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Trends In Area, Production And Productivity Of Food Crops In India

MAHESH BHATT

Department of School of Architecture and Planning, Graphic Era Hill University, Dehradun, Uttarakhand, India 248002

ABSTRACT

Research was carried out between 2003 and 2016 in Sikkim, India, to analyze the development of main grain crop acreage, output, and productivity. The Food Security & Agriculture Development Department's (the government agency responsible for agriculture in Sikkim) yearly reports provided the bulk of the research's information. It would be useful to establish future plans and take the right choices based on the trends identified in the time series of area, production, and productivity to ensure the continued viability of food production and the safety of food supplies in the future. The yield and cultivated area of key grain crops in Sikkim has decreased drastically. Major grain crop output may be declining because farmers are shifting their attention to horticultural and plantation crops. From a geographical, industrial, and culinary perspective, paddy is one of India's most vital staple crops.

KEYWORDS Agriculture, Sikkim, Production, Food Crop

INTRODUCTION

The Indian economy relies heavily on the agricultural sector, which is why it is so important to the nation. Annual Report, 2016–17) estimates that over 55% of the population is involved in agriculture and associated industries, which generate approximately 17% of the country's GDP. Two-thirds of the population of India lives in rural areas, and most of them depend on agriculture for their livelihood and as a source of food for the country's ever-growing population. It's also useful for feeding animals including cows, buffaloes, lambs, and chickens. To meet the expected demand of rice by 2050, it will need coordinated efforts to boost output in all major producing states, notwithstanding modest growth rates. Central India is home to the state of Chhattisgarh, which has an area of 137.90 lakh hectares. The state's reputation as the "rice bowl of India" necessitates an analysis of the absolute and relative changes in rice production, as well as an assessment of the probable availability of other cereal crops like maize and wheat in the state. Chhattisgarh's average production per hectare of rice land is between 1.2 and 1.6 tons, depending on the amount of precipitation received.

Vegetarians in India rely heavily on pulses for protein. Proteins, vital amino acids, vitamins, and minerals from it supplement those from grains, which are dietary staples. It has a protein content of 22-24%, making it almost three times as protein-rich as rice and twice that of wheat. Several noncommunicable illnesses, including colon cancer and cardiovascular disease, have been linked to a reduction in consumption of pulses due to their beneficial nutritional and health effects. It's beneficial in many ways for agricultural systems, including crop rotation, mixing and intercropping, preserving soil fertility via nitrogen fixation, releasing soil-bound phosphorus, and so on, and it can be grown in a wide range of climates, but it does best in a mild, cool, and rather dry climate with temperatures between 20 and 25 degrees Celsius and 40 to 50 centimeters of rainfall. Chickpea, pigeonpea or red gram, and lentil are among the most widely cultivated pulses in India, and they are mostly harvested during two distinct growing seasons: (i) The Kharif (June–October) and (ii) The Rabi (October–April). During the rabi season, farmers plant chickpeas, lentils, and dry peas, while in the kharif season they plant pigeonpeas, urd beans, mung beans, and cowpeas. About a quarter of the world's total output comes from India, making it the top producer. Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka, Bihar, Gujarat, Chhatisgarh, Tamil Nadu, and Andhra Pradesh account for more than 90% of the country's land and pulses production.

LITERATURE REVIEW

Chandra Mohan Misra (2017) In India, the states of Gujarat, Tamil Nadu, and Madhya Pradesh are among the most important in terms of production, and the nation consistently ranks in the top three of the world's groundnut producers. Area and output have, however, varied considerably throughout time and across the State. One of the most populous states in India, Uttar Pradesh, has long been one of the country's top two producers of mustard. However, if output and efficiency are the nuts and bolts, it ranks eighth. Given that groundnut oil is a vital cooking medium and groundnut seeds are a major ingradient in the processing sector, this paper aims to examine changes in the area, Production, and Productivity of Groundnut in Uttar Pradesh and the consequent commercial effects. To analyze the tendencies, an orthogonal polynomial method has been implemented.

Satinder Kumar (2014) When new agricultural technology was used on state farms during the green revolution, the results were nothing short of remarkable. This research investigates and analyzes the changes in area, production, and productivity of sugarcane crop in Haryana state at the district and regional levels encompassing the most recent period from 2000-01 to 2009-10 using basic descriptive statistics and linear growth rates. This study's findings on Haryana's district and regional-level area, output, and productivity of sugarcane crop are intriguing.

Aloka Kumar Goyal et.al (2013) Most of the people who reside in rural areas of Uttar Pradesh rely on agriculture for their livelihood. If the state economy is to thrive in the long run, agricultural output and productivity must continue to rise. The current state of agriculture in Uttar Pradesh must be investigated.

Amod Sharma (2013) The current research set out to examine the changing patterns of food grain cultivation in the states in the northeast. Secondary data from 1980-81 to 2011-12 were used for analysis. The information was compiled from a wide range of official reports and websites. Northeastern states' area, production, and productivity of food grains were analyzed using linear, quadratic, and exponential functional forms. Since the linear functional form had the highest R2 value, it was chosen to model the trend. In addition, we calculated things like the coefficient of variation and the instability index. In addition to estimating the impacts of area and productivity on output, the current research also calculated the interaction between the two. The smaller coefficient of variation indicates that producing food grain crops in the northeastern states is safe. Area, yield, and yield per acre were all less than 0.551 percent variable in terms of food grain crops. Positive instability indices for area, production, and productivity indicated a lower risk for growing food grain crops in the northeastern states. Food grain crop output in the United States has gone up because of both an increase in planted area and a positive feedback loop between planted area and yield.

Elumalai Kannan (2011) This research analyzes the upswing and downswing of India's agriculture sector on a national and regional scale. Area, production, input utilization, and the value of output are only few of the key factors for which we have collated data from numerous published sources covering the years 1967–68 through 2007–08. Data study shows that India's cropping pattern has changed considerably over time. There has been a dramatic change in focus from the production of food grains to that of cash crops. Between 1970–71 and 2007–08, the area planted with coarse cereals, a kind of cereal grain, fell by 13.3 percent. During the same time period, the area and output performance of pulses was also unimpressive. Pulses weren't the only crops where the application of technology advances in farming wasn't very noticeable. However, since the late 1960s, the growth in agricultural output has been a key driver in speeding up production in the nation. Increases in crop yields may be attributed in large part to the widespread use of modern agricultural practices like irrigation and fertilizer. Changes in crop acreage and production composition occurred in certain places as a result of technical and institutional support for select crops like rice and wheat. Increased capital creation, greater irrigation infrastructure, regular rainfall, and higher fertilizer usage were all factors in the country's increased agricultural production, according to the conclusions of the crop output growth model.

METHODS

Time series data on Sikkim's cereal crop acreage, output, and productivity were analyzed for this research. A time series of data on cereal crop output, area, and productivity from 2003–2004 through 2015–2016 was compiled by consulting annual reports, the Food Security & Agriculture Development Department of the Government of Sikkim, and other sources. Standard measures of central tendency and dispersion, such as the mean, standard deviation, and coefficient of variation, were determined. When displayed across a time scale, the data on agricultural acreage, production, and productivity may be smoothed out with the use of various curve fitting processes, which can aid in the meaningful interpretation of the data. Table 1 provides a brief overview of the most important cereal crops in Sikkim.

Table 1. Summary of cereal crops of Sikkim for trend analysis

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Sr.No.	Crops	Area	Production	Productivity
1.	Rice	☐	☐	☐
2.	Wheat	☐	☐	☐
3.	Buckwheat	☐	☐	☐
4.	Maize	☐	☐	☐
5.	Finger Millet	☐	☐	☐
6.	Barley	☐	☐	☐

The linear model, the multivariate distribution model, and the trellis model are the three most often used methods of statistical modeling for interpreting cereal crop area, production, and productivity, the exponential model, and the logarithmic model. The research calculated the rate of increase in area, production, and productivity of main cereal crops in the Indian state of Sikkim from 2003 to 2016 using the linear (y = a*x + b) equation. Both the exponential (y = aeb*x) and the logarithmic (y = a*ln(x) + b) models are examples of statistical modeling. Nonlinear estimation in this work also made use of the non-parametric Sen's slope estimator.

DATA ANALYSIS

This research was conducted to examine the changes in cultivation area and yield from 2003 to 2016 for a variety of cereal crops in the Indian state of Sikkim. The policymakers who benefited greatly from the gathered data praised its usefulness and importance. Rice, barley, wheat, buckwheat, maize, and finger millet were chosen as the principal cereal crops.

Table 2: **Statistical analysis of different crops of Sikkim**

Crops	Mean value			Standard Deviation (SD)			P Value		
	Area	Production	Productivity	Area	production	Productivity	Area	production	productivity
Rice	12.81	21.27	1674.58	1.50	0.94	142.31	1.27	0.79	120.56
Maize	38.99	64.76	1660.18	1.42	3.95	66.52	1.20	3.35	56.36
Wheat	3.38	4.28	1169.67	2.37	3.62	255.51	2.01	3.06	216.46

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Finger Millet	3.59	3.41	954.87	0.55	0.42	51.35	0.47	0.35	43.49
Barley	0.81	0.88	1052.70	0.31	0.43	127.04	0.26	0.37	107.62
Buck wheat	3.43	3.16	900.96	1.36	1.39	72.13	1.16	1.18	61.11

Table 2 shows the typical annual value of output, productivity, and cultivated land for the most important crops from 2003 to 2016. The standard deviation (SD) is a statistical metric used to evaluate the dispersion (or spread) of a collection of data values around the mean. Wheat had the most variability in its trend of area of production and productivity over the time, with an SD of 2.37 and 255.51 for area under cultivation and productivity, respectively. However, maize output exhibited the highest standard deviation (3.95), indicating a very unstable production pattern.

Figure 1 shows that although the quantity of rice produced in Sikkim has increased in recent years, the area of rice produced in the state has decreased from 2007 to 2016. In spite of a 27.6-percent decline in rice-growing land between 2006 and 2016, the state's overall rice output fell by just 13.22% during this same time period, according to the report.

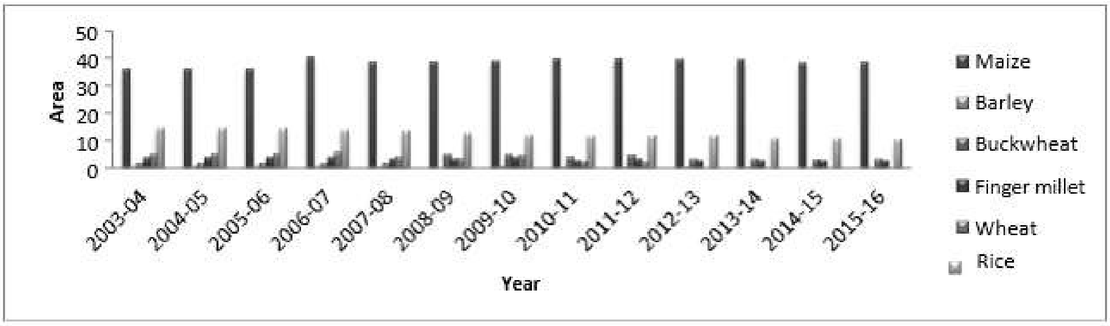

Figure 1: Area under the production of major cereal crops from 2003-2016 in Sikkim

Area planted with maize and total output have both been relatively constant in Sikkim throughout the years. The state's highest and lowest annual yields were 68.82 and 57.05 metric tons of produce, respectively, in 2014–15 and 2003–04, respectively. In 2008-09, there was a meteoric rise in both the cultivated area and the output of buckwheat compared to the previous year. The cultivated area increased by an average of around 171.5%, while output rose by an astounding 198.8%. The total cultivated land in Sikkim increased by an average of 77.6 percent between 2003 and 2016, with a corresponding rise in output of 123.8 percent.

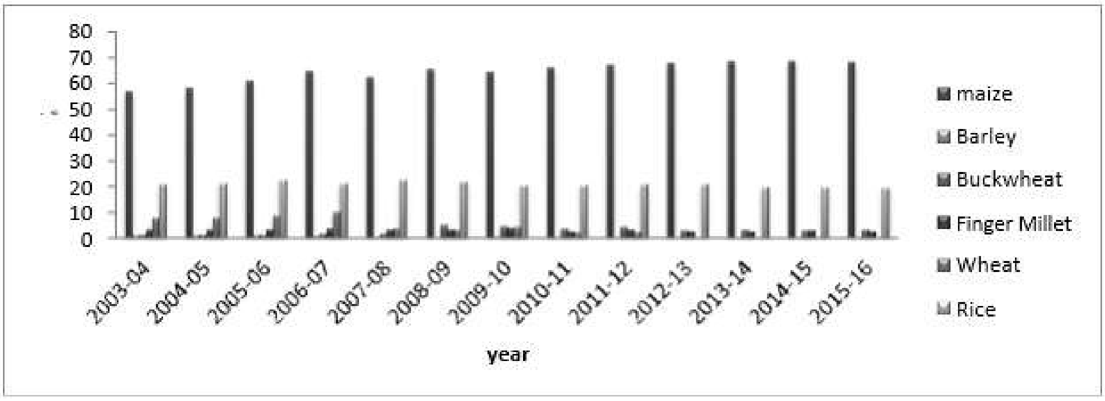

Figure 2: Production of major cereal crops from 2003-2016 in Sikkim

Figure 1 shows the total area used for farming and manufacturing. The stated area of output has decreased by 94.45 percent between 2003 and 2016. It also reveals a shift in emphasis from minor to main grain crops in Sikkim. The amount of wheat harvested fell by 95.67 percent between 2003 and 2016. Whereas, while there was exponential rise in the area of agriculture from 2003 to 2007, this may have been due to stable productivity leading to de-motivation among farmers, resulting in a significant decrease in the area of cultivation.

Finger millet yield and cultivation area both exhibited erratic growth patterns. Although the provided statistics demonstrated consistency in the first several years, fluctuations in both land use and output were seen beginning in the 2007–2008 period. Both land use and output decreased dramatically in 2010–11 compared to the previous year.

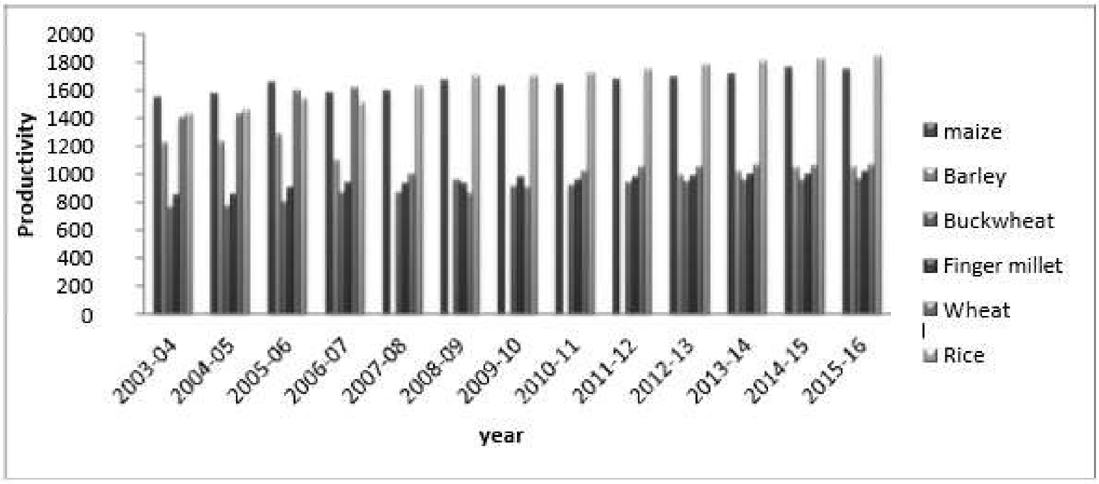

Figure 3: Productivity of major cereal crops from 2003-2016 in Sikkim

The total area and yield of barley farmed in Sikkim exhibited periodic fluctuations. However, from 2003 to 2016, there was a general decline in the total area used for cultivation and production. From 2003 to 2016, there was a divergence in the patterns of Barley area and output. From 2003 to 2016, the total cultivated area decreased by 63.41 percent, while total output fell by 68.8 percent.

PADDY CROP GROWING SEASONS IN INDIA

Rice is farmed in India in a broad range of altitudes and climates. Because of regional variations in temperature, rainfall, soil types, water availability, and other climatic factors, the growth seasons for rice farming are not uniform throughout the nation. Due to the relatively consistent annual temperatures in the east and south, two or three paddy harvests are possible. Only one crop of paddy is cultivated from May to November in the northern and western portions of the nation because to the heavy rainfall and relatively low winter temperatures. In India, the rice harvest occurs during one of three seasons: Kharif, Rabi, or Zaid. These three times of year are called after when certain crops are typically harvested. The months of May through August are dedicated to harvesting autumn paddy, also known as prekhar if paddy. However, climatic conditions and rainfall patterns vary from state to state, therefore the ideal time to plant seeds varies significantly. In September and October, it is time for the harvest. The name for the fall rice harvest varies from region to region: in West Bengal it is called Aus, in Assam it is called Ahu, in Odisha it is called Beali, in Bihar it is called Bhadai, in Kerala it is called Virippu, and in Tamil Nadu it is called Kuruvai. Seven percent of the world's rice crop is cultivated during this time. Most of the types cultivated at this time have short maturation times of 90–110 days.

Table – 3 Year - wise Linear Growth Rates of Area, Production and Productivity of Paddy in India

Sl. No	Year	Area	Production	Productivity
1	1991-92 to 1999-00	0.75 (5.39)**	2.15 (5.21)**	1.31 (3.69)**
2	2000-01 to 2009-10	0.12 (0.27) N.S	1.53 (1.75) N.S	1.56 (2.70)*
3	2010-11 to 2015-16	0.28 (0.78) N.S	1.33 (1.50) N.S	0.93 (1.31) N.S
4	1991-92 to 2015-16	0.09 (1.20) N.S	1.44 (9.01)**	1.38 (11.44)**

The table shows that between 1991–1992 and 1999–2000, the area planted with Paddy increased at a linear rate of 0.75 percent, which is statistically significant at the 1% level. However, the linear growth rate of area under Paddy dropped dramatically between 2000 and 2001, to 0.12, and the t value is not statistically significant. The rate increased to 0.28 percent between 2010 and 2015, although the t value is still not statistically significant. In addition, the linear growth in Paddy area from 1991–1992 to 2015–2016 is 0.09, and the t value is not statistically significant. From 1991–1992 to 1999–2000, the table shows that the linear growth rate of Paddy output was 2.15 percent, with a t value of 1 percent being statistically significant. However, between 2000 and 2001, the linear growth rate of Paddy area slowed to 1.53 percent (t value not significant), and again, between 2010 and 2015, it slowed to 1.33 percent (t value not significant). In addition, the linear increase in Paddy area from 1991–92 to 2015–16 is 1.44, and the t value is statistically significant at the 1% level. There was a 1.31 percent annualized increase in Paddy yield from 1991–1992 to 1999–2000, as shown in the table below, and the t value was statistically significant at the 1% level. In contrast, from 2000–01 to 2009–10, it fell to 1.56 percent, with a t value significant at the 5% level even though this is a much smaller sample size. Since then, Paddy production's compound annual growth rate has fallen dramatically to 0.93, and the t value is not statistically significant. Paddy output increased linearly by 1.38 percent during the whole research period, and this increase was statistically significant at the 1% level of significance.

CONCLUSION

Linear, exponential, and logarithmic models, as well as the sen's slope estimator, were used to analyze the 2003-2016 area, production, and productivity of the most important cereal crops in Sikkim, India, for goodness-of-fit. The government of Sikkim's yearly reports on food security and agricultural development provided the bulk of the study's data. Concern has been raised about the falling area, output, and productivity of important cereal crops in the state, which is being highlighted as a danger to food security. There was a declining trend in the total area planted with wheat, rice, finger millet, and barley at the rate of 0.544, 0.37, 0.12, and 0.065 thousand hectares annually. As a result, it's very evident that in recent years, the paddy crop in India has been under siege from both government policies and the personal interests of the formers, for a variety of reasons that may have permeated far into the Indian agricultural industry. This research concludes that it is crucial to increase paddy yield and output in India, and it suggests doing so.

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