Growth of area, production and productivity of banana (*Musa Paradisiaca*) cultivation in Theni district, Tamil Nadu – An analysis by component elements

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**ABSTRACT**
Banana called as the “fruit of the wise men” is an important fruit crop cultivated widely and consumed by the majority of the population in India as well as in Tamil Nadu. Tamil Nadu is the largest producer of banana in India. In Tamil Nadu, Theni District holds first position in area under cultivation of banana followed by Coimbatore, Erode and Tuticorin districts. The study was undertaken to study the rate of growth of area, production and productivity of banana cultivation in Theni District, Tamil Nadu and to compute the relative contribution of area, yield and their interaction to the change in production of banana cultivation. The results of this study revealed that the yield effect (25%) had significant contribution in Tamil Nadu and area effect (59.46%) had significant contribution in the state as a whole in increasing the production of banana cultivation. In Theni district, it reveals that the yield effect (26.08%) had significant contribution and area effect (39.20%) had significant contribution in the district as whole in increasing the production of banana cultivation. Therefore, keeping the area as constant the productivity of horticultural crops can be further increased by taking appropriate production technologies.

**Key words:** Banana, Component elements, Compound Growth Rate (CGR), Decomposition analysis, Production.

Banana and plantain (*Musa Paradisicia*) are widely grown in India and are associated with the historical, economic and social fabric of Indian sub-continent. The banana called as the “fruit of the wise men” (Angles and Sundar, 2012). Banana is one of the oldest and the world’s most important fruit crops. It is a very popular fruit due to its low price and high nutritive value with rich source of carbohydrate and vitamins. It helps in reducing risk of heart diseases so, banana has and honourable place on the dining table of any common household.

It is a very good natural preservative and indispensable ingredient of Indian medicine system, like Ayurveda. All the parts of the plant are used hence banana is named as plant of virtues (Kalpatharu). (Basha and Jacob Stanely Inbaraj, 2013).

Banana is the fourth important food crop it terms of gross value. It is produced in 130 countries in tropical and sub-tropical regions of the world of mostly developing economics. India is one of the leading banana producers in the world. Leading banana producer countries other than India are Brazil, Ecuador, China, Philippines, Columbia, Indonesia, Sri Lanka, Costa Rica, Cameroon, Mexico, which are accounting for 57 per cent of world share. It is an important fruit crop cultivated widely and consumed by the majority of the population in India as well as in Tamil Nadu. Tamil Nadu has the maximum production of banana followed by Maharashtra and Andhra Pradesh. The production is also higher in Tamil Nadu followed by Maharashtra and Andhra Pradesh. The important banana cultivars such as, Virupakshi, Robusta, Red banana, Poovan, Rsthali, Nendran, Monthan, Karpooравalli, Sakkai, Peyan and Matti are cultivated in larger areas of Tamil Nadu.

In India, banana and plantain are widely grown in both tropical and sub-tropical regions comprising Kerala, Karnataka, Gujarat, Orissa, Bihar, Eastern Uttar Pradesh, West Bengal, Assam and North Eastern states with considerable socio-economic and cultural importance. (Sangolkar, 2012)

**Review of Literature:** Angles and Sundar (2012) studied the variability and decomposition analysis of banana in India and Tamil Nadu in post green revolution era. The main objective of this study was to study the changes in pattern of production, variability in area, production and yield of banana in Tamil Nadu and India. The results of the study revealed that the area and production of banana in Tamil Nadu and India had shown higher instability in the post green revolution era. The decomposition analysis implied that yield effect (58%) had significant contribution in Tamil Nadu and area effect (48%) has shown significant contribution in the

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country banana production as a whole. In order to stabilize the growth and to increase productivity, efficient management approaches such as Integrated Nutrient Management (INM), Integrated Water Management (IWM) and Integrated Pest Management (IPM) may be followed.

Punit Kumar Agarwal et al., (2016) studied horticultural crops in India – growth, instability and decomposition approach. The results revealed that the growth in production was mainly due to the growth in productivity area rather than production especially in flower production and this means stress on land in coming years. The instability analysis reveals that there was high riskiness in flower production as compared to fruits and vegetable production. The contribution of area in productivity was high in all the three crops. The results show that available technologies were not adequate to push up the yield of these crops. Therefore, generation and dissemination of technologies was a matter of great challenge for researchers and extension agencies.

Objectives
• To study the rate of growth of Area, Production and Productivity of Banana Cultivation in Theni District, Tamil Nadu.
• To compute the relative contribution of area, yield and their interaction to the change in production of banana cultivation in Theni District, Tamil Nadu.

Methodology: The present study utilized the time series data for the period from 2003-04 to 2014-15 on area, production and yield of banana in Theni district, Tamil Nadu. Data on area, production and productivity were collected from secondary sources such as Season and Crop Report of Tamil Nadu, Statistical Abstract of Tamil Nadu and National Horticultural Board data base. The collected data were analyzed with the help of SPSS.

Compound Growth Rate: Several methods are available to estimated growth rates. In this study exponential function was used to estimate compound growth rate by taking time as the independent variable area, production and productivity as dependent variable. This exponential trend equation gives constant rate of increase or decrease per unit of time and they are termed as geometric or compound growth rate were estimated by fitting exponential trend equation of the following type.

\[ Y = ab^t \]  

Where,
\[ Y = \text{area/production/productivity} \]
\[ t = \text{time variable in years} \]
\[ a = \text{constant} \]
\[ b = (1 + r) \]

Where,
\[ r = \text{Compound Growth Rate} \]

The equation (1) takes the linear form by taking logarithms of both sides of the equation, 

\[ \log y = \log a + \log b. \]

Compound growth rate is computed using the following formula.

\[ \text{Compound Growth Rate} \]
\[ (\text{CGR}) = \text{Antilog} (\log b - 1) \times 100 \]

Growth of Banana Production – An Analysis by Component Elements: Component elements has been used to study the relative contribution of different components of growth i.e., area under cultivation, productivity of land or yield to the aggregate increase in the output of banana. But agricultural output may be measured either nominal or real/fiscal terms. In this study, the output is measured in fiscal terms. This obviates the need for the incorporation of relative prices and their interaction effect on growth of output. Overall growth of output in fiscal terms may be decomposed into growth due to the changes in area and growth due to changes in yield.

At the constant price weight the value of output can broadly be decomposed into two components: (i) area, (ii) production and (ii) productivity. Again productivity consists of two items (i) yield and (ii) cropping pattern or inter-crop reallocation. In case of individual crop there is no difference between yield and productivity. So ultimately the components of growth considered for output decomposition in the present study are area, yield and cropping pattern effects. In general, explanation of the area component takes into account the rate of growth of gross cropped area that includes the impact of change both in the net sown area and cropping intensity. In this connection it is important to mention that as far as Tamil Nadu’s land structure is concerned little scope exists for the extension of new land and maximum area growth reflects the increase in cropping intensity. The yield component measures the impact of change in output per hectare. Cropping pattern change implies to what extent area is shifted from a low yield crop to a high yield crop. (Tarujyoti Buragohain, 2007).

The production of any crop will be increased by way of increasing either area under the crop or both. In banana more area has been brought under cultivation during the last few years. Similarly, yield also has increased considerably. Ultimately the production of banana also increased over the years. The relative contribution of area, yield and their interaction in increased in production of crop can be estimated using the following measure.

\[ Q_n = A_n Y_n \]

Where,
\[ Q = \text{Production at base year} \]
\[ A = \text{Area at base year} \]
\[ Y = \text{Productivity at base year}. \]
\[ Q_n = A_n Y_n \]

Where,
\[ Q = \text{Production at n}^{th} \text{year} \]
\[ A = \text{Area at n}^{th} \text{year} \]
\[ Y = \text{Productivity at n}^{th} \text{year}. \]
Also,
\[ Q = Q_0 + \Delta Q, \quad A = A_0 + \Delta A \]
And
\[ Y = Y_0 + \Delta Y \]
Therefore,
\[ \Delta Q = A \Delta Y + Y_0 \Delta A + \Delta A \Delta Y \]
\[ AQ = A_0 \Delta Y + Y_0 \Delta A + \Delta A \Delta Y \]
\[ \text{Effect} \quad \text{Effect} \quad \text{Effect} \]

Where,
- \( A_0 \): Area at base year
- \( Y_0 \): Productivity at base year
- \( \Delta A \): Difference in area between the current and base years
- \( \Delta Y \): Productivity difference between the current and base years.

The first term (\( A \Delta Y \)) can be considered as the productivity effect, the second term (\( Y_0 \Delta A \)) as the area effect and the third (\( \Delta A \Delta Y \)) as the interaction effect. The total change in production can thus be decomposed into three effects viz. productivity effect, area effect and the interaction effect due to the changes in productivity and area.

Of Course, it would appropriate to indicate the limitation of the technique. This technique of analysis is based on only few years’ information viz., the base and current periods information and as such, do not necessarily reflects the actual trend for all the years in series.

The result of the study is presented in the following two tables like area, production and productivity of banana in Tamil Nadu and Theni district during 2003-04 to 2014-15.

Table 1 depicts that the area, production and productivity of banana cultivation in Tamil Nadu during 2003-04 to 2014-15. It shows that the general trend of productivity has also increased from 2515 million tones in 2003-04 to 4980 million tones in 2014-15 with fluctuations in the intervening years. The compound growth rate was 6.89 per cent per annum during the reference period.

The productivity of banana cultivation has been increased from 35 million tones per hectare in 2003-04 to 59.46 per cent was due to increase in productivity, 59.46 per cent was due to interaction between both area and productivity. Area effect is more than productivity effect in the case of change in total production of banana.

Table 2 represents the area, production and productivity of banana cultivation in Thani district. It reveals that the general trend of production has also increased from 91692 million tones in 2003-04 to 398454 million tones in 2014-15 with fluctuations in the intervening years. The compound growth rate was 14.05 per cent per annum during the study period.

The productivity of banana cultivation has been increased from 35 million tones per hectare in 2003-04 to 66 million tones per hectare in 2014-15 with some fluctuations in the intervening years.
Table 2: Area, Production and Productivity of Banana Cultivation in Theni District during 2003-04 to 2014-15

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (In Hectares)</th>
<th>% Change Over Previous Year</th>
<th>Production (In Million tonnes)</th>
<th>% Change Over Previous Year</th>
<th>Productivity (Million tonnes/hectare)</th>
<th>% Change Over Previous Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>2592</td>
<td>---</td>
<td>91692</td>
<td>---</td>
<td>35</td>
<td>---</td>
</tr>
<tr>
<td>2004-05</td>
<td>2842</td>
<td>109</td>
<td>120720</td>
<td>131</td>
<td>42</td>
<td>120</td>
</tr>
<tr>
<td>2005-06</td>
<td>3328</td>
<td>117</td>
<td>163420</td>
<td>135</td>
<td>49</td>
<td>117</td>
</tr>
<tr>
<td>2006-07</td>
<td>4102</td>
<td>123</td>
<td>200854</td>
<td>122</td>
<td>49</td>
<td>100</td>
</tr>
<tr>
<td>2007-08</td>
<td>4577</td>
<td>111</td>
<td>194517</td>
<td>96</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>2008-09</td>
<td>4846</td>
<td>105</td>
<td>432852</td>
<td>222</td>
<td>89</td>
<td>212</td>
</tr>
<tr>
<td>2009-10</td>
<td>5288</td>
<td>109</td>
<td>283344</td>
<td>65</td>
<td>54</td>
<td>61</td>
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<tr>
<td>2010-11</td>
<td>5164</td>
<td>97</td>
<td>308845</td>
<td>109</td>
<td>60</td>
<td>111</td>
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<td>2011-12</td>
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<td>121</td>
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<td>108</td>
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<td>2012-13</td>
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<td>95</td>
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<tr>
<td>2013-14</td>
<td>5996</td>
<td>99</td>
<td>398454</td>
<td>87</td>
<td>66</td>
<td>87</td>
</tr>
<tr>
<td>2014-15</td>
<td>6043</td>
<td>100</td>
<td>398454</td>
<td>100</td>
<td>66</td>
<td>100</td>
</tr>
<tr>
<td>CGR</td>
<td>8.28</td>
<td>---</td>
<td>14.05</td>
<td>---</td>
<td>5.33</td>
<td>---</td>
</tr>
</tbody>
</table>


fluctuations in the intervening years. The compound growth rate was 5.33 per cent per annum during 2003-04 to 2014-15.

Relative Contribution of Area and Productivity on Production of Banana in Tamil Nadu.

\[ AQ = A_0 \Delta Y + Y_0 \Delta A + \Delta A \Delta Y \]

\[ = (2592)(31) + (35)(3451) + (3451)(31) \]

\[ = 80352 + 120785 + 106981 \]

\[ = 3,08,118 \text{ million tonnes} \]

Effects of productivity, area and interactions of banana production in Tamil Nadu during the period 2003-04 to 2014-15 are calculated. The total production of banana increased during the reference period was about 3,08,118 million tonnes of which 26.08 per cent was due to increase in productivity, 39.20 per cent was due to interaction between both area and productivity. Area effect is more than productivity effect in the case of change in total production of banana.

CONCLUSION

The banana is an important fruit crop cultivated widely and consumed by the majority of the population in India and Tamil Nadu. Tamil Nadu is the largest producer of banana. The results of the study revealed that the area and production of banana cultivation in Theni district and Tamil Nadu had not shown the stability during the reference period. The component element analysis implied that yield effect (25 per cent) had significant contribution in Tamil Nadu and area effect (59.46 per cent) had significant contribution in the state as a whole in increasing the production of banana cultivation. In Theni district, an analysis by component elements reveal that the yield effect (26.08 per cent) had significant contribution and area effect (39.20 per cent) had significant contribution in the district as whole in increasing the production of banana cultivation. Therefore, keeping the area constant the productivity of horticultural crops can be further increased by taking appropriate production technologies.

REFERENCES


