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Production of Non-Estate Tea Sector in Assam

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Abstract: The state of Assam is well known for tea production and among all the tea producing states in India it alone contributes more than 50% of total tea production. Production of tea includes agricultural operations as well as processing and manufacturing and hence it can be placed in both agriculture and industry. Tea has immense potential in generating income and employment. Though the history of Assam Tea is more than 180 years old, the participation of local people in this sector was very limited. Earlier establishment of a tea garden was thought to be a capitalist activity requiring massive investment. It is only in the late 1980s, local Assamese people came to know that tea plantation can be profitably undertaken even in small scale with low capital investment. This paved the way for the educated unemployed youth of Assam to undertake tea plantation in small scale. Since then tea plantation in small scale in Assam grew gradually complementing estate gardens by supplying green tea leaves. In the late 1990s due to various constraints, the estate sector tea production in Assam experienced low productivity with declining tea acreage. This has further pushed the rapid growth of small tea growers. The estate gardens of Assam also became more dependent in procuring green tea leaves from the tea smallholding by offering high price. During the period 1996-98 small tea growers of the state received as high as Rs. 22/- per kg of green leaves which did not last very long. Due to various reasons price of produce of small tea growers has fallen sharply after the year 2000. Since then though acreage and productivity of small tea growers shows continuous growth, the growers often complain about low price for their produce. In this paper an attempt has been made to analyse the trend of tea acreage, production and price received in the non-estate sector tea production in Assam.

Keywords: Tea, Estate sector, Agricultural operations Non-Estate sector, productivity, price, small tea growers.

I. INTRODUCTION

Tea, itself has a glorious journey since its discovery and it continues to be the most consumed beverage in the world. The world production and consumption of tea shows an increasing trend in the recent years. In year 2013, world tea production increased by 6% to 5.07 million tons from 4.78 million tons in year 2012. Again world tea consumption has risen by nearly 5% in year 2013 to 4.84 million tons from 4.63 million tons in year 2012 (FAO, 2015).

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World tea export has risen to 1.77 million tonnes in 2013, a 5 percent increase compared to 1.69 million tonnes in 2012. It shows the dominant place of tea in the world's market of beverages.

Tea plantation in small scale is very ancient. It is considered to be a usual practice in some major tea producing countries like China, Japan, Indonesia, Kenya, and Sri Lanka etc. In China, tea was cultivated in family holdings from ancient past (Goswami, 2006). It is noteworthy that, there is no big tea estate in Japan. Entire tea production comes from the STGs. The average size holding of STGs in Japan are 0.01 hectare to 2 hectares. The practice of STGs is also adopted in some other countries like Malawi, Turkey, Vietnam, Tanzania, Bangladesh, Pakistan, Nepal, etc. Though the practice of tea cultivation in small scale was very ancient, it was mainly popularized by Kenya in 1950's by taking the decision to produce large quantity in small scale for export.

Cultivation of tea in smallholding was an old practice in India. Tea growing in smallholding started in Nilgiris of Tamil Nadu in 1920's. At that time large estates were granted a specified area of land by government thus, they were unable to expand their area of plantation. Because of that some of large plantation encouraged small farmers in Nilgiris to take up tea cultivation to supply green leaves to them. Small growers were further induced in 1933 due to introduction of export quota system by the government as a repercussion of the Great Depression in 1931. However, some of the reports and studies of various committees constituted by the government from time to time suggest that tea smallholdings emerged in early 1960's in India and they were mainly concentrated in Tamil Nadu, Karnataka and Kerala. The concept of small tea growers emerged in Assam and other north eastern states, West Bengal and others in the late 1980's or early 1990's only. Though, tea cultivation in small scale in India took its pace very recently but within a very short span of time it has shown a phenomenal growth in terms of growers, area and production. Estimated data provided by North Eastern Development Finance Corporation (NEDFI-2015) shows that there were about 2,00,000 STGs cultivating tea in around 1,60,000 hectares of land and contributed 374.910 million KGs of made tea to the total production of India.

Among all the tea producing states, Assam alone contribute more than 50% to the total tea production in India. Tea industry in Assam has a long history of more than 180 years, but tea plantation in smallholding is comparatively a recent development in Assam and its neighbouring states. The concept of tea plantation in small scale was not heard till 1975 in Assam and other north eastern states. The first commercial tea plantation in small scale in Assam was started in Golaghat district in 1978 (Borah and Das, 2015). In the year 1978, there were 16 small tea growers with 60.836 hectares of plantation area.

Since then tea smallholding in Assam has shown a phenomenal growth with a continuous increase in number, area of plantation and production.

The growth is further boosted during 1990's due to the good prices for green leaves prevailed in years 1996-98 (Hannan, 2013). Started with 16 STGs in 1978, the tea smallholding continues to increase every year and reached to 118832 Nos. of STGs which are operating with plantation area of 83880 hectares of land (AASTGA, 2015). The suitable weather condition and availability of highlands in Assam encouraged the young generation to start tea plantation in smallholding as a source of self employment. It provides a sustainable income for a long term with comparatively less investment. As estate sector of Assam was already developed thus, the availability of existing infrastructures like technology, processing facilities, skilled manpower and market for the produce highly induced the rapid growth of small tea gardens. Apart from these reasons Mudoi and Dutta (2016), identified that social prestige gained from tea plantation is the another reason which has attracted new generations to this field of cultivation. They want to be recognized as entrepreneur as tea plantation has the characteristics of an enterprise because it includes all elements required for an enterprise i.e. land, labour capital and organization and thereby making a tea cultivator an entrepreneur.

Tea plantation in the non-estate sector i.e. small tea growers sector is now a day transforming the rural subsistence economy in to a modern self sustained economy which is providing sufficient income and employment to educated unemployed youths of Assam. Large numbers of STGs are coming in to existence with developing new area of plantation in the recent past years. With the increase in number and area of plantation production of green leaves by the STGs of Assam is also increasing every year. While a production cost is rising day by day, the more or less static price of green leaves over the years is a major concern for the growers.

Against this backdrop an attempt has been made to forecast future values of area of plantation, production and price of green leaves based on the secondary data available for small tea growers in Assam.

II. MATERIALS AND METHODOLOGY

A. Data

This study is based on secondary data collected from various sources. The tea board of India (TBI) has started to recognise a tea grower having plantation area up to 10.12 hectares as small tea growers segregated small tea garden and estate gardens from ninth plan period. TBI started to present segregated statistics for tea smallholding and estate sector since 1998 and state wise segregated data were available up to 2008. Beyond 2008 state wise segregated data of tea smallholding or non estate sector and estate sector regarding area and production are not published by TBI. As such there is lack of concrete data on Non-estate tea production in Assam. Hence apart from sources like Tea Board of India, North Eastern Development Finance Corporation (NEDFI), Government of Assam survey reports, Statistical Handbook of Assam, All Assam Small Tea Growers' Association (AASTGA), various published and unpublished research works, Newspapers etc., some of the missing data were estimated regarding area of plantation and production of green leaf with the help of exponential growth trend as stated-

$\text{Log } Y_t = a + bt$

Where, Y_t = the variable under consideration

a =constant

b= growth rate to be estimated, t= time point

To analyse the price trend, the nominal price received by the small tea growers are converted in to real price. For calculation of real price received by the small tea growers of Assam, the consumer price index provided by the Directorate of Statistics of Assam is used where the year 1999-2000 is used as the base year. The formula used for converting nominal price in to real price is given by-

$$RP_t = \frac{\textit{Nominal price of year t}}{\textit{Consumer price index of year t}/100}$$

B. Analytical Tool

Autoregressive Integrated Moving Average (ARIMA) model is used to forecast future values of the variables i.e., area of plantation, production of green tea leaves and yield which are considered in the present study. For this purpose annual data on area of plantation, production of green leaves and yield for the period 2000 to 2015 were used as past trends. The ARIMA methodology is also known as Box-Jenkins methodology which is concerned with identifying the stochastic process of the time-series and predicting the future values accurately. The ARIMA method includes two processes viz. Autoregressive process and Moving Average process.

Autoregressive process: The autoregressive process is a process where each observation is made up of a random component and a linear combination of prior observations (Chitra, N. et al, 2015). If Y_t is a discrete time series variable which can take different values over a period of time then the autoregressive process can be specified as-

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_p Y_{t-p} + \varepsilon_t$$

Where, Y_t is the response variable at time t,

Y_{t-i} are lagged dependent variables, i =1,2,.........,p

$\alpha_0, \alpha_1, \alpha_2, \ldots, \alpha_p$ are parameters

Moving Average process: Independent from the autoregressive process, each element in the series can also be affected by the past error that cannot be accounted for by the autoregressive component, that is:

$$Y_t = \mu_t + \varepsilon_t + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} + \ldots + \beta_q \varepsilon_{t-q} + \nu_t$$

Where, μ_t is the constant mean of the series, $\beta_1, \beta_2, \ldots, \beta_q$ are the coefficients of the estimated error term, ν_t is the random disturbance term.

The combination of the two processes gives the Box-Jenkins autoregressive integrated moving average process which can be specified as-

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_p Y_{t-p} + \varepsilon_t + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} + \ldots + \beta_q \varepsilon_{t-q} + ut$$

III. ARIMA FORECASTING

ARIMA forecasting model is applied for stationary data and involves four steps which are discussed below-

A. Identification of appropriate order

Box-Jenkins ARIMA methodology is concerned with identifying the stochastic process of the time-series and predicting the future values accurately. A stochastic process is either stationary or non-stationary. The Box-Jenkins ARIMA process deal with stationary time series only and hence the first step in Box-Jenkins method is to reduce non stationary series in to stationary series. That is, the input series must have constant mean, variance and autocorrelation through time. Therefore, the non-stationary series needs to be differenced until it is stationary. The number of times needs to be differenced to achieve stationarity is termed as order of difference and indicated by '*d'*. The most commonly used tool to test stationarity is the Unit Root test. At this stage the number of autoregressive (*p*) and moving average (*q*) parameters are also needs to be determined which is necessary to yield an effective but still parsimonious model of the process. Commonly used tools in model specification and selection of order *p* and *q* involve plotting of autocorrelation function (ACF) and partial autocorrelation function (PACF) against the lag length. The ACF function specify the order of moving average, *q* and the PACF function specify the order of autoregressive process, *p*.

The three types of parameters in the model i.e. the autoregressive parameters (p), the number of differencing passes (d), and moving average parameters (q) gives the order of the ARIMA model and thus the Box Jenkins ARIMA model is expressed as ARIMA (*p, d, q*).

B. Model Estimation

After identifying the order *p, d and q* the next step is to estimate the parameters of the autoregressive and moving average terms considered in the model. This can be done by ordinary least square regression method. The significance of each coefficient can be tested by t- test and jointly together by F-test.

C. Diagnostic checking: In the third step it needs to be diagnosed whether the chosen ARIMA model fits the data which is done by checking the residual term obtained from the ARIMA model by applying the same ACF and PACF functions. Adjusted R^2, Bayesian information Criterion (BIC) or Schwarz Criterion values and Mean Absolute Percentage Error (MAPE) values are generally used to obtain the optimal ARIMA model.

D. **Forecasting:** In the last step future values of the variable included in the model can be forecasted by using the estimates of the parameters.

IV. RESULTS AND DISCUSSION

A. Results of Model Estimation

Autoregressive integrated moving average method is used to forecast future values of the variables viz. area of plantation, production of green leaves and real price received by the STGs in Assam. In this study 16 years annual data on area of plantation and production for the period 2000-2015 were used for future projection and tried to forecast future values of the variables for another ten years i.e. up to 2025. Again for real price the nominal price data of the period 2000 to 2015 are used for forecasting. Since the ARIMA method deals with stationary series only thus, stationary test has been undertaken for the three data series included in this study. For this Augmented Dickey-Fuller (ADF) test is applied to check stationarity of the three series. The null hypothesis taken is that the variable contains a unit root and the alternative is that the variable was generated by a stationary process. The ADF test results for the three series are presented in the table-I.

Table-I: Augmented Dickey-Fuller estimates

Variables	Level		First difference		Second difference	
	Intercept only	Trend and intercept	Intercept only	Trend and intercept	Intercept only	Trend and intercept
Area	4.699 (1.00)	2.270 (1.00)	1.131 (0.995)	-3.255 (0.114)	-5.642 (0.0007)*	-4.758 (0.019)**
Production	4.048 (1.00)	1.493 (0.999)	-0.431 (0.876)	-5.324 (0.004)*	-4.161 (0.009)*	-4.795 (0.013)**
Real Price	-3.545 (0.0259)**	-3.242 (0.123)	-3.874 (0.0126)**	-3.692 (0.0585)		

Figures within (..) Represent probability values of test statistics.
**, ** represent level of significance at 1% and 5% respectively*

From the ADF estimates of the variables it is observed that the two variables viz. Are and Production are non-stationary at level and at first difference, both including and excluding the trend term along with constant or intercept values. The two series become stationary only in the second difference. However, the variable real price is stationary at level and first difference without the trend term.

After identifying the order of differencing to make the series stationary the next step of ARIMA method is to identify number of autoregressive (AR) parameters and moving average (MA) parameters to be estimated for each series. Identification of the order of AR (*p)* and order of MA (*q*) needs plotting of autocorrelation functions (ACF) and partial autocorrelation functions (PACF) of each series. The ACF identifies the order of MA and the PACF identifies the order of AR. For ACF and PACF, Correlogram is the chief tool which is used in this study.

After identification phase the next step is to estimate the parameters of AR and MA terms included in the model. The estimates of best fitted ARIMA model for each series are reported in the table-II.

Table-II: Best fitted ARIMA model for Area, Production and Price received of STGs in Assam.

Variables	ARIMA (*p, d, q*) model	Adjusted R^2	F	AIC	BIC
Area (in hectares)	(0, 2, 2)	0.5041	5.405**	18.911	19.0945
Production (in Mn. KGs)	(1, 2, 1)	0.6373	8.615*	11.777	11.760
Real Price (in Rs./KG)	(4, 0, 2)	0.8830	17.178*	1.626	2.012

**, ** represent level of significance at 1% and 5% respectively*

The estimated results need to be diagnosed whether the chosen ARIMA model fits the data well. In this regard the adjusted R^2, the F-statistic, Akaike Information Criterion, Bayesian Information Criterion etc. helps in choosing the optimal ARIMA model.

The adjusted R^2 is used to check whether the model is a good model or not. It is used to indicate how well the independent factor explains the variations in the dependent variable. In this study the adjusted R^2 value in all the three models are greater than 50%.

Thus all these three models can be considered more or less good fit. The F-statistic represents joint significance of coefficients of a model and F-statistics for all the models were found significant at 1% and 5%. The idea of Akaike Information Criterion (AIC) is to select the model that minimises the negative likelihood penalised by the number of parameters (Acquah, 2010).

AIC is aimed at finding the best approximating model to the unknown true data generating process. In the present study the AIC values of selected models for each variable are the minimum among all other alternative models. The BIC values also provide information in selecting the best model. BIC is designed to find the most probable model given the data. If the BIC value for a variable equals or falls below zero, the data provide little support for including the variable in the model (Mech, 2017). The BIC difference 0-2 is termed as weak, 2-4 is positive, 6-10 is defined as strong and greater than 10 is defined as very strong in selecting a model. In the present study the BIC values of the selected models for area of plantation and production of green tea leaves are greater than 10 and thus, these two models can be termed as very strong and can be used for forecasting purpose. On the other hand, though the BIC value of the selected model for the real price is low but it is still positive for selecting the model and can be used for forecasting future values.

The final step of ARIMA method is to forecast future values of a variable taken in to consideration with the help of the estimated model. The forecasted values of all the three variables for years 2016 to 2025 obtained from the estimated ARIMA models are presented in the table-III.

Table-III: Forecasted values of Area, Production and Price to be received by STGs of Assam.

	Area of Plantation (in hectares)	Production of Green Leaves (in Mn. KGs)	Real Price of Green leaves (in Rs. per KG)
2016	90076	1156.90	5.624
2017	100733	1339.30	**6.652**
2018	112026	1498.82	7.178
2019	123954	1686.98	7.301
2020	136519	1879.28	7.666
2021	149720	2087.38	7.304
2022	163556	2305.72	6.557
2023	178029	2536.96	6.168
2024	193137	2779.83	5.817
2025	208882	3034.93	5.760

From the table-III it has been observed that area of plantation, production of green leaves and price of green leaves will rise in coming years.

B. Results of Future Values: The time series plots of observed and forecasted values of all three variables are shown in following figures.

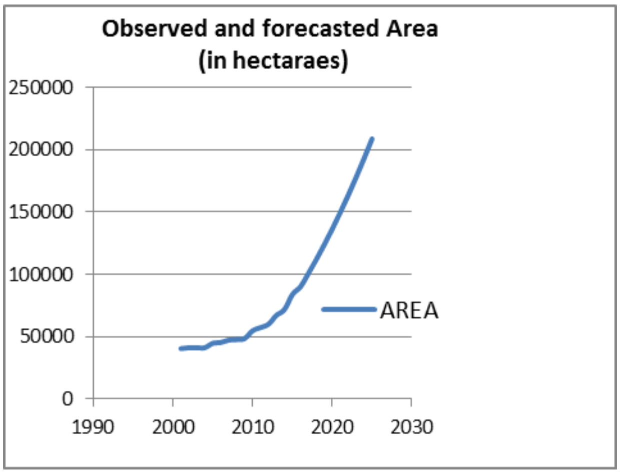

Fig-1: Observed and forecasted values of Area of plantation of STGs in Assam (From 2000 to 2025)

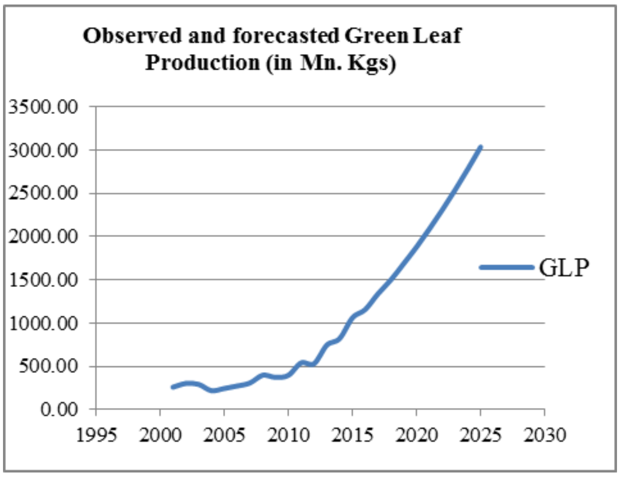

Fig-2: Observed and forecasted values of Green leaf production by STGs of Assam (From 2000 to 2025)

Fig-3: Observed and forecasted values of Real Price of Green leaf in Assam (From 2000 to 2025)

V. CONCLUSION

Based on the estimated results from the available data this study found that there will be increase in area of plantation and production of non-estate sector tea production in Assam. It is a good sign for the state of Assam that can increase employment opportunities and livelihood to many people, revenue earnings of the government etc. The domestic demand for tea in India is increasing with increase in population and per capita income. In this scenario STGs of Assam can play an important role in capturing the ever-growing beverage market of India and the world. The STGs in Assam are in advantageous position as there are plenty of suitable lands for tea cultivation and skilled manpower in tea plantation. Moreover, majority of small tea plantation Assam are below 10 years which can increase production for a series of years in future. However, amidst the prosperity in production the growers are not satisfied with the realised price that shows unwanted seasonality in a year. It can be observed from the trend of real price during the study period. The forecasted real price is not much encouraging for the small tea growers in Assam. Again most of the small tea growers are deprived of the benefits of TBI and government of Assam due lack of proper land possession documents. In this regard government has to take initiative in providing land possession and monitoring price situation in the state. The establishment of Small Tea Growers Directorate in 2013 is a positive step in providing support to STGs in various directions.

REFERENCES

1. All Assam Small Tea Growers' Association (AASTGA)
2. Acquah, H. (2010): "Comparison of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) In Selection of and Asymmetric Price Relationship", Journal of Development and Agricultural Economics, Vol. 2(1) pp. 001-006
3. Borah, K. and Das, A. (2015): "Growth of Small Tea Cultivation and Economic Independence of the Indigenous People of Assam", International Journal of Research in Social Sciences and Humanities, Vol-5, Issue No. I, P-82-93.
4. Borah, K. (2013): "Entrepreneurship in small tea plantation: a case study of Assam", The Echo-a journal of Humanities & Social science, Department of Bengali, Karimganj College.
5. Bhuyan, R.P. (2004): "Economic Analysis of Green Leaf Production-The Case of Small Tea Growers of Assam", A PHD Thesis submitted to AAU.
6. Chang, K. (2015): "World tea production and trade Current and future development", Food and Agriculture Organisation (FAO).
7. Chitra, N. et al (2015): "Application of Arima Model Using Spss Software - A Case Study in Supply Chain Management", International Journal of Science, Technology & Management, Volume No 04, Special Issue No. 01, p-206-216.
8. Das, K. (2014): "The Tea Smallholding of Assam-Search for Competitiveness and Inclusiveness", DVS Publishers, Guwahati-01.
9. G Goswami, M. (2006): "Emerging Entrepreneurship in Tea Plantation- A Study of Small Tea Growers of Assam", A PHD Thesis Submitted to the Gauhati University.
10. Government of Assam,(2013): A Type Study Report on the Economic Activities of Small Tea Growers in Assam, Directorate of Economics and Statistics.
11. Hannan, A. (2007): "Study on Cost of Production, Pricing of Green Leaf, and the Relationship of Small Tea Growers (STG) With Bought-Leaf Factories (BLF) and Auction Centres", Centre for Education and Communication (CEC), 173-A, Khirki Village, Malviya Nagar, New Delhi – 110017.

12. Hannan, A. (2013): "Organizational Innovations and Small Tea Growers (STGs) In India", NRPPD Discussion Paper 25.
13. Mech, A. (2017): "Status of Tea Production in Assam: Past Trends and its Future Projections", Journal of Open Learning and Reaserch Communication, Vol-III, P-45-56.
14. Mudoi, D.K. and Dutta, S. (2016): "Potential Factors behind the Rapid Growth of Small Tea Growers (STGs) In Golagaht District of Assam-An Analysis", International Journal of Business and Administration Research Review, Vol-2, Issue-1 P-98-102.
15. NEDFI Data Bank on Tea (2015).
16. Reddy, V. N. and Bhowmik, S. K. (1989): "Small Growers and Co-operative Tea Factories in Nilgiris", Economic and Political Weekly, Vol. 24, No. 39 (Sep. 30, 1989), pp. A145-A147+A149-A151.
17. Statistical Handbook of Assam (Various Issues).
18. Tea Board of India Statistics (Various Issues).

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