



Growth Rate of Area Production and Productivity of Litchi Fruit in Jashpur District of Chhattisgarh, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Present study was done to analyse the growth rate of litchi production in Jashpur district of Chhattisgarh. with specific objectives of determining trend in area, production and productivity of litchi. India is the second largest producer of litchi in the world after China. Presently in India, litchi is cultivated in an area about 99170 hectares with total production of 737200 metric tons and productivity of 7.43 metric tons / hectare. Chhattisgarh produces nearly cultivated in an area about 8474 hectares with a total production of 58907 metric tons and productivity of 1.94 metric tons / hectare. It is mainly cultivated in the old district of Surguja, Jashpur, Balrampur and Surajpur. The study revealed that the growth rates in area, production and productivity was negative and found to be -0.02 %, -0.04 % and -0.02 % respectively in India while, in Chhattisgarh it was recorded - 0.05%, -0.05%, and -0.003% In Jashpur district, it was noted to be -0.06%, -0.04%, and 0.01% respectively.

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1. INTRODUCTION

Litchi fruit is famous for its excellent quality, characteristics pleasant flavour and attractive red colour [1,2]. Martina (1655) called the litchi "the king of fruits". "Litchi fruit contains about 60 % juice, 8 % of rag, 19 % seed and 13 % rind which depends upon the varieties and the climate under which it is grown. The principle chemical constituents in the fruit are carbohydrate, organic acids, vitamins, pigments, proteins and fat. Litchi fruit is considerably rich in sugar and the sugar content in the fruit of Indian varieties varies from 6.74 to 18.0 % with the average of 11.85 %. Litchi is also an excellent source of vitamins 'C' (ascorbic acid) ranging from 40.20 to 90 mg/100g. It also contains proteins (0.8-0.9%), fat (0.3%), pectin (0.42%) and minerals specially calcium, phosphorus and iron (0.7%). Thus, litchi fruit adds to the country's total production of bulky food over and above its nutritive value" [3]. "Litchi is a fruit containing healthy vitamins and antioxidants. China, India, and Vietnam are the major producers of litchi in the globe. According to the International Society for Horticultural Science (ISHS), China ranked first with a production volume of 2,000.0 thousand metric tons, followed by India and Vietnam with 677.0 thousand metric tons and 380.0 metric tons, respectively; in 2018. Vietnam has become the second-largest exporter of litchi despite its smaller output when compared to China and India [4,5]. The United States, Canada, and Europe are the major importers of litchi which accounted for 80% of China's litchi export market in 2018. Vietnam was the second-largest exporter of litchi during 2018. The major reason for the increase in exports of litchi is the increasing demand for Vietnam's litchi due to the better fruit quality when compared to India and China, the largest litchi producers in Asia during the same period. Litchi occupies a prominent place in the fruit platter of Indian households. This increase in demand has led to an increase in litchi production in the country [6,7]. According to AGRICOOP, the production of litchi was 568.0 thousand metric tons in 2016, which has increased by 20.8% and reached 686.0 thousand metric tons in 2017. ICAR-National Research Centre on Litchi (NRCL), has developed few litchi varieties that are suitable for agro-regions of South India such as Tamil Nadu and Andhra Pradesh. Bihar, Jharkhand, Chhattisgarh, and Assam are the major litchi producing states in the country. Bihar accounted for 62.1% of the total

country's production, followed by Jharkhand, Chhattisgarh, and Assam, respectively; in 2017 [8-10]. Shahi litchi is one of the most cultivated varieties of litchi in the major litchi producing state in India. Farming of litchi fruit is being done in 7965 hectare of land area and 559060 M.T. production in Chhattisgarh state. Surguja district is the leading districts of area and production of litchi followed by Surajpur, Jashpur, balrampur and Korla. In Jashpur district, the area and production of litchi is 1700 hectare and 7650 M.T. respectively.

2. MATERIALS AND METHODOLOGY

It includes the selection of district, block, villages ultimate unit of sample farmers (Litchi growers), market functionaries, consumers technique of collection of data and method of analysis.

- 1) Sampling framework
- 2) Collection of data
- 3) Analytical tools and techniques

1) Sampling framework

Sampling procedure: Multistage sampling was followed, in which the district (Jashpur) was considered as the first stage unit, the block as second stage.

Selection of District: Out of 32 district, Jashpur district of Chhattisgarh was selected purposively for this study as it has the third highest area and production of litchi in the state.

Selection of block: Among the 9 blocks of Jashpur district, two blocks (Kunkuri and Duldula) were selected on the basis of area and production of litchi. Selection of villages:- Selection of villages was done according to litchi growing farmer available in the village. 2%-3% villages from each block were sampled.

Selection of Respondents: Suitable no. of litchi farmers were selected from the selected villages based on availability. About 100-150 litchi growers were sampled for the purpose of study.

2) Collection of data: The primary data was collected from the respondents on various aspects for the analysis of different objectives of the study. The personal interview method was adopted for collection of primary data with the help of well designed questionnaires.

The secondary data was collected from published sources and from various government offices and official websites etc.

3) Analytical tools and techniques: Collected data was tabulated and analysed by using appropriate statistical tools and techniques. Descriptive statistics, Compound growth rate, Cost concepts, Returns, Marketing costs and margins in marketing of litchi, Resource-use efficiency and Garret ranking etc. may be employed.

- 1) Per cent over previous year (succeeding year- preceding year)/succeeding year*100
- 2) Compound growth rate:

Exponential trend equation: $Y = abT^u$

Where,

Y = Area/production/productivity of litchi,
 T = Time element i.e. year which takes the value 1, 2 ...n,
 Ut = Disturbance term
 b = Growth rate over a time period.

3. RESULTS AND DISCUSSION

3.1 Growth Rates in Area, Production, and Productivity of Litchi Fruit in India

In this section an attempt has been made to analyze the compound growth rate (CGR) and per cent change in area production and productivity of the litchi in India and the data pertaining to it was accessed from the secondary source for a period of ten years (2012-13 to 2021-22).

The area, production and productivity of litchi in India from 2012- 13 to 2021-22 has been presented in the Table:1 The area under litchi cultivation in 2012-13 was seen as 82740 hectares in 2013-14 which increased to 84170 hectares i.e. 1.69 % over the previous year and it further increased to 84950 ha (0.92% in the subsequent year whereas, in 2015-16 they are increased to 90050 hectare (5.66%) and again it further increased to 93310 hectares (3.49%) in the year 2016-17. In 2017-18, the area decrease

by 92340 hectare (-1.05% Further in 2018-19 the area again extended to 95510 hectares i.e. 3.32 % over the previous year and again it increased to 96550 hectares (1.07%) in 2019-20. The area increase by 97910 hectare (1.39%) in the year 2020-21, finally in 2021-22, the area increased to 99170 hectares i.e. 1.27 % over previous year. The increase in area of litchi cultivation from 2012-13 to 2021-22 was mainly due to increase in remunerative price of litchi.

The production of litchi fruit in India in 2012-13 was recorded as 580080 MT in 2013-14 it increased to 585300 MT (0.89 %). Whereas, in 2014-15, the production decreased to 528260 MT (-10.79%) and inter covered to 558770 MT (5.46%) in the subsequent year in 2015-16. The production increased to 568200 MT (1.66%) in 2016-17, raised further to 686450 MT (17.22%) in the year 2017-18. The production level of litchi in India again increased in 2018-19 and 2019-20 to 721390 MT (4.84%) and 726220 MT (0.66%) over the previous year respectively. In 2020-21, it decreased to 720120 MT (-0.85%). Finally in 2021-22, the production level increased comparatively to 737200 MT i.e. 2.31 % over previous year.

The productivity of litchi fruit in India in 2012-13 was recorded to be 7.01 MT/ha which decreased to 6.95 MT/ha (-0.86%) in 2013-14 and further decrease to 6.22 MT/ha (-11.73%) in the year 2014-15. The production level of litchi in India again decreased in 2015-16 and 2016-17 to 6.20 MT/ha (-0.32%) and 6.09 MT/ha (-1.80%) respectively, then recovered to 7.43 MT/ha (18.03%) in the year 2017-18. The productivity further increased to 7.55 MT/ha in 2018-19, then decreased to 7.52 MT/ha (-0.39%) in the year 2019-20 and to 7.35 MT/ha (-2.31%) in the year 2020-21. Finally, in 2021-22 the productivity increased to 7.43 MT/ha (1.01%) over the previous year.

From the above observation, the compound growth rates for area, production and productivity of litchi fruit were -0.02%, -0.04% and -0.02%, respectively. Among all the variables, the area and production growth rates are significant at 1% significance level, and productivity is significant at 5% level of significance.

Table 1. Growth rate of area, production, productivity of litchi fruit in India

| S.N. | Year | Area(ha) | Per cent over previous year | Production (MT) | Per cent over previous year | Productivity | Per cent over previous year |
|------|---------|------------------|-----------------------------|------------------|-----------------------------|-----------------|-----------------------------|
| 1 | 2012-13 | 82740 | - | 580080 | - | 7.01 | - |
| 2 | 2013-14 | 84170 | 1.69 | 585300 | 0.89 | 6.95 | -0.86 |
| 3 | 2014-15 | 84950 | 0.92 | 528260 | -10.79 | 6.22 | -11.73 |
| 4 | 2015-16 | 90050 | 5.66 | 558770 | 5.46 | 6.20 | -0.32 |
| 5 | 2016-17 | 93310 | 3.49 | 568200 | 1.66 | 6.09 | -1.80 |
| 6 | 2017-18 | 92340 | -1.05 | 686450 | 17.22 | 7.43 | 18.03 |
| 7 | 2018-19 | 95510 | 3.32 | 721390 | 4.84 | 7.55 | 1.59 |
| 8 | 2019-20 | 96550 | 1.07 | 726220 | 0.66 | 7.52 | -0.39 |
| 9 | 2020-21 | 97910 | 1.39 | 720120 | -0.85 | 7.35 | -2.31 |
| 10 | 2021-22 | 99170 | 1.27 | 737200 | 2.31 | 7.43 | 1.01 |
| 1 | Cagr | -0.020960669 *** | | -0.044553358 *** | | -0.023108336 ** | |

*** Significant @ 1% level of significance **Significant @ 5% level of significance

3.2 Growth Rates in Area, Production and Productivity of Litchi Fruit in Chhattisgarh

In Chhattisgarh, the cultivated area under litchi was 4990 hectares during 2012-13. During 2013-14, the area expanded to 5363 hectares which was 6.95% more than the previous year. The area extended to 5548 hectares in 2014-15 (3.33%) from the preceding year. It over again greater than before to 6614 ha (16.11%) in 2015-16. Further in the year 2016-17 increase area with 7017 hectare (5.74%). Similarly in the year 2017-18 and 2018-19 further the area extends to 7409 hectares (5.29%) and 7708 hectares (3.88%) respectively from preceding year. In the year 2019-20 the area decreased with 7065 hectares with -9.10% from the preceding year. In the year 2020-21 further the area extends to 8087 hectare 12.63% from preceding year. Finally In the year 2021-22, area also increased with 8474 hectare with 4.56% from before year. Cultivated area under litchi cultivation increase from 2012-13 to 2021-22 was mainly due to remunerative price of Litchi.

The litchi production in the state in 2012-13 was 30887 MT. In 2013-14 it greater than before to 37631 MT (17.92%) and same as augmented to 39152 metric ton (3.88%) in succeeding year. the production increased to 45381 metric ton (13.72%) in 2015-16 from preceding year. The increase in production 49924 MT (9.09%) in 2016-17 year. In 2017-18 increased to 52501 MT (4.91%) from the prior year. The increase in production is 54298 MT in 2018-19 & (3.31 per cent) The level of production in state again increased during 2019-20 and 2020-21 to 55907 MT and 56807 MT respectively. Finally in 2021-22 production level increased to 58907 MT i.e. 3.56% preceding year.

The Litchi productivity in 2012-13 is seen as 1.82 MT/ha which increased to 1.94 MT/ha in 2013-14 and it increased marginally to 1.95 MT/ha (0.51%) in year of 2014-15. where as the productivity decreased to 1.92 MT/ha (-1.56 per cent) in 2015-16 and then increased 2.04% during 2016-17. Then the productivity decreased to 1.95 MT/ha (-0.51 per cent) in 2017-18. The productivity stable with 0.00, MT/hectare in year 2018-19, and it marginally increased to 2.07 MT/ha in 2019-20. Whereas in 2020-21, the productivity decreased to 1.95 MT/ha (-6.15%)

from the preceding year & also decreased with 1.94 MT/ha (-0.51%) in the year 2021-22.

From the above observation the Area, production, and productivity have the compound growth rates of -0.054539123%, -0.058485184%, and -0.003741976%, respectively. Among all the variables, the area and production growth rates are significant at 1% significance level, and productivity is significant at 5% level of significance.

3.3 Growth Rates in Area, Production and Productivity of Litchi Fruit in Jashpur District

The litchi cultivated area in 2012-13 was 1079 hectares. During 2013-14, the area expanded by 0.55 per cent rise in the previous year to 1085 hectares. The area extended to 1090 hectares in 2014-15. (0.45 from the preceding year) It over again greater than before to 1102 ha (1.88%) in 2015-16. Further in the year 2016-17 increase area with 1220 hectare (9.67 per cent). Similarly in the year 2017-18 and 2018-19 further the area extends to 1320 hectares (7.57 %) and 1420 hectares (7.04%) respectively from preceding year. In the year 2019-20 the area also increased with 1520 hectares with 6.57% from the preceding year. In the year 2020-21 the area stable with 1520 hectare 00.00% from preceding year. Finally In the year 2021-22, area also increased with 1700 hectare with 10.58% from before year. Cultivated area under litchi cultivation increase from 2012-13 to 2021-22 was mainly due to remunerative price of Litchi.

The litchi production in the state in 2012-13 was 5395 MT. In 2013-14 it greater than before to 5425 MT (0.55%) and same as augmented to 5450 metric ton (0.45%) in the year 2014-15. the production increased to 5500 metric ton (0.90%) in 2015-16 from preceding year. The increase in production 5600 MT (1.78%) in 2016-17 year. In 2017-18 increased to 5940 MT (5.72%) from the prior year. Further the production increased to 6999 MT (15.13 per cent) in the year 2018-19 The level of production in district decreased during 2019-20 to 6840 MT (-2.32%). In the year 2020-21 the area stable with 6840 hectare 00.00% from preceding year. Finally in 2021-22 production level increased to 7650 MT i.e. 10.58% preceding year.

Table 2. Growth rate of area, production, productivity of litchi fruit in Chhattisgarh

| S.N. | Year | Area | Per cent over previous year | Production | Per cent over previous year | Productivity | Per cent over previous year |
|------|---------|--------------|-----------------------------|--------------|-----------------------------|--------------|-----------------------------|
| 1 | 2012-13 | 4990 | - | 30887 | - | 1.82 | - |
| 2 | 2013-14 | 5363 | 6.95 | 37631 | 17.92 | 1.94 | 6.18 |
| 3 | 2014-15 | 5548 | 3.33 | 39152 | 3.88 | 1.95 | 0.51 |
| 4 | 2015-16 | 6614 | 16.11 | 45381 | 13.72 | 1.92 | -1.56 |
| 5 | 2016-17 | 7017 | 5.74 | 49924 | 9.09 | 1.96 | 2.04 |
| 6 | 2017-18 | 7409 | 5.29 | 52501 | 4.91 | 1.95 | -0.51 |
| 7 | 2018-19 | 7708 | 3.88 | 54298 | 3.31 | 1.95 | 00 |
| 8 | 2019-20 | 7065 | -9.10 | 55907 | 2.88 | 2.07 | 5.79 |
| 9 | 2020-21 | 8087 | 12.63 | 56807 | 1.58 | 1.95 | -6.15 |
| 10 | 2021-22 | 8474 | 4.56 | 58907 | 3.56 | 1.94 | -0.51 |
| 1 | | | | | | | |
| Cagr | | -0.054539123 | *** | -0.058485184 | *** | -0.003741976 | |

*** Significant @ 1% level of significance **Significant @ 5% level of significance

Table 3. Growth rate of area, production, productivity of litchi fruit in Jashpur district

| S.N | Year | Area (Ha) | Per cent over previous year | Production (MT) | Per cent over previous year | Productivity | Per cent over previous year |
|------|---------|-----------|-----------------------------|-----------------|-----------------------------|---------------|-----------------------------|
| 1 | 2012-13 | 1079 | - | 5395 | - | 1.60 | - |
| 2 | 2013-14 | 1085 | 0.55 | 5425 | 0.55 | 1.60 | 00 |
| 3 | 2014-15 | 1090 | 0.45 | 5450 | 0.45 | 1.60 | 00 |
| 4 | 2015-16 | 1102 | 1.88 | 5500 | 0.90 | 1.60 | 00 |
| 5 | 2016-17 | 1220 | 9.67 | 5600 | 1.78 | 1.52 | -5.26 |
| 6 | 2017-18 | 1320 | 7.57 | 5940 | 5.72 | 1.50 | -1.33 |
| 7 | 2018-19 | 1420 | 7.04 | 6999 | 15.13 | 1.59 | 5.66 |
| 8 | 2019-20 | 1520 | 6.57 | 6840 | -2.32 | 1.50 | -6.00 |
| 9 | 2020-21 | 1520 | 00 | 6840 | 00 | 1.50 | 00 |
| 10 | 2021-22 | 1700 | 10.58 | 7650 | 10.58 | 1.50 | 00 |
| cagr | | -0.06164 | | -0.0463 | | 0.014451508** | |

*** Significant @ 1% level of significance **Significant @ 5% level of significance

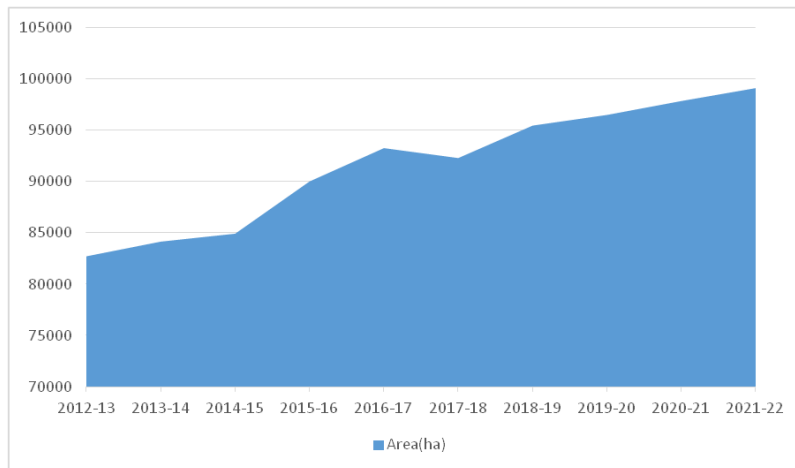


Fig. 1. Area (ha) of litchi cultivation in India

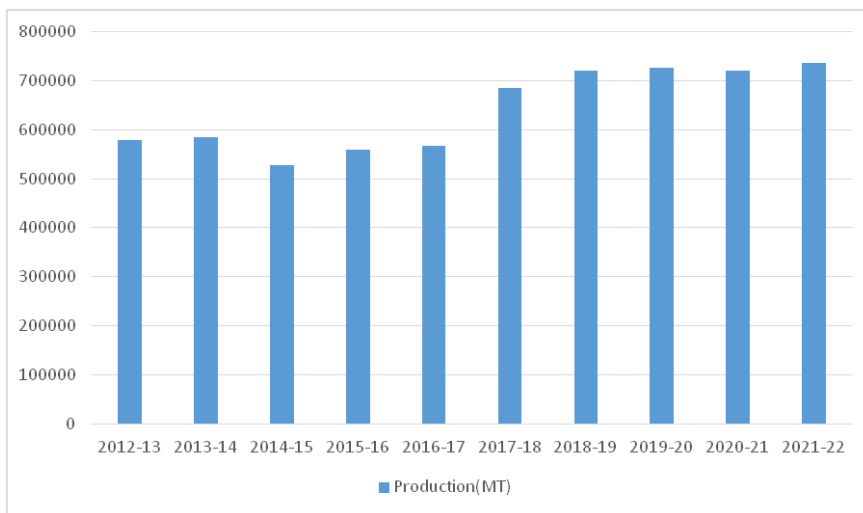


Fig. 2. Production (MT) of litchi in India

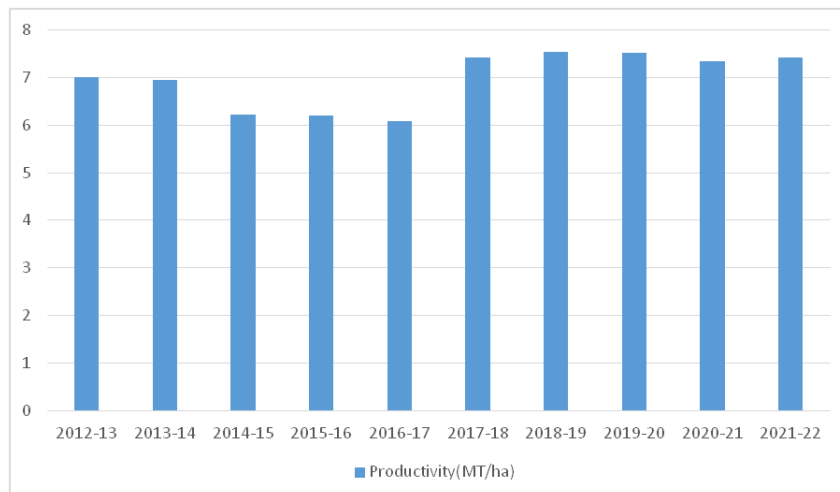


Fig. 3. Productivity (MT/ha) of litchi cultivation in India

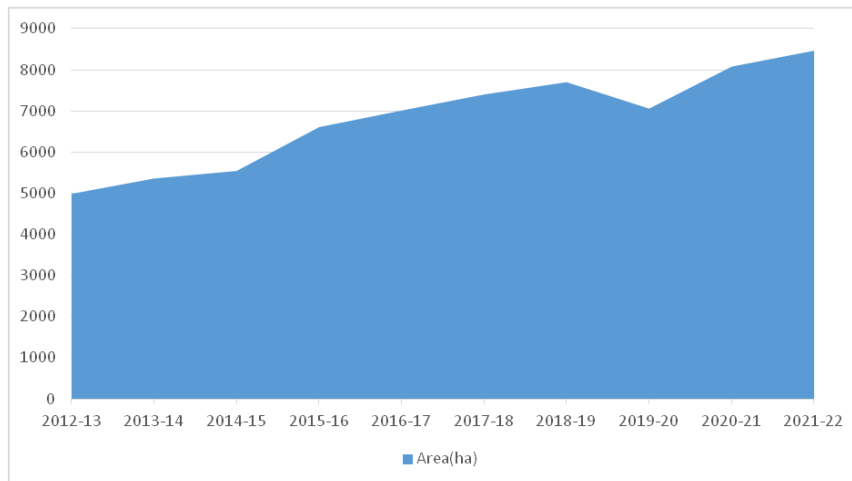


Fig. 4. Area (ha) of litchi cultivation in Chhattisgarh

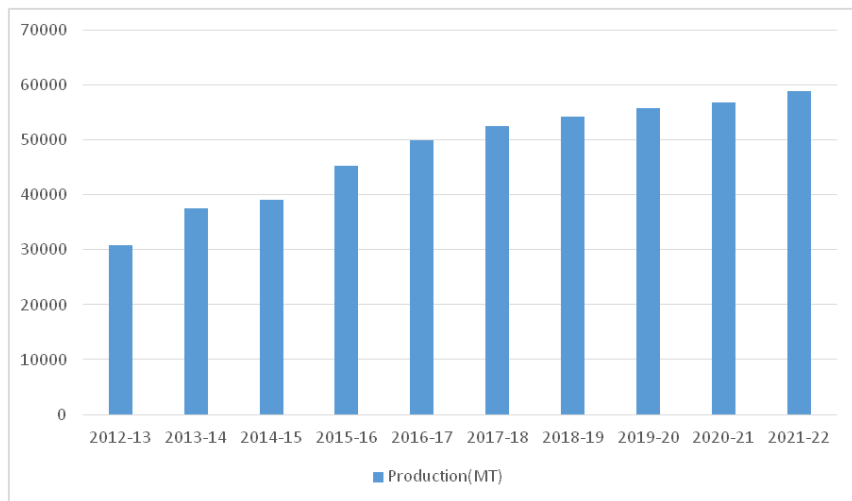


Fig. 5. Production (MT) of litchi cultivation in Chhattisgarh

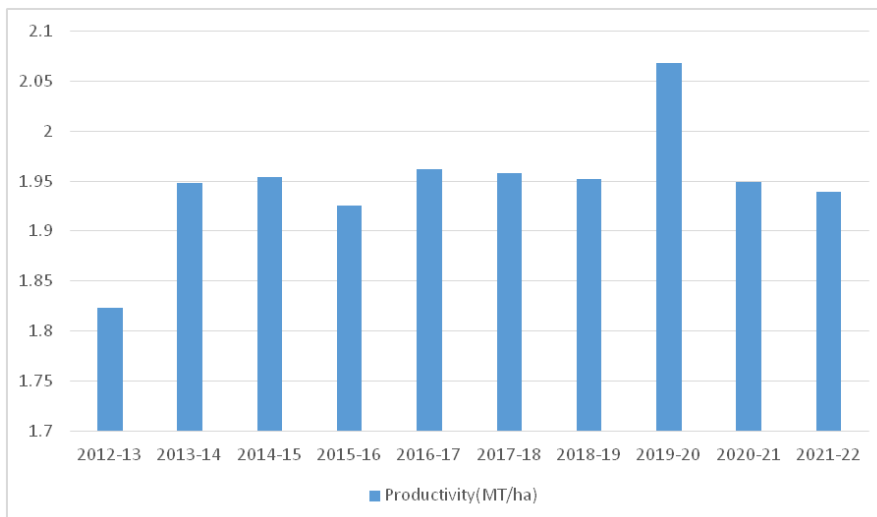


Fig. 6. Productivity (MT/ha) of litchi cultivation in Chhattisgarh

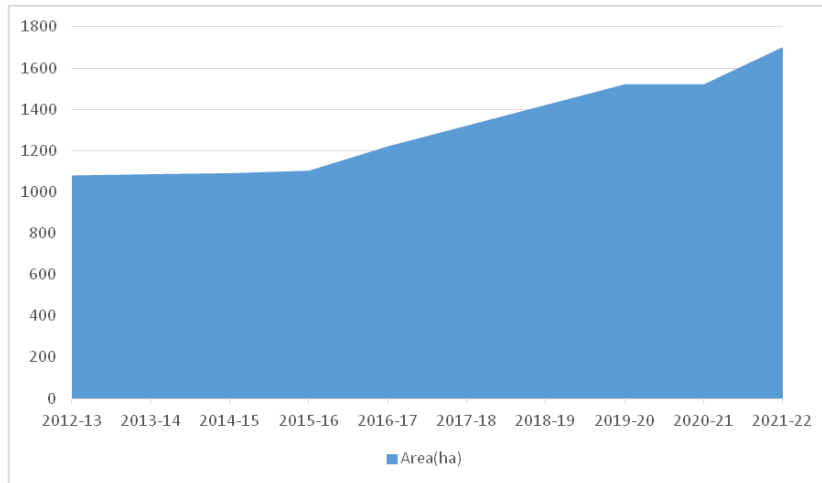


Fig. 7. Area (ha) of litchi cultivation in Jashpur district

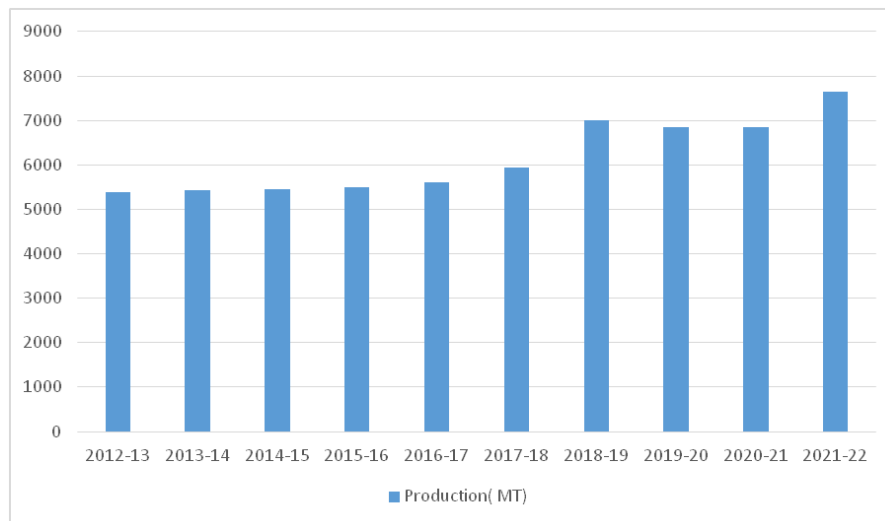


Fig. 8. Production (MT) of litchi cultivation in Jashpur district

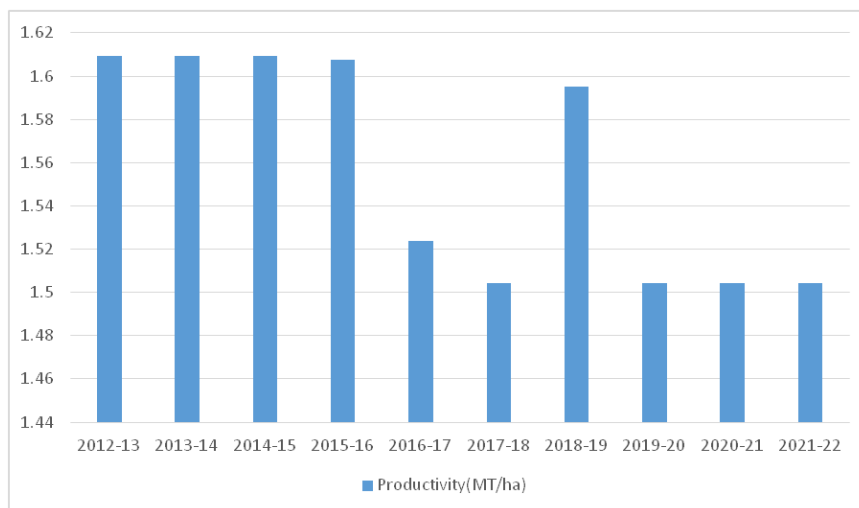


Fig. 9. Productivity (MT/ha) of litchi cultivation in Jashpur district

The Litchi productivity in Jashpur districts from 2012-13 is seen as 1.60 MT/ha which is stable from 2013-14 to 2015-16. Where as the productivity decreased to 1.52 MT/ha (-5.26%) in year of 2016-17. And also decreased to 1.50 MT/ha (-1.33 per cent) in 2016-17 and then increased 2.04% during 2016-17. Then the productivity decreased to 1.95 MT/ha (-0.51 per cent) in 2017-18. Further in 2018-19 the productivity extended to 1.59 MT/ hectares i.e. 5.66 per cent over the previous year and again it decreased to 1.50 hectares (-6.00 percent) in 2019-20. The productivity stable with 0.00, MT/hectare in year 2018-19 and 2021-22.

From the above observation the Area, production, and productivity have the compound growth rates of -0.06164%, -0.0463%, and 0.014451508%, respectively. Among all the variables, the area and production growth rates are significant at 1% significance level, and productivity is significant at 5% level of significance.

4. CONCLUSION

The study reveals that the growth rates in area, production and productivity in India is negative and found -0.02 per cent, -0.04 per cent and -0.02 per cent respectively while in Chhatisgarh state, it is recorded of -0.054539123%, -0.058485184%, and -0.003741976 per cent and negative rate -0.0616%, -0.0463%, and 0.0144% respectively in Jashpur Districts. From the above observation the Area, production, and productivity have the compound growth rates were negative rate. Among all the variables, the area and production growth rates are significant at 1% significance level, and productivity is significant at 5% level of significance.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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