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An economic analysis of chickpea cultivation in India: An statistical study

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Abstract

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 per cent of world population from 2.3 per cent world geographical area and 4.2 per cent of world's water resources. Agriculture in India has witnessed an impressive growth trajectory, taking the country from a food deficit one during the 1960s to a marginally food surplus one. Indian agriculture has registered impressive growth over last few decades. The food grain production has increased from 51 million tones in 1950-51 to 310.74 million tones during 2020-21 highest ever since independence. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. The present study is based on secondary data for the 70 years. The study examines growth rates of area, production and yield of Chickpea (Gram) in India and as well as major Gram growing states. In order to examine the trend in area, production and yield, the statistical methods have been used.

Keywords: Pulses, food grains, chickpea, gram, growth rate, least square technique, production, yield

Introduction

Agriculture in India has witnessed an impressive growth trajectory, taking the country from a food deficit one during the 1960s to a marginally food surplus one. Indian agriculture has registered impressive growth over last few decades. The food grain production has increased from 51 Million tones in 1950-51 to 310 Million tones during 2020-2, highest ever since independence. India is the world's largest producer of milk, pulses and jute, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 20 per cent of the area under foodgrains and contribute around 7-10 per cent of the total foodgrains production in the country. The most popular types of pulses grown in India are gram, tur, urad, moong. Gram commonly known as chickpea or Bengal gram is the most important pulse crop of India. According to history, the origin of Gram is in South West Asia – probably Afghanistan and Persia, Pigeonpea in Africa, Lentil in Turkey to South Iran and Fieldpeas in Mediterranean Region of Southern Europe and Western Asia. Gram is having a share of around 40 per cent in the total production followed by Tur/Arhar at 15 to 20 per cent and Urad/Black Matpe and Moong at around 8-10 per cent each. Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka are the top five pulses producing States.

Methodology

The present study is based on secondary data for the 70 years period from 1950 to 2020. The study examines growth rates of area, production and yield Gram in India and as well as major Gram growing states. The following formulae were used:

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Fig 1: Chickpea

Three Year Moving Average

$$Y_{t+1} = \frac{Y_t + Y_{t+1} + Y_{t+2}}{3}$$

Where Y_t is variable (area sown, production or productivity) and
 t is period, say, $t = 0, 1, 2, \dots$

Growth Rate

The moving averages have been used to estimate growth rates.

$$R_t = \frac{Y_1 - Y_0}{Y_0} * 100$$

Where R_t is the simple growth rate during two periods

Projection

Least Square Technique has been applied for the following linear model:

$$Y = a + b X$$

Where Y is Gram production

a is constant

b is regression of Y on X ,

X is year ($X=1$ for 1995-96 =2 for 2000-01 & so on)

Results and Discussions

Agriculture in India has witnessed an impressive growth trajectory, taking the country from a food deficit one during the 1960s to a marginally food surplus one. India has made remarkable progress in enhancing production of pulses during the past 15 years. During 2005-06, the total production of pulses in India was 13.38 million MT, which increased to 25.58 million MT during 2020-21. India is the largest producer, with about 10 million tons Gram, accounting for about 70% of total world production. Six countries including India, Australia, Turkey, Myanmar, Pakistan and Ethiopia account for about 90% of world chickpea production.

Table -1 presents the major Gram producing countries in the world. It is seen from this table, that India is the highest producing country and has 73% share. Turkey is the second highest country with 4.18% share followed by Pakistan with 3.30% and Myanmar with 3.20% share. Thus India, Turkey, Pakistan and Myanmar together produce more than 84% Gram Globally. The highest yield has been observed of the order of 2072 kg per ha in Ethiopia followed by USA 1822 kg per ha, Canada 788 per ha, Argentina 1573 kg per ha, Myanmar 1297 kg per ha, Turkey 1232 kg per ha, Australia 1069 kg per ha and India 1012 kg per ha.

Table 1: Major Gram Producing Countries in the World (2020)

| Country | Production (Lakh Tones) | %age Share | Cumulative %age Share | Area (Lakh ha) | %age Share | Cumulative % Share | Yield (Kg per ha) |
|--------------------|-------------------------|------------|-----------------------|----------------|------------|--------------------|-------------------|
| India | 110.8 | 73.46 | 73.46 | 109.49 | 73.77 | 73.77 | 1012 |
| Turkey | 6.3 | 4.18 | 77.63 | 5.11 | 3.44 | 77.21 | 1232 |
| Pakistan | 4.98 | 3.30 | 80.93 | 9.44 | 6.36 | 83.57 | 527 |
| Myanmar | 4.82 | 3.20 | 84.13 | 3.72 | 2.51 | 86.08 | 1297 |
| Ethiopia | 4.57 | 3.03 | 87.16 | 2.21 | 1.49 | 87.57 | 2072 |
| Russian Federation | 2.91 | 1.93 | 89.09 | 3.35 | 2.26 | 89.83 | 868 |
| Australia | 2.81 | 1.86 | 90.95 | 2.63 | 1.77 | 91.60 | 1069 |
| Iran | 2.27 | 1.50 | 92.46 | 5.14 | 3.46 | 95.06 | 441 |
| Canada | 2.14 | 1.42 | 93.87 | 1.2 | 0.81 | 95.87 | 1788 |
| USA | 1.94 | 1.29 | 95.16 | 1.06 | 0.71 | 96.58 | 1822 |
| Argentina | 1.77 | 1.17 | 96.33 | 1.13 | 0.76 | 97.35 | 1573 |
| Other Countries | 5.53 | 3.67 | 100 | 3.94 | 2.65 | 100 | |
| Global | 150.84 | 100 | | 148.42 | 100 | | 1016 |

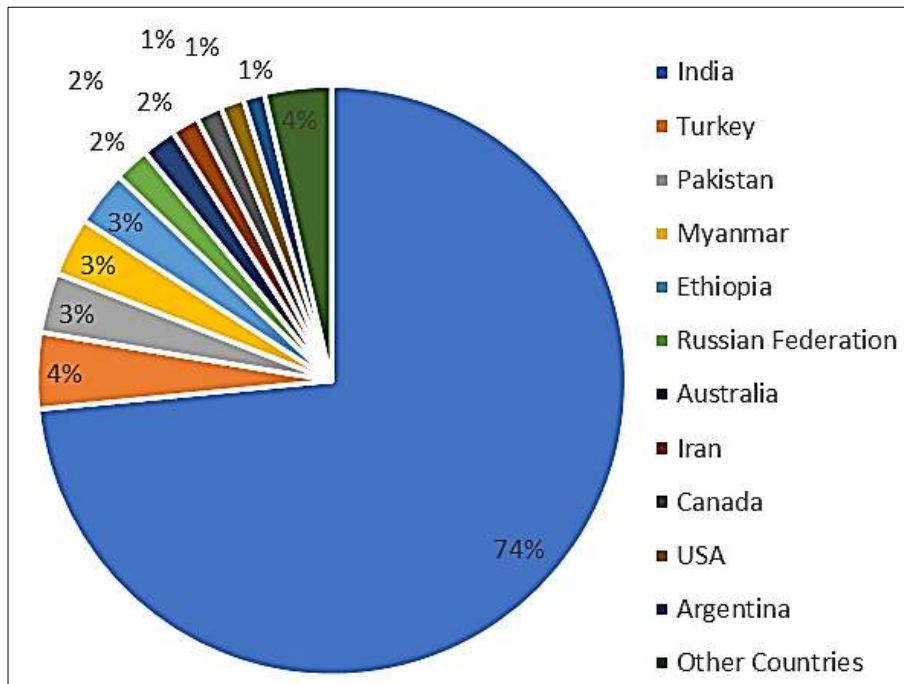


Fig 2: Major Gram Producing Countries

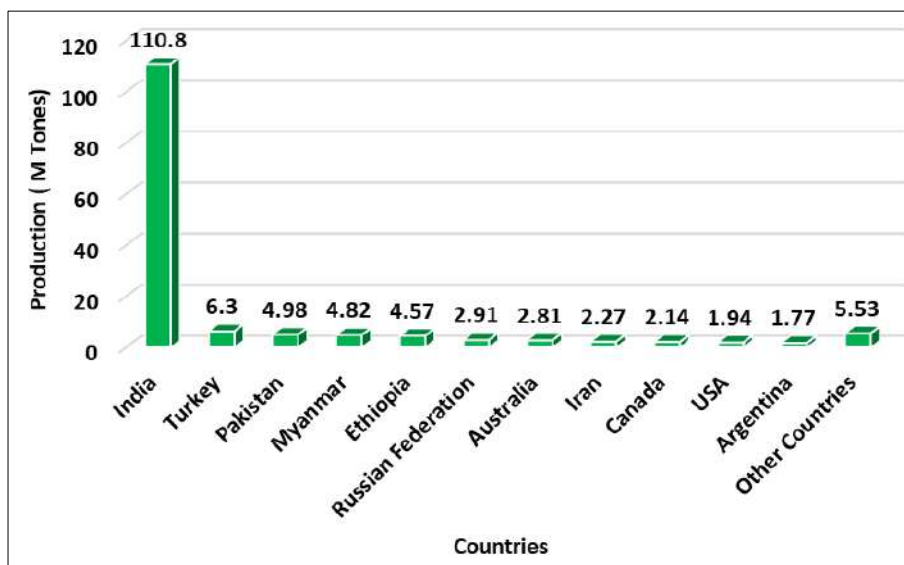


Fig 3: Major Gram Producing Countries

Table 2: Three years moving average of area, production and yield of the Gram

| Year. | Area Sown M ha | Growth rate per annum | Production M Tones | Growth rate per annum | Yield Kg per ha | Growth rate per annum |
|---------|----------------|-----------------------|--------------------|-----------------------|-----------------|-----------------------|
| 1950-51 | 7.32 | | 3.56 | | 487 | |
| 1960-61 | 9.73 | 3.29 | 5.89 | 6.54 | 607 | 2.46 |
| 1970-71 | 7.83 | -1.95 | 5.28 | -1.04 | 673 | 1.09 |
| 1980-81 | 7.15 | -0.87 | 4.11 | -2.22 | 576 | -1.44 |
| 1990-91 | 6.52 | -0.88 | 4.57 | 1.12 | 701 | 2.17 |
| 2000-01 | 5.92 | -0.92 | 4.82 | 0.55 | 810 | 1.55 |
| 2010-11 | 8.55 | 4.44 | 7.8 | 6.18 | 912 | 1.26 |
| 2020-21 | 9.8 | 1.46 | 11.69 | 4.99 | 1192 | 3.07 |

Table-2 presents the three yearly moving averages of area sown, production and yield for Gram. It is observed that area sown has decreased from 7.32 M ha in 1950-51 to 5.92 M ha during 2000-01 and then there is increased in area in 2020-21 (9.8 M ha). The production has increased from 3.56 M tones in 1950-51 to 5.28 M tones in 1970-71. However, there is decreased trends has been observed up-to 2000-01. From 2010-11 to 2020-21, the production has positive trends and it

has reached to 11.69 M tones during 2020-21. The yield has increasing trend throughout. The yield level has been 487 kg/ha during 1950-51 which has gone up to 1192 kg per ha during 2020-21. This table also shows annual growth rates during different periods. The highest growth rate in area sown i.e.4.44% was observed during 2000-01 to 2010-11. The lowest growth rate was -1.95% during 1960-61 to 1970-71. The growth rate has been highest at the level of 6.54% per

annum during 1950-51 to 1970-71 and lowest i.e. -2.22% during 1970-71 to 1980-81. In case of yield, the highest

growth rate was observed during 2010-11 to 2020-21 (i.e. 3.07%) and lowest (-1.44%) during 1970-71 to 1980-81.

Table 3: Area, Production and Yield of Gram (2019-20)

| | Area M ha | %age of Total Area | Cumulative % Share Area | Production M Tones | %age of Total Production | Cumulative % Share Production | Yield Kg per ha |
|----------------|-----------|--------------------|-------------------------|--------------------|--------------------------|-------------------------------|-----------------|
| Madhya Pradesh | 1.93 | 19.90 | 19.90 | 2.73 | 24.64 | 24.64 | 1417 |
| Maharashtra | 2.04 | 21.03 | 40.93 | 2.24 | 20.22 | 44.86 | 1096 |
| Rajasthan | 2.46 | 25.36 | 66.29 | 2.66 | 24.01 | 68.86 | 1079 |
| Gujarat | 0.41 | 4.23 | 70.52 | 0.64 | 5.78 | 74.64 | 1568 |
| Uttar Pradesh | 0.62 | 6.39 | 76.91 | 0.85 | 7.67 | 82.31 | 1371 |
| Andhra Pradesh | 0.46 | 4.74 | 81.65 | 0.56 | 5.05 | 87.36 | 1218 |
| Karnataka | 0.86 | 8.87 | 90.52 | 0.68 | 6.14 | 93.50 | 782 |
| Jharkhand | 0.23 | 2.37 | 92.89 | 0.28 | 2.53 | 96.03 | 1197 |
| Chhattisgarh | 0.38 | 3.92 | 96.80 | 0.09 | 0.81 | 96.84 | 231 |
| Others | 0.31 | 3.20 | 100.00 | 0.37 | 3.34 | 100 | 1203 |
| All India | 9.7 | 100 | | 11.08 | 100 | | 1142 |

The state-wise analysis for Gram is presented in Table-3. It is seen that the major states producing about 82% of the total pulses are Madhya Pradesh (25%), Maharashtra (20%), Rajasthan (24%), Gujarat (6%) and Uttar Pradesh (8%). The

highest yield has been observed of the order of 1417 kg per ha in Gujarat 1568 kg per followed by Madhya Pradesh 1417 kg per ha, Uttar Pradesh 1371 kg per ha, Andhra Pradesh 1218 kg per ha and Jharkhand 1197 kg per ha.

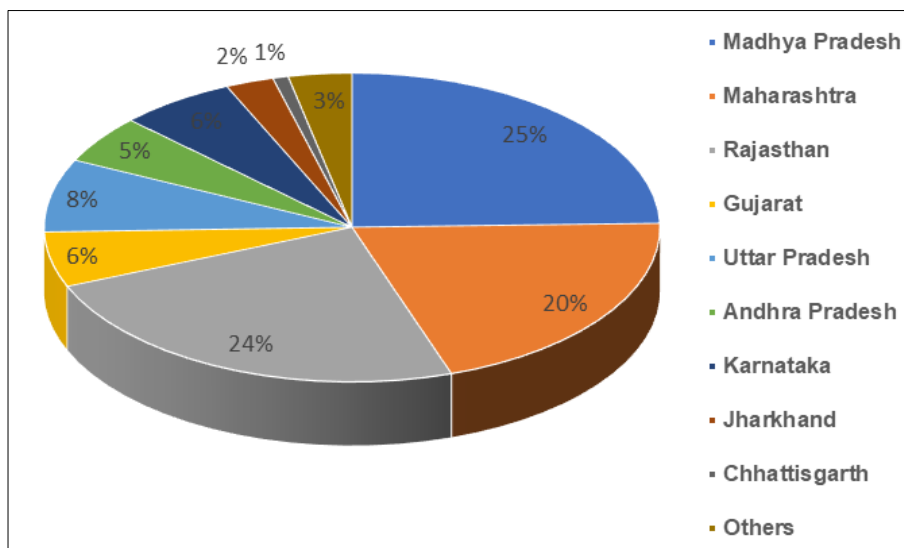


Fig 4: Major Gram Producing States (%age Share)

The following Table presents the projected area sown, production and yield for Gram for 2025-26 and 2030-31. It is seen that the estimated area will be 10.34 M ha in 2025-26 and 11.06 M ha in 2030-31. The production has been estimated of the order of 11.68 M tones in 2025-26 and 13.03 M tones in 2030-31. The projected yield will be 1163 kg per ha and 1248 kg per ha in 2025-26 and 2030-31 respectively.

Table 4: Projected Area, Production and Yield for Gram

| | 2025-26 | 2030-31 |
|--------------------|---------|---------|
| Area M ha | 10.34 | 11.06 |
| Production M Tones | 11.68 | 13.03 |
| Yield Kg per ha | 1163 | 1248 |

Conclusion and Way Forward

India has high population pressure on land and other resources to meet its food and development needs. Challenges ahead for meeting food demands are formidable considering the non-availability of favorable factors of growth, fast declining factor productivity in major cropping systems and rapidly shrinking resource base. India has made remarkable progress in enhancing production of pulses during the past 15

years. However, India still has many growing concerns. Owing to the significance of pulses in ensuring food and nutritional security along with environmental sustainability, we need to improve its management of agricultural practices on multiple fronts, the following recommendations are suggested: increasing incomes of farming households, diversifying production of crops, empowering women, strengthening agricultural diversity and productivity, and designing careful price and subsidy policies

References

1. Department of Agriculture, Cooperation & Farmers Welfare, Government of India website, <https://agricoop.nic.in>
2. Annual Report. MINISTRY OF Agriculture & Farmers welfare Department of Agriculture and farmers welfare, Directorate of Pulses Development, Vindhyachal Bhavan, Bhopal-462004 (Madhya Pradesh); c2021-22.
3. Agricultural Statistics at a Glance. Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics & Statistics, Govt of India; c2021.

4. Annual Report. Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Govt of India; c2020-21.
5. Annual Repor. ICAR- Indian Institute of Pulses Research Kanpur; c2020.
6. Prabha Rani, Charu Singh. Perspective Scenario of Pulses Production in India – Using Statistical Techniques, Journal of Emerging Technologies and Innovative Research. 2022;9(5):c858-c862.
7. Joshi PK, Rao PP. Global pulses scenario: status and outlook. Annals of the New York Academy of Sciences. 2017 Mar;1392(1):6-17.
8. Ahlawat IPS, Sharma P, Singh U. Production, demand and imports of pulses in India. Indian J of Agri. 2016;61:33-41
9. Anil Kumar Singh, Singh SS, Ved Prakash, Santosh Kumar, Dwivedi SK. Pulses Production in India: Present Status, Bottleneck and Way Forward, Journal of Agri Search. 2015;2(2):75-83
10. Vision 2050. Indian Institute of Pulses Research, (Indian Council of Agricultural Research), Kanpur; c2015. www.iipr.res.in
11. Swain H, Bhakur RR. Trends and variability of some cereals, pulses and commercial crops in Rajasthan; c2006.
12. Agricultural situation in India. Directorate of Economics and Statistics, Ministry of Agriculture, Govt of India; c2006.
13. Agrawal PC, Kishore Kumar. Technology & Environment impact on agricultural production- International conference on environment and development – Challenges & Opportunities. Delhi University, Delhi; c2005 Mar.
14. Kishore Kumar, Agrawal PC. Water Resource Management for sustainable agricultural production – National conference on environment and challenges in central Himalaya, Srinagar (Garhwal); c2004 Nov.
15. Gupta SC, Kapoor VK. Fundamentals of Mathematical Statistics, Seventh Revised Edition, Sultan Chand & Sons; c1980.
16. Hanumantha Rao CH. Agricultural growth, rural poverty and environmental degradation in India – Oxford university press, New Delhi; c1994.