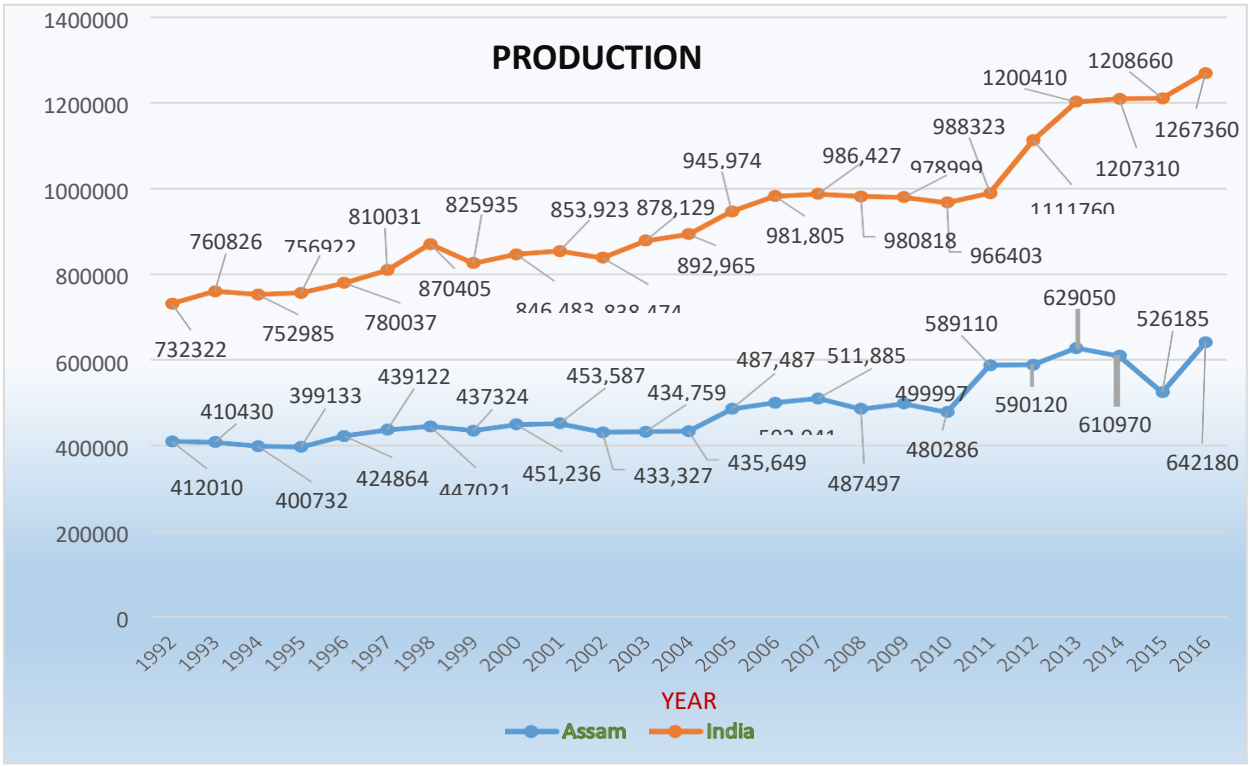

Figure 1

From the above graph we see that from 1992-1995, tea production in India and Assam were almost constant i.e. 75000 Kg and 40000 Kg respectively. From 1996-2001 we see a steady growth in production of Assam Tea whereas the production of India dropped from 870405 Kgin 1998 to 825935 Kg in 1999.

Assam tea dropped to 487497 Kg in 2008 from 511885 Kg in 2007. From 2002-2008 we can see an increase in the production of tea in India. From 2009- 2016 we can see a continuous growth in the production for both Assam and India except for the year 2015 when tea production of Assam had a drop from 610970 Kg to 526185 Kg.

5.2 Area

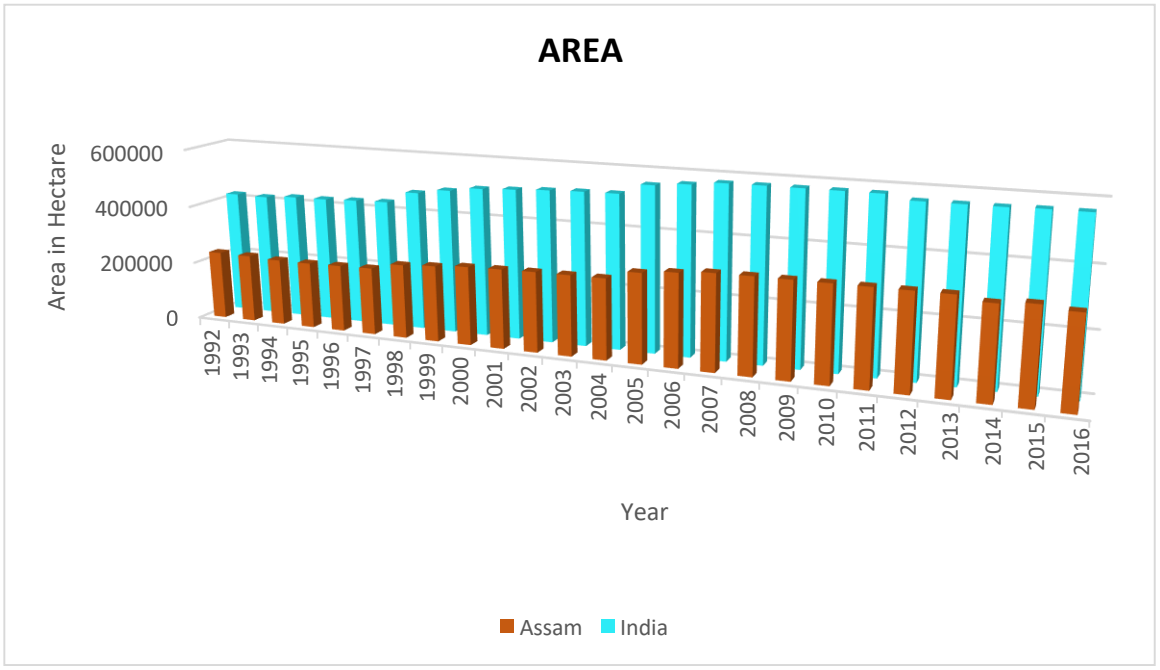

Figure 2

From the above graph it can be clearly seen that the area for production had an increase from 1992-2011 both for Assam and India. In 2012 there was a slight drop from 579353 hectare to 563979 hectare in India and there was a drop in Assam in the year 2014 from 322210 hectare to307080 hectare.

5.3 Average Yield

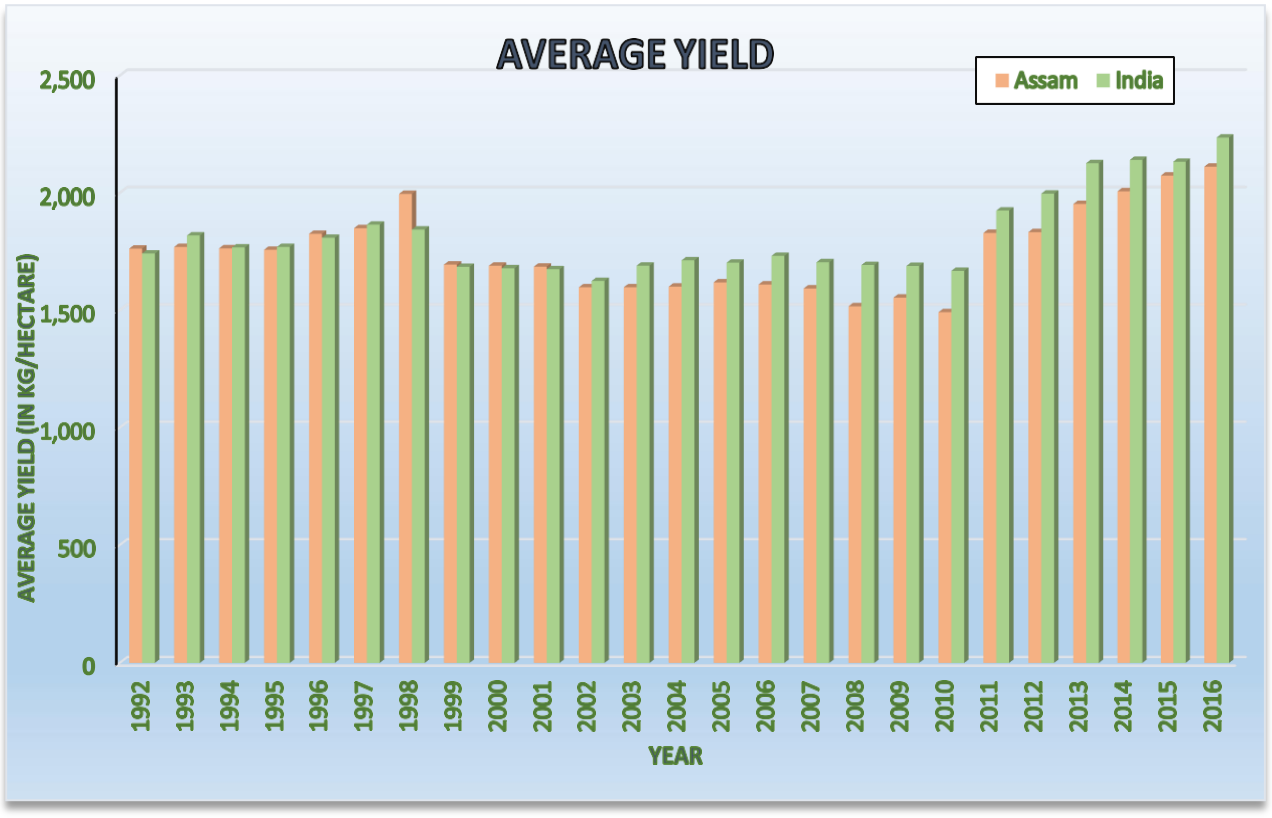

Figure 3

From the above bar graph we see that productivity/ average yield of tea in India and Assam increased from 1795-1844 kg/ hectare in India and 1719-1996 kg/hectare in Assam from the year 1992-1998. In 1999

productivity dropped to 1695 for Assam and 1685 for India. The productivity for both Assam and India continued to drop till the year 2002. Productivity of both India and Assam remained almost the same from 2003-2007. From the year 2011- 2016 we can see a steadygrowth in the average yield of tea in Assam as well as in India.

6. Descriptive Statistics

Table 1: Descriptive Statistics for studying the status of tea in Assam and India

DescriptiveStatistics	Production(in '000 kg)		Area (in hectare)		Average Yield (kg per hectare)	
	Assam	India	Assam	India	Assam	India
Mean	485440.1	936947.4	281284.6	517493	1751.56	1817.32
Maximum	642180	1267360	322314	579353	2112	2236
Minimum	399133	732322	226280	418363	1492	1625
StandardDeviation	73805.25	157400.8	37404.85	60355.23	174.8137	175.7196
Coefficient ofVariation	15.31	16.93	13.30	11.66	9.98	9.67
Skewness	0.85886	0.69617	-0.24427	-0.54689	0.506194	1.143763
Kurtosis	2.533449	2.450943	1.498949	1.756075	2.299063	3.017296

The above table shows the descriptive statistics corresponding to production, area and average yield of tea in Assam and India. The maximum unit of tea produced in Assam is 642180 thousandkg while the minimum is 399133 thousand kg. On average 936947.4 thousand kg of tea was produced in India during the period of study. The average area under tea in Assam and India is 281284.6 hectare and 517493 hectare respectively. Average yield of tea in Assam is 1751.56 kg/hectare and varied between 2112 kg/ hectare and 1492 kg/hectare while in India it is 1817.32 kg/ hectare and varied between 2236 kg/hectare and 1625 kg/hectare. The coefficient of variationfor the production variable for Assam and India is 15.31% and 16.93 % respectively which meansthat there is less variability in the data for production in Assam as compared to India. Similarly for the area variable we can say that variability for India is less than that of Assam. Positive kurtosis and negative skewness indicate an uneven increase in the cultivated area of tea throughout the period.

7. Forecasting of production, area and average yield

7.1 Augmented Dickey Fuller Test

For forecasting the variables under study i.e. production, area and average yield of tea in Assamand India, the Autoregressive Integrated Moving Average (ARIMA) model is used. The annual data of tea production, cultivated area and average yield in the period 1992-2016 were used for forecasting the future values. Since the ARIMA model is used for stationary time series data weperform the Augmented Dickey Fuller (ADF) Test to check the stationarity of the time series data. It tests the null hypothesis that a unit root is present in a time series sample against the alternative that the time series is stationary. The ADF tests results both for Assam and India areestimated with level and difference at 5% level of significance. The estimated results are shownin Table 2 below.

Table 2: Augmented Dickey Fuller Tests

Variable		Level		First Difference		Second Difference	
		Test statistic	p value	Test statistic	p value	Test statistic	p value
Production	Assam	-3.3609	0.08321	-5.838	0.01		
	India	-1.3412	0.8234	-3.9572	0.0247		
Area	Assam	-0.67145	0.9607	-3.8786	0.0301		
	India	-0.35855	0.9811	-3.8464	0.0324		
Averageyield	Assam	-0.70937	0.9576	-2.4573	0.3982	-3.7438	0.03973
	India	-0.68224	0.9598	-2.7628	0.2818	-3.1811	0.1225

From the above table, we can see that the variables production, area and average yield for both Assam and India is found to be non- stationary in all the three cases as the null hypothesis of theADF test is accepted at the 5% level of significance. This implies that the variables have a time-varying mean or a time-varying variance or both. Since for forecasting with ARIMA model we require a stationary time series data, so we convert the non-stationary time series to a stationarytime series by further differencing. And we can see from

Table 2 that at the first difference production and area of tea becomes stationary as the null hypothesis is rejected at 5% level of significance for Assam as well as India whereas the average yield of tea becomes stationary at the second difference for Assam.

7.2 Box- Jenkins ARIMA model

The Box- Jenkins forecasting model involves the following steps which are discussed below:

Identification: The first step of applying Box- Jenkins forecasting model is to identify the appropriate order of the ARIMA (p,d,q) model. The order of p, d and q can be estimated with the help of auto. arima function present in the forecast package of the R program or with the helpof the autocorrelation function (ACF) and partial autocorrelation function (PACF). The ACF function determines the order of q and the PACF function determines the order of p. Also, the order of d can be can be estimated through the process of the Augmented Dickey Fuller Test.

Estimation of the model: The next step is to estimate the parameters of the autoregressive movingaverage terms included in the model. The regression model is estimated with the maximum likelihood estimation method.

Diagnosis: The last step is to check whether the fitted ARIMA model is a good fit or not. AkaikeInformation Criterion (AIC) values, Bayesian Information Criterion (BIC) values and Mean Absolute Percentage Error (MAPE) values are used to obtain the optimal ARIMA model.

Table 3: Best Fitted ARIMA Model

Variable		ARIMA (p,d,q)Model	AIC values	BIC values	MAPE
Production	Assam	0,1,1	576.49	580.02	5.137608
	India	0,1,0	574.75	577.1	2.639714
Area	Assam	0.1,0	508.77	511.12	2.108181
	India	0,1,0	519.99	522.34	1.418879
Average Yield	Assam	0,2,1	287.69	289.96	3.25674
	India	0,2,1	271.35	273.62	2.63313

Akaike Information Criterion (AIC) is a fined technique based on in-sample fit to estimate the likelihood of a model to predict/estimate the future values. AIC estimates the relative amount ofinformation lost by a given model: the less information a model loses, the higher the quality of that model. Bayesian Information Criterion (BIC) is a criterion for model selection among a finite set of models. It is based in part on likelihood function. BIC difference of 0-2 is defined asweak; 2-6 as positive; 6-10 as strong and greater than 10 as very strong. As in the above Table 3it can be seen that the BIC values are much greater than 10 for all the cases so we can say that both the models for Assam and India are very strong. Another criteria that is used for model selection is the Mean Absolute Percentage Error (MAPE) which expresses accuracy as a percentage of the error. It is the most commonly used statistics in all types of forecasting. It measures the average relative size of the absolute forecasting error as a percentage of the corresponding demand value, irrespective of whether the forecasting error is positive or negative. MAPE value less than 20% is good and MAPE value less than 10% is excellent. As the MAPE value both for Assam and India for production, area and average yield of tea is less than 10% shows that the models are very good fit. Hence, the fitted ARIMA models are the best fit.

7.3 Forecasting

After obtaining the best fitted ARIMA model, we find the future values by estimating the appropriate model devoid of problems. The forecasted values obtained from the ARIMA modelare shown in the Table 4 for the next 20 years i.e. till 2036.

Table 4: Forecasted Values of Production, Area & Average Yield

Year	Production (in '000 kg)		Area (in hectare)		Average Yield(Kg/hectare)	
	Assam	India	Assam	India	Assam	India
2017	616681.7	1289653	307347.6	572758.8	2148.053	2288.298
2018	625559.5	1311946	310295.2	578857.6	2184.107	2340.596
2019	634437.3	1334240	313242.7	584956.4	2220.160	2392.894
2020	643315.1	1356533	316190.3	591055.2	2256.213	2445.192

2021	652192.9	1378826	319137.9	597154.0	2292.267	2497.490
2022	661070.6	1401119	322085.5	603252.7	2328.320	2549.788
2023	669948.4	1423413	325033.1	609351.5	2364.374	2602.086
2024	678826.2	1445706	327980.7	615450.3	2400.427	2654.384
2025	687704.0	1467999	330928.2	621549.1	2436.480	2706.682
2026	696581.8	1490292	333875.8	627647.9	2472.534	2758.980
2027	705459.6	1512586	336823.4	633746.7	2508.587	2811.278
2028	714337.3	1534879	339771.0	639845.5	2544.640	2863.576
2029	723215.1	1557172	342718.6	645944.3	2580.694	2915.875
2030	732092.9	1579465	345666.2	652043.1	2616.747	2968.173
2031	740970.7	1601759	348613.7	658141.9	2652.801	3020.471
2032	749848.5	1624052	351561.3	664240.7	2688.854	3072.769
2033	758726.3	1646345	354508.9	670339.5	2724.907	3125.067
2034	767604.0	1668638	357456.5	676438.2	2760.961	3177.365
2035	776481.8	1690932	360404.1	682537.0	2797.014	3229.663
2036	785359.6	1713225	363351.7	688635.8	2833.067	3281.961

From the forecasting values we can see that there will be increase in production, cultivated area and yield of tea both in Assam and India for the next 20 years. The graphical representation of the future values for Assam and India are shown below in Figure 4, Figure 5 and Figure 6 respectively.

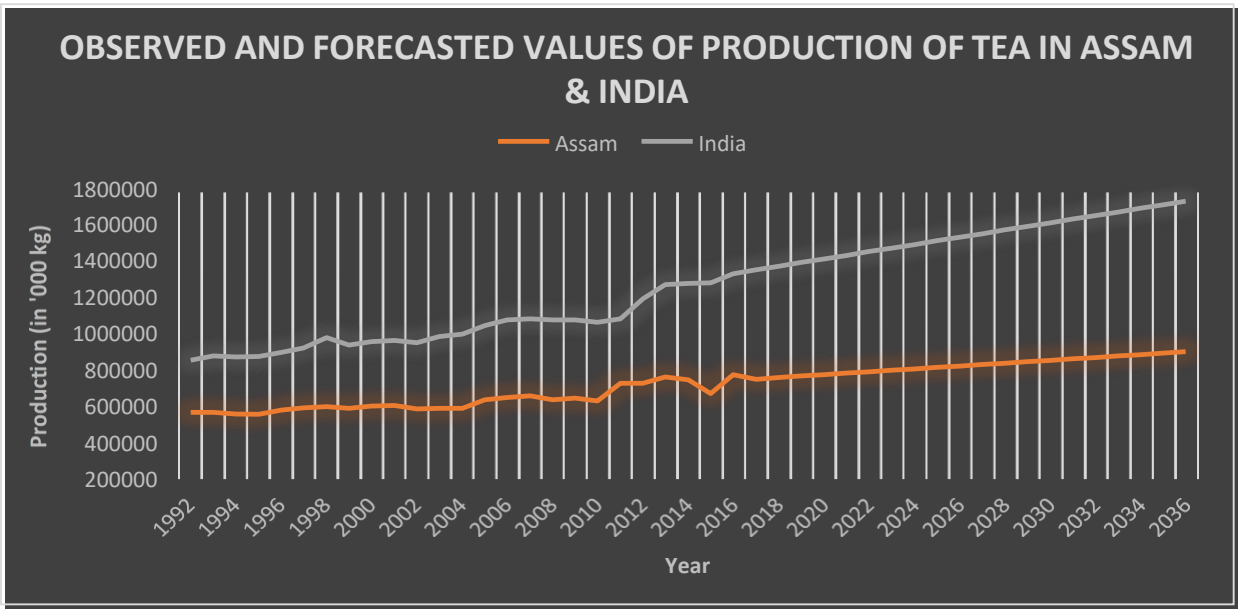

Figure 4

From the above graph it can be seen that the production of tea for both Assam and India had an increasing trend almost from 1992 till the year 2008. During the period 2009-2016 the productionwas unsteady which may be due to various factors. But it can be clearly seen from the graph thatthe forecasted values from 2017-2036 shows an increasing trend in the production of tea in Assam and India.

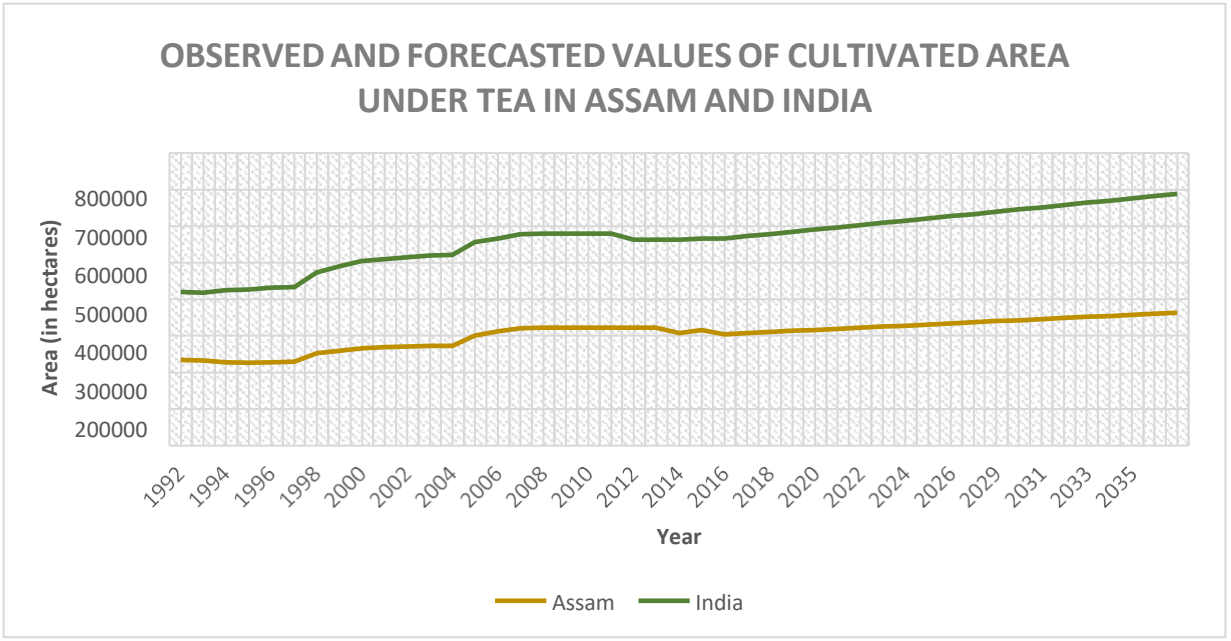

Figure 5

From the graph shown in figure 5 we can see that the cultivated area under tea for Assam andIndia shows almost a similar trend pattern from 1992 – 2016. And the forecasted values from 2017– 2036 shows a steady increase in the cultivated area of tea both in Assam and India.

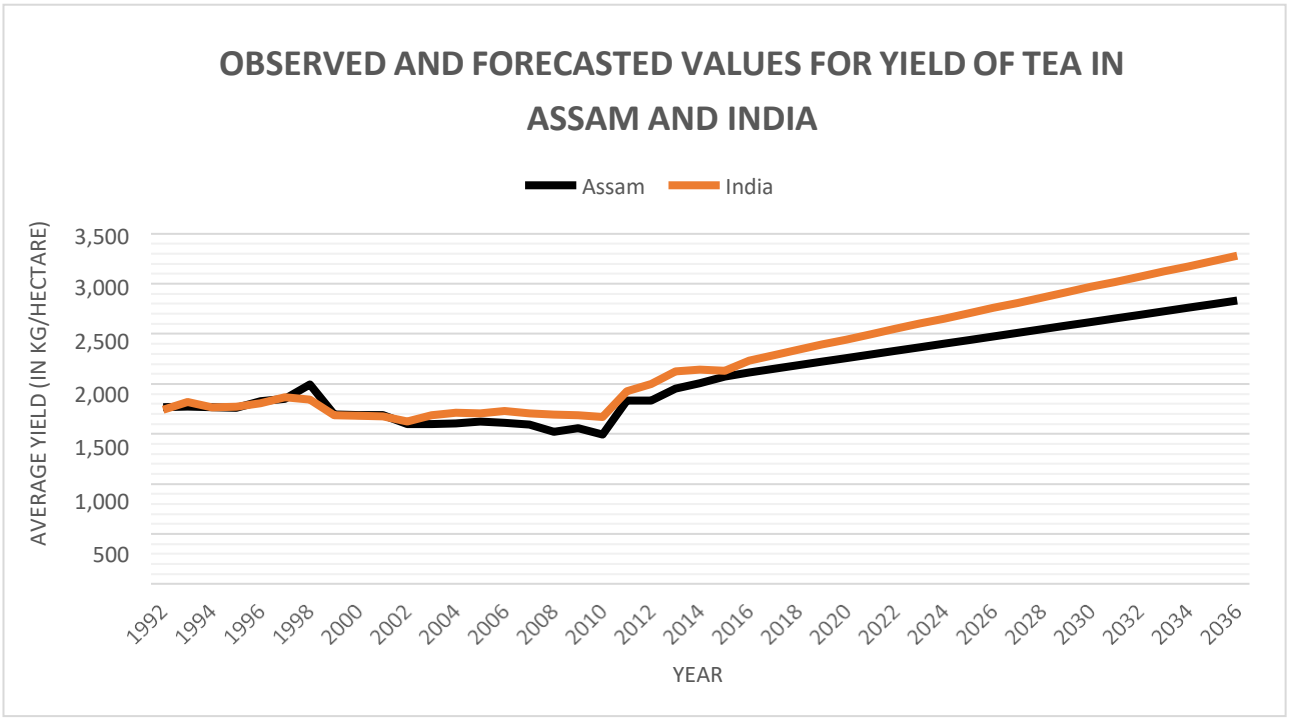

Figure 6

We can clearly see from the above graph that the values for the average yield of tea are almost thesame for Assam and India as the two lines in the graph overlap with each other during the period1992 – 2016. Both the forecasted values for Assam and India shows an increasing trend with the average yield for India slightly more than the average yield of Assam for the forecasted years, 2017 – 2036.

8. Discusion and Conclusion

It is found in the study that there existed disparity in tea production and area which might be the result of many seen and unseen factors available in the region. To study the future prospects of tea industry both in

Assam and India, the ARIMA model has been used. Using the past data pattern, the future trend of the production scenario for the next twenty years has been forecasted. It has been found that all the three variables viz. production, area and average yield of tea in Assam and India will increase in the next twenty years which is a positive sign for the tea industry where the demand of tea is rising day by day with the increase in population consuming tea. This will also increase the revenue earnings of Assam as well as India. Tea industry is undergoing a process of modernisation, which will considerably transform the economies of India. The tea industry has a good potential in domestic market. The international market should be explored by the tea industryfor value added products. Moreover, the government should take special care so that the tea growers receive a stable price throughout the year. There are some inherent problems that are linked with the industry, therefore due attention is required to remove the hurdles of the tea industry to grow tea leaves.

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