ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Seasonal Growth and Trends of Food Grains in India; Yield, Area, and Production: A Structural Stability Regression Model Approach

Dr. Krishnan Kutty. V [1]

[1] Assistant Professor of Economics, Department of Economics,
Government College Kodenchery, Kozhikode,
University of Calicut, Kerala, India
Email- [1] kkmapprom@gmail.com

ABSTRACT:

The area and yield of agricultural output throughout the kharif and rabi seasons, as well as the growth, trend, and structural stability of agricultural production of food grains, represent an economy's structural stability and contribution to GDP. This study aims to assess the growth, trend, and structural stability of food grain production in India throughout the kharif and rabi seasons before (1980-2000) and after the implementation of the new agricultural policy (2001-2020). Secondary data was acquired to achieve the objectives from the Agricultural Statistics at a Glance—2021, Government of India—the Ministry of Agriculture and Farmers' Welfare—the Directorate of Economics and Statistics. The structural stability regression model, t test, and trend line were used to estimate and compare the growth of food grain output, area, and yield. According to the study, the area, production, and yield growth rates from 1980 to 2020 were -14.84, 85.20, and 117.47 percent in kharif, 29.15, 195.89, and 129.12 percent in rabi, and 0.253, 129.57, and 129.03 percent in total food grains. Additionally, the study found that India's food grain production and area under cultivation had undergone structural change throughout time. In order to produce more food grains, there has been an increase in area, a higher yield per hectare, and changes in production methods. The focus of policymakers should be on enlarging the area by making effective use of available land, increasing production through technological advancements, research in agriculture, and instruction, as well as accelerating the execution of policies in India.

Keywords: Food Grains, Kharif Crops, Production, Rabi Crops, Structural Stability, Yield.

INTRODUCTION:

Agriculture contributes significantly to the overall Indian frugality, contributing to over seventeen percent of the nation's GDP and employing over 60 percent of the pool. Agriculture provides a living for around fifty- eight percent of the population of India. Agriculture and associated sectors contribute to20.19 percent of GDP on a sector- by- sector base. The agrarian assiduity provides acceptable nutrition and food security for India's huge population, as well as a massive force of raw accoutrements for the country's artificial

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

foundation and overpluses for import. More structure for irrigation-monsoon downfall, new technology preface, investment, mechanization, seeds, pricing practices, and other factors all led to the tremendous increase in food grain as well as marketable crop product. According to the crops section's computations, food grain product climbed by129.57 percent from1295.9 million metric tonnes in 1980 – 81 to 2975 million metric tonnes in 2019 – 20. The area under food grain civilization (in lakh hectares) and yield (kg per hectare), with growth rates of0.236 percent and129.03 percent, independently, were 1267 to 1270 lakh hectares and 1023 to 2343 kg per hectare. India's product of food grains grew at a pace of129.57 percent as compared to the typical thunderstorm cast. Crops were oppressively damaged by failure and unseasonal downfall in several countries across the nation. At the end of the thunderstorm or the launch of downtime, rabi crops are sown. They go by the name" downtime crops." Crops known as kharif, or thunderstorm crops, are sown at the launch of the stormy season. Long days are necessary for flowering. In June and July, the Kharif crop was planted, and in September and October, it was gathered. Rice, sludge, jowar, bajra, tur, moong, urad, cotton, jute, groundnut, soybean, and other crops are being cultivated. Assam, West Bengal, littoral Odisha, Andhra Pradesh, Telangana, Tamil Nadu, Kerala, and Maharashtra were the countries that were tilling the crops. The rabi crop was sown from October to December and gathered in April and June. The cultivating countries were Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttarakhand, and Uttar Pradesh. The cultivating crops included wheat, barley, peas, gram, mustard, etc. On July 28, 2000, the first- ever public Agriculture Policy was unveiled. Since a comprehensive public agrarian land policy was absolutely necessary to capitalize on the essential strengths of husbandry and related sectors to address constraints and make the topmost possible use of the coffers and possibilities establishing themselves as a result of advancements in wisdom and technology and the emergence of a new profitable governance, the government has been considering the expression of a husbandry policy. The National Agriculture Policy aims to tap into India's vast untapped growth eventuality, strengthen pastoral structure in order to encourage briskly development in husbandry, promote the creation of fresh value, speed up the growth of agro-business, produce a position in pastoral areas, secure a decent standard of living for growers along with agrarian workers and their homes, help migration to civic areas, and face the challenges of profitable liberalization and globalization. A growth rate of further than 4 per time in the agrarian assiduity; Growth that's resource-effective and conserves our land, water, and biodiversity; Growth with equity, that is, growth that's distributed between regions and growers; Growth is substantially demand driven, caters to home requests, and maximizes earnings from agrarian product exports in the face of profitable liberalization and globalization issues. Technological, environmental, and profitable growth that's sustainable. Consequently, the food grain product in the kharif season increased significantly, from77.65 million tonnes in 1980 – 81 to105.51 million tonnes in 1999 – 00. During the kharif season period I, the product of food grains increased by35.87 percent. The loftiest average monthly growth rate (28.27 percent) was set up in 1988 – 89, followed by27.65 percent in 1983 – 84,

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

and a positive low in 1985 – 86 with0.86 percent. The area under civilization of food grains in the kharif season has remained fairly flat, dwindling from83.21 million hectares in 1980 – 81 to73.24 million hectares in 1999 – 00. In period I, this is a-11.98 percent drop. In 1988 – 89, the average periodic growth rate was at its loftiest (9.53 percent). Food grain yields increased from 933 kg per hectare in 1980 – 81 to 1441 kg per hectare in 1999 – 00. In period I, the yield per acre of food grains during the kharif seasons increased by54.45 percent. The times 1983 – 84 had the topmost periodic average growth rate (19.91 percent), followed by17.07 percent. The product and yield of food grains during the first period have a positive relationship. That is, the area under civilization of food grains in the kharif seasons dropped over time, performing in changes in food grain product and yield per hectare. Food grain product in the kharif season increased significantly from102.09 million metric tonnes in 2000 – 01 to143.81 million tonnes in 2019 – 20. During kharif season period II, the product of food grains increased by40.87 percent. The loftiest average monthly growth rate (34.14 percent) was set up in 2003 – 04, followed by16.25 percent in 2010 – 11, and a positive low was in 2013 – 14 with0.48 percent. The area under civilization of food grains in the kharif season has remained fairly flat, dwindling from75.22 million hectares in 2000 – 01 to70.86 million hectares in 2019 – 20. In period II, this is a-5.79 percent drop. In 2003 – 04, the average periodic growth rate was at its loftiest (10.04 percent). Food grain yields increased from 1357 kg per hectare in 2000 – 01 to 2029 kg per hectare in 2019 – 20. In period II, the yield per acre of food grains during the kharif seasons increased by49.52 percent. The time 2003 – 04 had the topmost periodic average growth rate (21.93 percent), followed by11.56 percent in 2010 – 11. The product and yield of food grains during the alternate period have a positive relationship, but not the strongest. That is, the area under cultivation of food grains in the kharif seasons decreased over time, resulting in changes in food grain production and yield per hectare. The food grain production in the Rabi season increased significantly from 51.94 million tonnes in 1980–81 to 104.29 million tonnes in 1999–00. During Rabi Season Period I, the production of food grains increased by 100.79 percent. The highest average yearly growth rate (12.90 percent) was found in 1988–89, followed by 11.98 percent in 1996–97, and a positive low was in 1900–00 with 3.58 percent. The area under cultivation of food grains in the rabi season has remained relatively flat, decreasing from 43.46 million hectares in 1980–81 to 49.87 million hectares in 1999–00. In period I, this is a 14.75 percent gain. In 1981–82, the average annual growth rate was at its highest (4.03 percent). Food grain yields increased from 1195 kg per hectare in 1980–81 to 2091 kg per hectare in 1999–00. In period I, the yield per acre of food grains during the rabi seasons increased by 74.97 percent. The years 1988–89 had the greatest annual average growth rate (10.82 percent), followed by 1996–97 at 10.06 percent. The production, and yield of food grains during the first period have a positive relationship. That is, the area under cultivation of food grains in the rabi seasons over time has slightly decreased, resulting in changes in food grain production and yield per hectare. Food grain output has increased significantly from 94.73 million tonnes in 2000-01 to 153.69 million tonnes in 2019-20, owing to an increase in the rate of production, area, and yield of

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

food grains during the rabi season in period II. That is, during Period II, food grain output increased by 62.24 percent. In 2006–07, the yearly average growth rate in food grain production was the greatest at 8.32 percent. The area under cultivation of food grains increased by only 22.47 percent, from 45.83 kg/hectare in 2000–01 to 56.13 kg/hectare in 2019–20. During this time, the yearly growth rate was at its highest (6.93 percent) in 2019–20. Food grain yields grew from 2067 kg per hectare in 2000–01 to 2738 kg per hectare in 2019–20. This represents a 32.46 percent gain over the previous year. The highest yearly average growth rate was in 2011–12, i.e., 6.67 percent. During this period, the annual average growth rates of food grain production, area, and yield became 62.24 percent, 22.47 percent, and 32.46 percent, respectively. The average production, area, and yield of food grains in the kharif and rabi seasons in periods I, II, and the grand average show that in the kharif seasons; average production changed from 92.01 to 120.58 million tonnes, with overall period averages of 106.29. The average growth from period I to period II was 31.05 percent. The average area in periods I and II were 78.57 and 71.66, with a grand average of 75.12 and -8.79 percent from period I to II. The average yield was changed from 1177.10 in period I to 1684.45 in period II, with a grand average of 1430.78. The average growth rates from periods I and II were 43.1 percent and 37.9 percent, respectively. During the rabi seasons, the average production in two periods was 75.53 and 118.31, with a grand average of 96.92. the average area was 46.66 to 51.74 in periods I and II, and the grand average was 49.20. The average yield from periods I and II and the grand average were 1610.95 and 2275.10 with 1943.03. The average growth rate from period I to period II was 41.23 percent. There are no statistically significant differences in the production, area, and yield of food grains during the kharif and rabi seasons, because the p value is greater than 0.05. There is a very high positive relationship between the yield per hectare during the kharif and rabi seasons in India. There is a positive but low relationship shown in the area under the cultivation of food grains in the rabi seasons. That the CAGR of food grain output, area under food grain cultivation, and yield per hectare from period I to period II and the overall CAGR were the same, indicating that the period I and overall CAGR were the same in production of food grains and slightly better in period II. There is a negative CAGR for the area under cultivation of food grains in periods I, II, and overall. There is no more change in the CAGR of yield per hectare during the Kharif seasons. There is a fundamental change in the CAGR of food grains in the rabi seasons of the production, the least CAGR in the area, and the yield of food grains. That the trend in the total production, area, and yield of food grains in the pooled period I. It shows the trend line of food grain output, area under cultivation, and yield per hectare for periods I and II together. Food grain output climbed by 3.8636 percent from 1980–81 to 2019–20, yield per hectare increased by 31.398 percent from 1980–81 to 2019–20, and area decreased by -0.0578 percent from 1980–81 to 2019–20. Similarly, the intercept of the trend in food grain output, area, and yield per hectare was 61176, 239.96, and 7526, respectively. The coefficient denotes a high level of production and yield but a low level of food grain cultivation area. The trend line in the total production, area, and yield of food grains in kharif seasons by the

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

pooled period It shows the trend line of food grain output, area under cultivation, and yield per hectare for periods I and II together. The growth rate of food grain output climbed by 1.5509 percent from 1980–81 to 2019–20, yield per hectare increased by 26.975 percent from 1980–81 to 2019–20, and area decreased by -0.3469 percent from 1980–81 to 2019–20. Similarly, the intercepts in the trend lines of the food grain output, area, and yield per hectare were 1.5509, -0.3469, and 52533, respectively. The coefficient denotes a high level of production and yield but a low level of food grain cultivation area during the kharif seasons in India. The trend line in the total production, area, and yield of food grains in rabi seasons by the pooled period It shows the trend line of food grain output, area under cultivation, and yield per hectare for periods I and II together. The growth rate of food grain output climbed by 2.3128 percent from 1980–81 to 2019–20, yield per hectare increased by 35.21 percent from 1980–81 to 2019–20, and area decreased by 0.2891 percent from 1980–81 to 2019–20. Similarly, the intercepts in the trend lines of the food grain output, area, and yield per hectare were 4529.8, 0.2891, and 68495, respectively. The coefficient denotes a high level of production and yield but a medium level of food grain cultivation area during the rabi seasons in India. The trend line of the food grain production, area, and yield per hectare in kharif and rabi seasons during the periods I, II, and the pooled period shows that the area trend was -1.35, the production 0.45, and the yield 0.032 with -1.11, 0.344, and 0.025 of the periods I and II in kharif seasons; the coefficient was positive for the period I, but there is a very low coefficient for area during the period II of the kharif seasons. The area trend was 2.23, the production was 0.37, and the yield was 0.021 with 1.56, 0.294, and 0.022 of the periods I and II in the rabi season; the coefficient was positive for the period I, and there was a very low coefficient for area during the period II of the kharif season. The fact that the area trend was -2.21, the production was 0.56, and the yield was 0.035 with 0.7636, 0.864, and 0.945 being the correlation coefficient of the overall periods in kharif seasons; the fact that the area trend was 0.41, the production was 2.73, and the yield was 0.954 with 0.955, 0.791, and 0.945 of the overall periods in rabi seasons; and the total trend line of the food grains was in the area with -0.77, the production was 0.24, and the yield was 0.031; the correlation coefficients were 0.045, 0.938, and the rabi The structural stability of the regression equation used to estimate agricultural production and the area under the cultivation of food grains in kharif and rabi and the total food grains before and after the new agricultural policy of 2000 The calculated values of food grains in the kharif, rabi, and total food grains were 19.031, 6.727, and 31.59, respectively. When the level of significance is set to 5%, the crucial factor $F_{2,38}$ is computed to be 0.004, which is less than 0.05. As a result, the null hypothesis should be rejected because the observed test values for food grains in kharif, rabi, and the total food grains were all higher than the critical value, indicating structural stability. As a result of the new agricultural strategy, there has been a structural change in the production of food grains and the area under cultivation in India in the kharif and rabi seasons.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

LITERATURE REVIEW:

This study primarily concentrated on recent literature on the area, product, and yield of agrarian product of food grains in the kharif and rabi seasons. Below are a many recent benefactions. An analysis of India's product of food grains in 2020 by trends Surender Mor and Amita Rani India's north Crop yields in North India are lower than those in the rest of India in Kharif but lesser in Rabi. The product of the Kharif crops (rice and sludge) is adding sluggishly, and the yield difference between the two crops looks to be widening time by time. While the product difference for the gramme crop is anticipated to profit all of India, it's prognosticated that the wheat yield difference will favour North India. According to the exploration, some food crops' growth rates may be braked down, also increased, in order to save tone- adequacy in the product of food grains and feed the expanding population. Using and enforcing innovative climate- responsive husbandry technology will help achieve this. The paper goes on to say that redundant trouble may be demanded to not only increase the product of the food crops but also to maintain situations given the rising mean temperature and lower mean downfall caused by climate change in North India as opposed to India. Mishra (2016) looked into how globalisation has affected the area, product, and productivity of food grains in India. The exploration claims that the post-reform period had a mischievous effect on India's product, affair, and productivity of food grains. The number of food grains produced has dropped, along with the land used to grow them. The study" Trends of Area, Production, and Productivity of Food Grain in the North Eastern States of India" by Sharma, A. (2013) uncovered salutary trends in food grain yield and affair in the North Eastern states. Elumalai Kannan's 2011 composition is named" Trends in India's Agricultural Growth and its Determinants." The study set up that India's cropping patterns have drastically changed over time, with a pronounced movement down from the civilization of food grains and towards marketable crops. Throughout the study period, there was a13.3 drop in the civilization of coarse grains. During this time, the affair and palpitation areas weren't operating duly. ultramodern seed kinds, fertilisers, irrigation systems, and other rudiments all contributed to advanced crop yields. Agricultural Productivity Trends in India Sustainability Issues, Praduman Kumar and Surabhi Mittal, 2006. Crop product's long- term viability is getting more and more important. High input utilisation and a dwindling rise in total factor productivity define the post-Green Revolution period. rises in agrarian R&D expenditures, which raise the affair of all factors. In the Indian frugality, agrarian exploration and development are given a lot of attention. Cropping practises in India have changed from the civilization of food grains to the development of marketable crops." Analysis of growth trends in the Indian agrarian sector" by Sulochna Meena (2016) The preface of superior seeds, increased fertiliser rates, factory protection chemicals, and irrigation systems led to an increase in food crop product. To increase the productivity of the agrarian assiduity, careful planning and backing are demanded. According to V.P.S. Arora's (2013)" Agricultural programs in India Retrospect and Prospect" study, Indian husbandry is shifting towards exports after nearly achieving tone- adequacy in the product of introductory foods. presently,

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

in addition to the standard import goods, India also exports beast products, wheat, and rice. The path of commerce is also changing. Indeed, if trade with the region's neighbours still predominates, trade with OECD nations is growing more and more important, especially for high- value food exports. In his 2009 composition" Food Security in Indian Agriculture programs, Affair Performance, and Marketing terrain, S.S. Acharya reported that throughout the 20- time period between the triennial ending in 1974 – 75 and the triennial concluding in 1994 – 95, the average incremental product was about 4 MT per time. The population and cereal demand have both increased at a rate that has kept up with cereal product. India is getting the largest exporter of cereals worldwide. increases in the physical availability of food for homes around the nation as well as ongoing advancements in the fiscal availability of food for guests. An exploratory study on agrarian exploration in India was published in 2012 by Anwesha Borthakur and Pardeep Singh. Indian agrarian exploration has a rich history of growth and progress. It was the largest exploration system in the world when it started with agrarian exploration in the social period. The Indian Council of Agricultural Research (ICAR) primarily supports, promotes, and manages civil exploration and educational enterprise. At the state position, exploration and instruction are handled by the state agrarian universities. Regarding investment, technology transfer, and other angles of agrarian growth in India, five- time plans are pivotal. Amarnath Tripathi and A.R. Prasad's study," Agricultural Development in India Since Independence A Research on Progress, Performance, and Factors," was published in 2009. According to this study, since the WTO, the overall growth trend of husbandry, with the exception of forestry, has been declining. The agrarian pool has changed from tillers to agrarian labourers; the number of empty effects is adding, the area under food crops has shifted to non-food crops, and within food crops, the area under cereals has shifted to non-cereals. product insecurity now heavily depends on indigenous insecurity. (2017) Malik, Ruchi," Growth, Insecurity, and corruption of Food Grains in India," The bulk of the population still relies substantially on husbandry for their livelihood; thus, indeed if the Indian frugality is growing, it's still an agricultural bone. The area, product, and yield of food grains in India were examined using time series data from 2001 – 2002 to 2015 – 2016 in the current study. According to the research, the rise in yield and/or area in India's food grain production was the cause of the rise in output. (2020) Kumari et al., Trends and Decompositions in Food Grain Production in India, according to the present study, food grains are grown on 123.22 million hectares in India, with an output of 251.57 million metric tonnes. The results of the study showed that the output of food grains in the nation increased at a rate of 1.73 percent annually due to a slight increase in area and productivity during the study period. Main cereals like rice, wheat, and maize have demonstrated constant improvement in food grain production, while pulse output has not. After rice and wheat, maize is the third-highest yielding coarse cereal, with yields rising from approximately 1595 kg per hectare in 1995–1996 to 2563 kg per hectare in 2015–16.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

OBJECTIVES:

To analyze the growth and trends in the production, area and the yield of food grains in various seasons before and after the new agricultural policy

To evaluate the structural stability of agricultural production and the area under cultivation of food grains in kharif and rabi seasons.

HYPOTHESIS:

There is no structural change in the agricultural production and area under cultivation of various seasons before and after the new agricultural policy in India.

There is no difference between the average (Mean) of production, area and yield of food grains in kharif and rabi seasons on the before and after the new agricultural policy of India.

MATERIAL AND METHODS:

The study's production, area under cultivation, and yield per hectare of food grains throughout the kharif and rabi seasons in India were all accomplished using secondary data. The information on the area under cultivation (in million hectares), crop production (in million tonnes), and food grain yield per hectare (Kg/hectare) was gathered from the Agricultural Statistics at a Glance—2021 report published by the Ministry of Agriculture and Farmers' Welfare of the Government of India. Before and after India's agricultural policy, from 1980 to 2000 and 2001 to 2020, respectively, the data covered two distinct periods linked to food grains throughout the kharif and rabi seasons. From 1980 to 2020 in India, both time periods require distinct research. Gregory Chou's structural stability regression model—also known as the Chou test—is used to measure the structural stability of agricultural production of food grains. It is generated using a pooled sample for periods I and II separately and is significant at a level of 5%. During the kharif and rabi seasons, before and after India's new agricultural policy, the average, compound annual growth rate (CAGR), t test, and F test were used to estimate, compare, and highlight the growth trend in the production, area, and yield per hectare of food grains.

Structural Stability Regression Model:

A structural stability regression framework was used to examine the ongoing stability of the rate of growth parameter, and the following F statistics were used to compare the stability in the expansion parameters between the kharif and rabi seasons before and after the new agricultural policy period.

$$M_t = N_1 + N_2 Q_t + w_t$$

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Where Q is the area used to cultivate food grains, M denotes the volume of grains produced, t denotes the time period, N_1 denotes the intercept, N_2 denotes the growth parameter to be estimated, and w denotes the stochastic term in the pooled sample.

$$M_t = O_1 + O_2 Q_t + w_t$$

Where Q is the area under food grain cultivation in the I period, M is the volume of food grains produced in the I period, t is the time period, O_1 is the intercept, O_2 is the growth parameter to be estimated, and w is the stochastic term in the I period; in the sample.

$$M_t = P_1 + P_2 Q_t + w_t$$

In the sample, M stands for the volume of food grains produced in period II, t stands for the time period, P_1 stands for the intercept, P_2 stands for the growth parameter that needs to be estimated, Q stands for the area planted with food grains in period 2, and w stands for the stochastic term in period II.

$$F = \frac{R5/k}{R4/(n1 + n2 - 2k)}$$

R_1 is the residual sum of squares for the pooled sample, R_2 is the residual sum of squares for the I period, R_3 is the residual sum of squares for the II period, and R_4 is the combined value of R_2 and R_3. R_5, n_1 and n_2 are the number of observations, k is the number of parameters, and R_5 is the disparity between R_1 and R_4.

RESULTS AND DISCUSSION:

The study showed that the yield per hectare of food grains during the kharif and rabi seasons on before the new agricultural policy (2000), as shown in table 1, the yearly average growth rate of agricultural production of food grains, area under cultivation of food grains, and the yield per hectare of food grains.

Table 1. Growth Rate of Production, Area and Yield of Food Grains in Kharif Season - Period I

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
1980-81	77.65	-	83.21	-	933	-
1981-82	79.38	2.23	83.93	0.87	946	1.39
1982-83	69.9	-11.94	79.08	-5.78	884	-6.55
1983-84	89.23	27.65	84.14	6.40	1060	19.91
1984-85	84.52	-5.28	81.18	-3.52	1041	-1.79

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
1985-86	85.25	0.86	81.8	0.76	1042	0.10
1986-87	80.2	-5.92	81.46	-0.42	985	-5.47
1987-88	74.56	-7.03	74.89	-8.07	996	1.12
1988-89	95.64	28.27	82.03	9.53	1166	17.07
1989-90	100.99	5.59	81.4	-0.77	1241	6.43
1990-91	99.44	-1.53	80.78	-0.76	1231	-0.81
1991-92	91.59	-7.89	78.02	-3.42	1174	-4.63
1992-93	101.47	10.79	77.92	-0.13	1302	10.90
1993-94	100.4	-1.05	75.81	-2.71	1324	1.69
1994-95	101.09	0.69	75.19	-0.82	1344	1.51
1995-96	95.12	-5.91	73.6	-2.11	1292	-3.87
1996-97	103.82	9.15	75.34	2.36	1379	6.73
1997-98	101.58	-2.16	74.37	-1.29	1370	-0.65
1998-99	102.91	1.31	73.99	-0.51	1391	1.53
1999-00	105.51	2.53	73.24	-1.01	1441	3.59

Source: Agricultural Statistics at a Glance-2021, Government of India.

According to Table 1, food grain output increased dramatically during the kharif season, from 77.65 million tonnes in 1980–81 to 105.51 million tonnes in 1999–2000. The production of food grains increased by 35.87 percent during the kharif season period I. The year with the highest average annual growth rate was 1988–1989 (28.17%), followed by 1983–1984 (27.16%), and the year with the lowest average annual growth rate was 1985–1986 (0.86%). The area used for food grain cultivation during the kharif season has decreased somewhat over time, from 83.21 million hectares in 1980–81 to 73.24 million hectares in 1999–2000. This is a decrease of -11.98% in period I. The average annual growth rate peaked in 1988–1989 at 9.53 percent. From 933 kg per hectare in 1980–1981 to 1441 kg per hectare in 1999–2000, food grain yields increased. The output of food grains per acre during the kharif seasons increased by 54.45% in period I. The highest yearly average growth rate was in the years 1983–1984 (19.91%), followed by 17.07%. Food grain output and yield during the first period are positively correlated. In other words, as the area used for food grain cultivation during the kharif seasons reduced throughout time, the yield per hectare of food grain also changed.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Table 2. Growth Rate of Production, Area and Yield of Food Grains in Kharif Season - Period II

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
2000-01	102.09	-	75.22	-	1357	-
2001-02	112.07	9.78	74.23	-1.32	1510	11.27
2002-03	87.22	-22.17	68.56	-7.64	1272	-15.76
2003-04	117	34.14	75.44	10.04	1551	21.93
2004-05	103.31	-11.70	72.26	-4.22	1430	-7.80
2005-06	109.87	6.35	72.72	0.64	1511	5.66
2006-07	110.58	0.65	72.67	-0.07	1522	0.73
2007-08	121	9.42	73.58	1.25	1644	8.02
2008-09	118.18	-2.33	71.45	-2.89	1654	0.61
2009-10	104	-12.00	69.51	-2.72	1496	-9.55
2010-11	120.9	16.25	72.42	4.19	1669	11.56
2011-12	131.27	8.58	72.08	-0.47	1821	9.11
2012-13	128.07	-2.44	67.69	-6.09	1892	3.90
2013-14	128.69	0.48	69.05	2.01	1864	-1.48
2014-15	128.06	-0.49	68.77	-0.41	1862	-0.11
2015-16	125.09	-2.32	69.2	0.63	1808	-2.90
2016-17	138.33	10.58	73.2	5.78	1890	4.54
2017-18	140.47	1.55	72	-1.64	1951	3.23
2018-19	141.52	0.75	72.34	0.47	1956	0.26
2019-20	143.81	1.62	70.86	-2.05	2029	3.73

Source: Agricultural Statistics at a Glance-2021, Government of India.

Food grain production in kharif season were increased significantly from 102.09 million tonnes in 2000-01 to 143.81 million tonnes in 2019-20, as shown in table 2. During kharif season period II, the production of food grains increased by 40.87 percent. The highest average yearly growth rate (34.14 percent) was found in 2003-04 followed by 16.25 percent in 2010-11 and positive low were in 2013-14 with 0.48 percent. The area under cultivation of food grains in kharif season has remained relatively declining, decrease from 75.22 million hectares in 2000-01 to 70.86 million hectares in 2019-20. In period II, this is a -5.79 percent drop In 2003-04, the average annual growth rate was at its highest (10.04 percent). Food

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

grain yields increased from 1357 kg per hectare in 2000-01 to 2029 kg per hectare in 2019-20. In period II, the yield per acre of food grains during the kharif seasons increased by 49.52 percent. The year 2003-04 had the greatest annual average growth rate (21.93 percent) followed by 11.56 percent in 2010-11. The production, and yield of food grains during second period have a positive relationship but least. That is, the area under cultivation of food grains in the kharif seasons over time were decreased, resulting in changes in food grain production and yield per hectare must affected.

Table 3. Growth Rate of Production, Area and Yield of Food Grains in Rabi Season - Period I

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
1980-81	51.94	-	43.46	-	1195	-
1981-82	53.92	3.81	45.21	4.03	1193	-0.17
1982-83	59.62	10.57	46.02	1.79	1296	8.63
1983-84	63.14	5.90	47.02	2.17	1343	3.63
1984-85	61.02	-3.36	45.49	-3.25	1341	-0.15
1985-86	65.19	6.83	46.22	1.60	1410	5.15
1986-87	63.22	-3.02	45.74	-1.04	1382	-1.99
1987-88	65.79	4.07	44.8	-2.06	1469	6.30
1988-89	74.28	12.90	45.64	1.88	1628	10.82
1989-90	70.05	-5.69	45.37	-0.59	1544	-5.16
1990-91	76.95	9.85	47.06	3.72	1635	5.89
1991-92	76.79	-0.21	43.85	-6.82	1751	7.09
1992-93	78.01	1.59	45.23	3.15	1725	-1.48
1993-94	83.86	7.50	46.94	3.78	1787	3.59
1994-95	90.41	7.81	48.67	3.69	1858	3.97
1995-96	85.3	-5.65	47.42	-2.57	1799	-3.18
1996-97	95.52	11.98	48.24	1.73	1980	10.06
1997-98	90.68	-5.07	49.7	3.03	1825	-7.83
1998-99	100.69	11.04	51.18	2.98	1967	7.78
1999-00	104.29	3.58	49.87	-2.56	2091	6.30

Source: Agricultural Statistics at a Glance-2021, Government of India.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

As indicated in Table 3, food grain output in the rabi season increased dramatically from 51.94 million tonnes in 1980–81 to 104.29 million tonnes in 1999–00. Food grain production grew by 100.79 percent during Rabi Season Period I. The highest average yearly growth rate (12.90 percent) was observed in 1988–89, followed by 11.98 percent in 1996–97, and a positive low of 3.58 percent in 1900–00. In the rabi season, the area under cultivation of food grains has remained reasonably stable, falling from 43.46 million hectares in 1980–81 to 49.87 million hectares in 1999–00. This is a 14.75 percent growth in period I. The highest average yearly growth rate (4.03 percent) occurred in 1981–1982. From 1195 kg per hectare in 1980–1981 to 2091 kg per hectare in 1999–2000, food grain yields increased. The yield of food grains per acre during the rabi seasons grew by 74.97 percent in period I. The highest annual average growth rate was 10.82 percent in 1988–1989, followed by 10.06 percent in 1996–1997. Food grain output and yield during the first period are positively correlated. In other words, variations in food grain production and yield per hectare must have been caused by a minor decrease in the area under cultivation of food grains throughout the rabi seasons over time.

Table 4. Growth Rate of Production, Area and Yield of Food Grains in Rabi Season - Period II

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
2000-01	94.73	-	45.83	-	2067	-
2001-02	100.78	6.39	48.55	5.93	2076	0.44
2002-03	87.55	-13.13	45.3	-6.69	1933	-6.89
2003-04	96.19	9.87	48.01	5.98	2004	3.67
2004-05	95.05	-1.19	47.82	-0.40	2004	0.00
2005-06	98.73	3.87	48.88	2.22	2020	0.80
2006-07	106.71	8.08	51.04	4.42	2091	3.51
2007-08	109.77	2.87	50.49	-1.08	2174	3.97
2008-09	116.28	5.93	51.39	1.78	2263	4.09
2009-10	114.11	-1.87	51.83	0.86	2202	-2.70
2010-11	123.6	8.32	54.25	4.67	2278	3.45
2011-12	128.01	3.57	52.67	-2.91	2430	6.67
2012-13	129.06	0.82	53.09	0.80	2431	0.04
2013-14	136.35	5.65	55.99	5.46	2435	0.16
2014-15	123.96	-9.09	55.53	-0.82	2232	-8.34

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Year	Production	Simple Growth Rate	Area	Simple Growth Rate	Yield	Simple Growth Rate
2015-16	126.45	2.01	54.01	-2.74	2341	4.88
2016-17	136.78	8.17	56.03	3.74	2441	4.27
2017-18	144.55	5.68	55.53	-0.89	2603	6.64
2018-19	143.76	-0.55	52.49	-5.47	2739	5.22
2019-20	153.69	6.91	56.13	6.93	2738	-0.04

Source: Agricultural Statistics at a Glance-2021, Government of India.

Table 4 demonstrates how the output of food grains has increased dramatically from 94.73 million tonnes in 2000-01 to 153.69 million tonnes in 2019-20, reflecting expansion in production, area, and yield during the second rabi season. In other words, food grain output rose by 62.24 percent during Period II. The highest annual average increase rate in food grain production was in 2006–07, at 8.32%. Only 22.47 percent more land was planted with food grains, from 45.83 kg/hectare in 2000-01 to 56.13 kg/hectare in 2019-20. The highest annual growth rate throughout this time was 6.93 percent in 2019–20. From 2067 kg per hectare in 2000–01 to 2738 kg per hectare in 2019–20, food grain yields increased. This is an increase of 32.46 percent from the prior year. 2011–12 saw the greatest average annual growth rate, or 6.67 percent. Production of food grains increased by an average of 62.24 percent, 22.47 percent, and 32.46 percent every year throughout this time period, respectively.

Table 5. Average Production, Area and Yield of Food Grains: Period I, Period II, and Pooled

Season – Wise Average Production, Area and Yield of Food Grains						
Average	Kharif			Rabi		
	Production	Area	Yield	Production	Area	Yield
Average (Period I)	92.01	78.57	1177.10	75.53	46.66	1610.95
Average (Period II)	120.58	71.66	1684.45	118.31	51.74	2275.10
Grand Average	106.29	75.12	1430.78	96.92	49.20	1943.03
t – test	-13.19	9.09	-23.81	-26.32	1.73	-25.04
P- value	5.75	2.38	1.31	2.06	1.26	5.16
Pearson “r”	0.765	0.449	0.912	0.935	0.586	0.900

Source: Authors calculation.

Significant at 5% level of Probability.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

In the kharif seasons, average production increased from 92.01 to 120.58 million tonnes, with overall period averages being 106.29. Table 5 shows the average production, area, and yield of food grains in periods I and II and the grand average. Between period I and period II, the average growth was 31.05 percent. The average area for periods I and II was 78.57 and 71.66, respectively, with a 75.12 overall average and a -8.79 percent change from period I to period II. From 1177.10 in period, I to 1684.45 in period II, with a grand average of 1430.78, the average yield changed. Between periods I and II, the average growth rate was 43.1 percent. In two time periods during the rabi seasons, the average production was 75.53 and 118.31, with a grand average of 96.92. In periods I and II, the average ranged from 46.66 to 51.74, with a 49.20 overall average. The grand average yields for periods I and II were 1610.95 and 2275.10, respectively, with 1943.03 being the average. Between periods I and II, there was an average growth rate of 41.23 percent. Because the p value is greater than 0.05, there are no statistically significant changes between the kharif and rabi seasons in terms of food grain output, area, or yield. India's kharif and rabi seasons show a strong positive correlation between the yield per hectare. In the area where food grains are grown during the rabi seasons, there is a favourable but weak association.

Table 6. CAGR of Food Grains Production and Area – Period I, Period II, and Pooled

Seasons – Wise CAGR of Production, Area and Yield of Food Grains						
CAGR	**Kharif**			**Rabi**		
	Production	**Area**	**Yield**	**Production**	**Area**	**Yield**
CAGR (Period I)	0.016	-0.007	0.023	0.037	0.007	0.030
CAGR (Period II)	0.018	-0.003	0.021	0.026	0.011	0.015
Overall CAGR	0.016	-0.004	0.021	0.029	0.007	0.022

Source: Authors calculation.

Table 6 shows the CAGR of food grain production, area under cultivation for food grains, yield per hectare from period I to period II, and overall CAGR, showing that period I and the overall CAGR were similar in terms of food grain production, with period II doing somewhat better. The area used for food grain production in periods I, II, and the overall period has a negative CAGR. The CAGR of the yield per acre during the Kharif seasons has not changed in the past. The CAGR of food grains significantly changes during the rabi seasons of production, with the area's CAGR being the lowest and the yield of food grains increasing.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

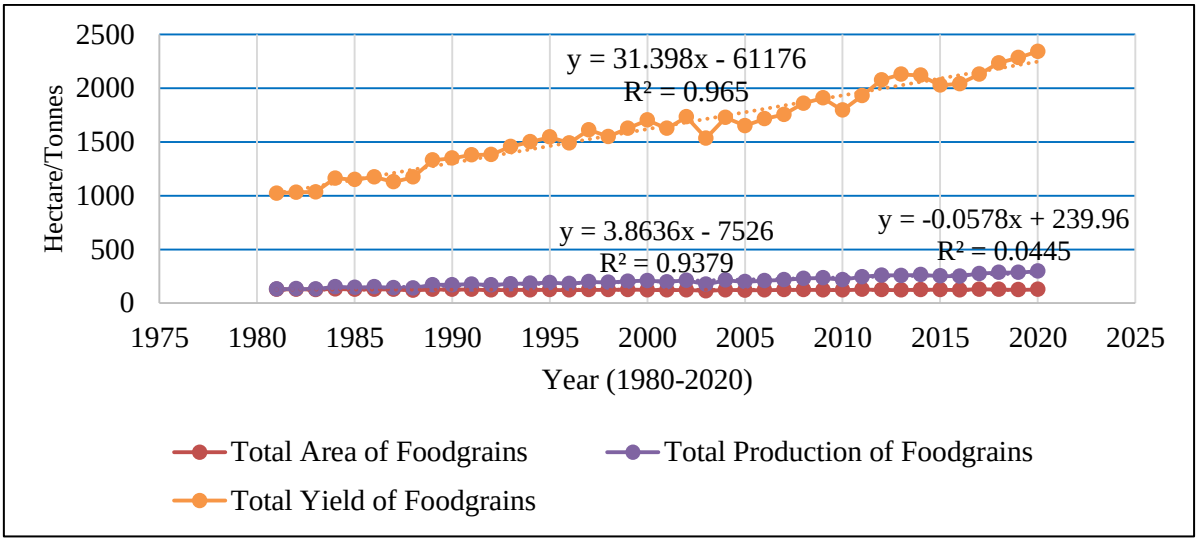

Figure 1. Trend Line of the Area, Production and Yield of Food Grains – 1980-81 to 2019-20

Source: Authors Calculation.

The trend in the overall production, area, and yield of food grains throughout the pooled period is depicted in Figure 1. For periods I and II combined, it displays the trend line of food grain production, area under cultivation, and yield per hectare. Between 1980–1981 and 2019–2020, the output of food grains increased by 3.8636 percent, the yield per hectare increased by 31.398 percent, and the area shrank by 0.0578 percent. The trend's intercepts for yield, area, and production of food grains per hectare were also similar, measuring 61176, 239.96, and 7526, respectively. A high production and yield but a low area under food grain cultivation are indicated by the coefficient.

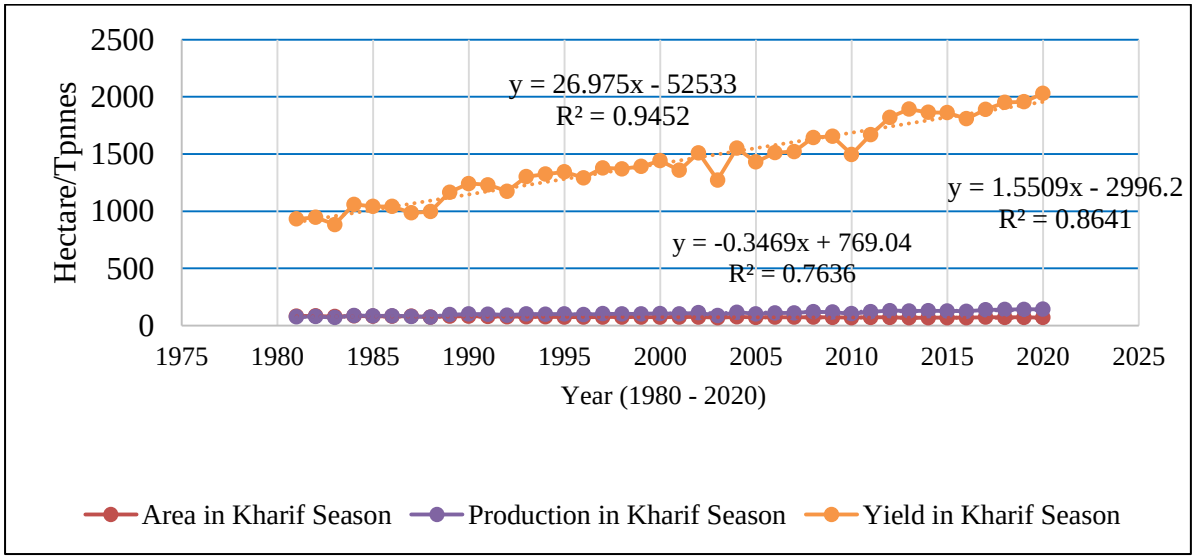

Figure 2. Trend Line of the Area, Production and Yield in Kharif Season – Pooled Period

Source: Authors calculation.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

The trend line for the total production, area, and yield of food grains during the kharif seasons is depicted in Figure 2 for the pooled period. For periods I and II combined, it displays the trend line of food grain production, area under cultivation, and yield per hectare. Food grain output growth rate increased by 1.5509% between 1980 and 2019; yield per hectare increased by 26.97% between 1980 and 2019; and area fell by -0.3469% between 1980 and 2019. Similar to this, the intercepts in the trend lines of the yield per hectare, area, and production of food grains were 1.5509, -0.3469, and 52533, respectively. The coefficient indicates that during India's kharif seasons, there is a high level of production and yield but a low level of food grain cultivation area.

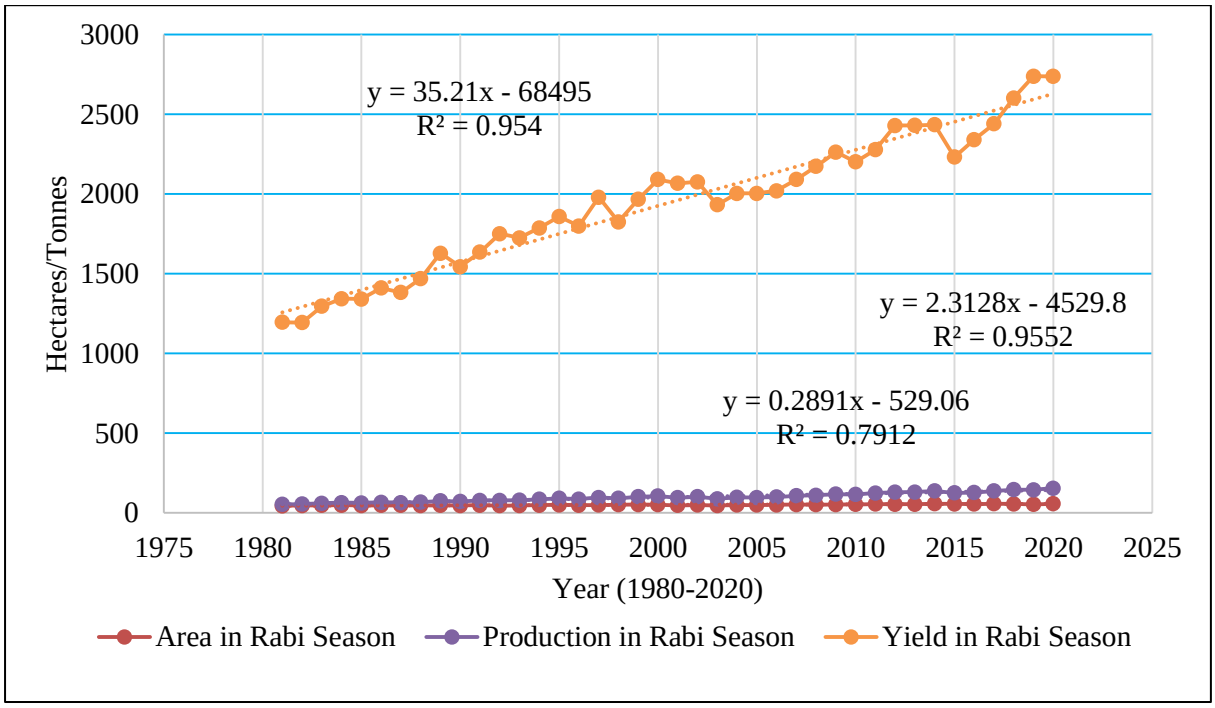

Figure 3. Trend Line of the Area, Production and Yield in Rabi Season – Pooled Period

Source: Authors calculation.

The trend line for the total production, area, and yield of food grains during the rabi seasons is depicted in Figure 3 for the pooled period. For periods I and II combined, it displays the trend line of food grain production, area under cultivation, and yield per hectare. From 1980–81 to 2019–20, the growth rate of food grain output increased by 2.3128 percent, yield per hectare increased by 35.21 percent, and area was reduced by 0.2891 percent. Similar to this, the intercepts in the trend lines of the yield per hectare, area, and production of food grains were 4529.8, 0.2891, and 68495, respectively. During India's rabi seasons, the coefficient indicates a high level of production and yield but a middling level of food grain cultivation area.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

Table 7. Trend in the Total Production, Area and Yield of Food Grains Items in Kharif and Rabi - Pooled Period

Seasons	Area	Production	Yield
Kharif Period I & II	$Y = 2096.74 – 1.35X$ $R^2 = 0.735$	$Y = 1948.93 + 0.45X$ $R^2 = 0.718$	$Y = 1953.04+0.032X$ $R^2 = 0.910$
	$Y = 2090.05 – 1.11X$ $R^2 = 0.176$	$Y = 1968.91 + 0.344X$ $R^2 = 0.775$	$Y = 1968.41+0.025X$ $R^2 = 0.875$
Rabi Period I & II	$Y = 1888.42 + 2.23X$ $R^2 = 0.566$	$Y = 1962.11 + 0.37X$ $R^2 = 0.958$	$Y = 1956.17+0.021X$ $R^2 = 0.961$
	$Y = 1929.89 + 1.56X$ $R^2 = 0.822$	$Y = 1975.61 + 0.294X$ $R^2 = 0.921$	$Y = 1959.45+0.022X$ $R^2 = 0.837$
Kharif in Total	$Y = 2165.86 – 2.21X$ $R^2 = 0.7636$	$Y = 1941.27 + 0.56X$ $R^2 = 0.864$	$Y = 1950.37+0.035X$ $R^2 = 0.945$
Rabi in Total	$Y = 1960.47+0.41X$ $R^2 = 0.955$	$Y = 1865.25 + 2.73X$ $R^2 = 0.791$	$Y = 1947.85+0.954X$ $R^2 = 0.945$
Total Foodgrains	$Y = 2096.2 – 0.77X$ $R^2 = 0.045$	$Y = 1951.17 + 0.24X$ $R^2 = 0.938$	$Y = 1950.22+0.031X$ $R^2 = 0.964$

Source: Authors calculation.

The trend line for food grain production, area, and yield per hectare during periods I, II, and the pooled period is shown in Table 7. While the coefficient was positive for the period I, the coefficient for area during the period II of the kharif seasons is very low. The area trend was 1.35, the production trend was 0.45, and the yield trend was 0.032 with -1.11, 0.344, and 0.025. Table 7 displays the trend line for food grain production, area, and yield per hectare during periods I, II, and the pooling era. Although the area coefficient was positive for period I of the kharif seasons, it is relatively low for period II. The trends for the area, output, and yield were 1.35, 0.45, and 0.032, respectively, with -1.11, 0.344, and 0.025; the overall periods during the rabi seasons had an area trend of 0.41, production of 2.73, and yield of 0.954; the overall trend line for food grains had an area trend of -0.77, production of 0.24, and yield of 0.031; the correlation coefficients for these three variables were 0.045, 0.938, and 0.964, respectively.

Table 8. The Structural Stability of Regression Model - Production and Area of Food Grains

	Pooled Sample	Period I	Period II
Kharif	$\hat{Y}_t = 92.3687 – 0.1623X_t$ $r^2 = 0.453$ $R_1 = 448.96$ d f = 38	$\hat{Y}_t = 99.031 – 0.168X_t$ $r^2 = 0.247$ $R_2 = 201.365$ d f = 18	$\hat{Y}_t = 72.825 -0.0096X_t$ $r^2 = 0.0042$ $R_3 = 94.951$ d f = 18
	$R_4 = 296.316$	$R_5 = 156.644$	F = 19.031 P-value = 0.004

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

	Pooled Sample	**Period I**	**Period II**
Kharif	$\hat{Y}_t = 92.3687 - 0.1623X_t$ $r^2 = 0.453$ $R_1 = 448.96$ d f = 38	$\hat{Y}_t = 99.031 - 0.168X_t$ $r^2 = 0.247$ $R_2 = 201.365$ d f = 18	$\hat{Y}_t = 72.825 - 0.0096X_t$ $r^2 = 0.0042$ $R_3 = 94.951$ d f = 18
	$R_4 = 296.316$ $R_5 = 156.644$ F = 19.031 P-value = 0.004		
Rabi	$\hat{Y}_t = 36.818 + 0.1277X_t$ $r^2 = 0.8654$ $R_1 = 75.76$ d f = 38	$\hat{Y}_t = 38.473 + 0.1083X_t$ $r^2 = 0.6723$ $R_2 = 25.782$ d f = 18	$\hat{Y}_t = 32.447 + 0.1631X_t$ $r^2 = 0.8311$ $R_3 = 38.05$ d f = 18
	$R_4 = 63.832$ $R_5 = 11.928$ F = 6.727 P-value = 0.004		
Total Food Grains	$\hat{Y}_t = 124.715 - 0.0019X_t$ $r^2 = 0.0008$ $R_1 = 399.91$ d f = 38	$\hat{Y}_t = 132.6128 - 0.0441X_t$ $r^2 = 0.1482$ $R_2 = 138.033$ d f = 18	$\hat{Y}_t = 104.858 + 0.0776X_t$ $r^2 = 0.6345$ $R_3 = 74.95$ d f = 18
	$R_4 = 212.983$ $R_5 = 186.927$ F = 31.59 P-value = 0.004		

Source: Authors Calculation.

Before and after the new agricultural policy of 2000, Table 8 compares the structural stability of the regression equation used to estimate agricultural production, the area under food grain cultivation in kharif and rabi, and the overall area under food grains. Food grains were valued at 19.031, 6.727, and 31.59 in the kharif, rabi, and overall food grain categories, respectively. The important factor F2,38 is calculated to be 0.004, which is less than 0.05, with a level of significance of 5%. The observed test values for food grains in kharif, rabi, and the total food grains were all higher than the critical value, suggesting structural stability, and the null hypothesis should be rejected as a result. The production of food grains and the area cultivated in India during the kharif and rabi seasons have undergone structural change as a result of the new agricultural strategy.

CONCLUSION:

Agriculture continues to be the vast majority of people's main source of income, despite the fact that India's economy is still in its infancy. The agricultural sector provides a sizable number of raw materials to numerous sectors, ensures food security and nutrition for India's enormous population, strengthens the nation's industrial base, and generates production surpluses for export. According to the study, the growth rates for area, production, and yield were -14.84, 85.20, and 117.47 percent in the kharif seasons and 29.15, 195.89, and 129.12 percent in the rabi seasons, respectively. The growth rates for total food grains were 0.253, 129.57, and 129.03 percent. Although there is no statistically significant change in output

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022**

between periods I and II, the average area under cultivation is increasing. Furthermore, there are no substantial differences in yield per hectare, indicating that the Indian agricultural industry has not changed significantly throughout the years. As a result of the new agricultural policy, there has been a structural change in food grain production and cultivated area in India.

Acknowledgment:

This paper received no specific grant from any funding agency in the public, commercial, or not-for profit sector.

REFERENCES:

1. *Agricultural Statistics at a Glance*— (2021) report published by the *Ministry of Agriculture and Farmers' Welfare of the Government of India.*
2. Amita, Rani. & Surender, Mor. (2020). Trends in foodgrains production in India: an analysis of India vis-a-vise north India, *Plant Archives* Vol. 20, Supplement 2, 2020 pp. 3592-3599.
3. Borthakur, A., and P. Singh. (2012). Agricultural research in India: An exploratory study *International Journal of Social Science & Interdisciplinary Research*, Vol.1 Issue 9, September 2012, ISSN 2277 3630.
4. Bruinsma,J.(2003). World Agriculture: Towards 2015/2030 An FAO perspective. London: *Earthscan Publications Ltd*. Available at http://www.fao.org/3/a-y4252e.pdf.
5. C.S. Ruchi. (2014). Comparative Study on Institution - wise Credit Flow to Agriculture Sector in India. *International Journal of Economics Law and Social Sciences*.1 (8): 5 - 9. ISSN: 2348 -165X.
6. Dr. N. Eswaran. (2017). A Study on Growth and Performance of Food Grains in India with Special Reference to Maize. *IOSR Journal of Humanities and Social Science (IOSR-JHSS).* vol. 22 no. 12, pp. 28-36.
7. Fischer, G.M.; van Velthuizen, H.T.; Shah, M.M. and Nachtergaele, F.O. (2002). Global Agro-ecological Assessment for Agriculture in the 21st Century: Methodology and Results. *Laxenburg:* IIASA.
8. Gangwar, B. (1999). Technical Advances for Increasing Crop Productivity in Diara Areas, Agricultural Situation in India, Vol.LV, No. 10, pp:615-620. Government of India. *Economic Survey of India*, Various Issues, Ministry of Finance, New Delhi.
9. Ghosh, Nilabja and Chiranjib Neogi. (1995). Supply Response of Food grains and Policy Actions: A Model with Rational Exceptional Hypothesis, *Indian Journal of Agricultural Economics*, Vol. 50, No. 2, pp: 135-152.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper **© 2012 IJFANS. All Rights Reserved,** **UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022**

10. K. K, Prashar D. (2012). An Analysis on Changing Trends on Food grains in Himachal Pradesh, *International Journal of Pharmacy & Life Sciences*. 3(6):1739 -1742. ISSN: 0976 -7126.

11. Malik, Ruchi. (2017). Food grains in India: Growth, instability and decomposition analysis, *International Journal of Multidisciplinary Research and Development*, Volume 4; Issue 6; June 2017; Page No. 304-308.

12. Mishra VK. (2016). Impact of Globalization on the Area, Production and Yield of the Food grains in India, 3rd International Conference on Science, Technology and Management, 978 -81 -932074 - 0 -6, 2016; 36 -43.

13. Kannan, Elumalai. (2011). Trends in India's Agricultural Growth and its Determinants, *Asian Journal of Agriculture and Development, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)*, vol. 8(2), pp 1-21.

14. Kumar, P., and S. Mittal. (2006). Agricultural productivity trends in India: Sustainability issues, *Agriculture economics research review*, Vol.19, pp 71-88.

15. *Economic Affairs*, Vol. 65, No. 3, pp. 333-342, September 2020 DOI: 10.46852/0424-2513.3.2020.3.

16. Kumari, N., Mehta, V.P. and Bhatia, J.K. (2020). Food grains Production in India: Trend and Decompositions Analysis. *Economic Affairs*, 65(3): 333-342.

17. Lal, M.; Singh, K.K.; Rathore, L.S.; Srinivasan, G. and Saseendran, S.A. (1998).Vulnerability of rice and wheat yields in NW India to future changes in climate. *Agricultural and forest meteorology*, 89(2): 101-114.

18. Mor, S. and Madan, S. (2016). Climate Change and Food Production: A Case of Four North Indian States. *In N. Mehta & A. Arya (Eds),* 'Role of Public Policy in Development Process', (pp.77-80). New Delhi: Academic Foundation.

19. Reserve Bank of India Handbook of Statistics on Indian Economy, Mumbai, 2020-21.

20. Ruchi. (2014). A Study on Agricultural Credit System in India. *International Journal of Business, Management & Social Sciences*. 2 (1):41 -45. ISSN: 2249 -7463.

21. Ruchi. (2017). Food grains in India: Growth, instability and decomposition analysis, *International Journal of Multidisciplinary Research and Development*, Impact Factor: RJIF 5.72 www.allsubjectjournal.com Volume 4; Issue 6, Page No. 304-308.

22. S. S. Acharya. (2009). Food security and Indian agriculture: Policies, Production performance and marketing environment, *Agricultural economic research review* – Vol.22, pp 1-19.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 2, 2022

23. Sharma A. (2013). Trends of Area, Production and Productivity of Food grain in the North Eastern States of India, *Indian J. Agric*; 47(4):341 -346.

24. Sharma, H. R., Kamlesh Singh & Shanta Kumari. (2006). Extent and Source of Instability in Food Grains Production in India, *Indian Journal of Agricultural Economics*, Vol. 61, No. 4, pp: 647-666.

25. Sinha, D. K., and Jawahar Thakur. (1993). An Economic Analysis of Growth Performance of Major Food Crops in Bihar, *Agricultural Situation of India*, Vol. XLVIII, No. 7, pp: 543-548.

26. Sulochna, Meena. (2016). Analysis of growth trends in Indian agricultural sector, *Asian Resonance*- Vol, Issue: IV, RNI No. VPENG/2012/42622.

27. Tripathi, A., and A R. Prasad. (2009). Agricultural development in India since independence: A study on progress, performance and determinants, *journal of emerging knowledge on emerging markets*, Vol. 1, issue 1, pp 63-92.

28. V.P.S Arora. (2013). Agricultural Policies in India: Retrospect and Prospect, *Agricultural Economics Research Review* Vol. 26 (No.2), pp 135-157.