

Research Paper

Growth of Foodgrain Production in India

Mamta Rani^{1*} and Rupinder Kaur²

¹Rattan Professional Education College, Sohana, Mohali, India

²Department of Economics, Punjabi University, Patiala, India

*Corresponding author: mamtamahajan20@gmail.com (ORCID ID: 0000-0002-1654-5369)

Received: 20-01-2023

Revised: 30-05-2023

Accepted: 09-06-2023

ABSTRACT

Food is an essential need for the survival of mankind. Food security and its maintenance are key concerns of developing countries. India was primarily an agricultural economy like many other developing countries as its agriculture sector has a greater share in the Gross Domestic Product (GDP) of the country. The understanding of foodgrain production is substantial to administer the food security level of the country. The present paper aims to analyze the growth of foodgrains production in India. The paper also assesses the current status of foodgrain production in India and identifies the factors that have an impact on the growth of foodgrain production. The data relating to the area, production, and yield of major food grains in India for the period 2010-11 to 2020-21 is collected from various secondary sources. The percentile method is used to analyze the data. The results highlighted that the production of wheat and rice has increased year by year, whereas the production of coarse cereals and pulses fluctuates. It was found that the overall foodgrain production has been on a rising trend with a minor variation in the study period. The present study may persuade policymakers to re-examine and modify the current policies to increase the production of foodgrain, which could meet the food requirements of the country.

HIGHLIGHTS

- ① The production of wheat and rice in India has risen gradually throughout time, in contrast to the erratic production of coarse cereals and pulses.
- ② Currently, Rajasthan is the primary producer of coarse cereals, whereas Uttar Pradesh is the primary producer of wheat, rice, and pulses.

Keywords: Agrarian distress, Agriculture growth, Technological change, Food security, Mechanisation

The production of foodgrains is one of the most important activities in every country to carry out the dietary needs of the increased population and to generate feedstock needed for industries. India has a massive population that puts a strain on land and many other resources to address development and food demands. The government's main policy concern is maintaining food security in the country at the household level. The Department of Agriculture and cooperation is coordinating with state-level bodies and implementing Central Sectors Schemes in their respective sectors. It was renamed the Department of Agriculture, Cooperation and Farmers Welfare on 15th August 2015 (State of Indian Agriculture, 2015-16). GOI has established

the Commission of Costs and Prices (CACP) to develop a balanced price structure and is tasked with advising on the Minimum Support Price (MSP) policy of major crops (Annual Report, 2020-21). The MSP policy attempts to ensure remunerative prices for farmers to encourage increased production of crops grown on farms. India produces a wide range of agricultural products. These are broadly divided into two categories which are foodgrain crops and commercial crops. Foodgrain crops account for around 66 percent of the total farmed area

How to cite this article: Rani, M. and Kaur, R. (2023). Growth of Foodgrain Production in India. *Econ. Aff.*, 68(02): 1081-1088.

Source of Support: None; **Conflict of Interest:** None



(Kumari & Prasad, 2018). Improving the foodgrain crop production is one way to fulfill the growing population's future food demands (Kulkarni, 2009).

Indian agriculture has steadily progressed since its independence. Agricultural production increased at a historically unprecedented rate during this period. In the wake of policies and initiatives targeted at accelerating the rate of agricultural expansion, Indian Agriculture has begun to recover after a period of stagnation and agrarian misery caused by farmers' indebtedness, recurrent drought and floods, and an unpredictable global economic environment (Joshi, 2015). Therefore, the government adopted technological transformation in the green revolution period and spread knowledge about the use of modern techniques in the production of agricultural commodities. The benefits of the green revolution have been realized over time as the scene in Indian agriculture has dramatically changed with the country's agriculture transitioning from food scarcity to self-sufficiency. The 1980s had a greater increase in foodgrain production to such an extent that the foodgrain supply surpassed demand in the country. However, when India initiated the economic reforms in 1991, the rate of expansion in foodgrain output and productivity slowed. The average production of foodgrains increased in the 1990s over the 1980s due to an increase in mean yield whereas individual crop production became steadier in the 1990s compared to the 1980s (Sharma *et al.* 2006). The predicament is exacerbated by the rate of growth of rice and wheat. In the pre-reform period, the annual growth rate of foodgrain output was 2.80 percent, but it fell to 1.98 percent after the introduction of reforms (Ahmad & Haseen, 2012). The major reasons for this distress were increased input cost, the growing shift of area under cultivation from food crops to non-food crops, and the significant increase in the number of small and marginal holdings.

The extent of the difference in the production of foodgrains between 1996 and 1997 is not remarkable for years of normal monsoon and these variations must not have a significant influence on the GDP if the normal variation is allowed in the economy (Gadgil *et al.* 2005). A study conducted on the performance of the agriculture sector in India indicated that the area under foodgrains grew at a negative rate whereas production and

productivity grew at a positive rate from the period 1985-86 to 2014-15 (Priscilla *et al.* 2017). Another study examined trends in the area, production, and productivity of foodgrains from 1995-96 to 2015-16 and demonstrated that the production of foodgrains increased at a 1.73 percent annual rate in the country, owing to a small rise in area and productivity over the period taken for this study (Kumari *et al.* 2020). However, Indian agriculture has grown at a rapid pace over the previous few decades. Food grain cultivation accounts for the lion's share of cropped land in the last two decades. Food grains are grown on an area of 1270 lakh hectares in India with a yield of 2386 lakh tonnes in 2019-20. The production of foodgrains in 2021 is conjectured to be 7.94 million tonnes higher than the production of foodgrains attained in 2019-20 (Ministry of Agriculture and Farmers Welfare, 2021). The foodgrain production sets a new record due to the good monsoon in 2020. Rice stocks increased to 6.5 times the buffer norms, whereas wheat stocks increased to 2 times the buffer norms (RBI Annual Report, 2020-21).

Keeping the foregoing facts in mind, the present paper examines the trends in the growth of foodgrains production in India. This paper also analyses the current status of foodgrain production in India. Another goal of this paper is to determine the elements influencing the growth of foodgrain production.

OBJECTIVES

- ♦ To analyze the trends in foodgrains production in India.
- ♦ To assess the current status of foodgrain production in India.
- ♦ To identify the factors that affect the growth of foodgrain production.

Data Resources and Methodology

The paper is based on secondary data. The data for the period 2010-11 to 2020-21 is collected from the RBI Handbook of statistics on the Indian economy, the annual publications of RBI, Economic surveys, the Directorate of Economics and Statistics, the Ministry of Agriculture and Farmers Welfare, and Government Reports. The percentile method is used to analyze the data.

RESULTS AND DISCUSSION

Change in area under cultivation for foodgrains

Table 1 depicts the year-wise change in area under cultivation for foodgrain production in India. The area under cultivation of total foodgrains shows minor fluctuation year by year but increased from 1267 lakh hectares in 2010-11 to 1270 lakh hectares in 2019-20. The area under pulses has also decreased by 7.19 percent in 2011-12 than the previous year. The area under cultivation of rice and wheat has increased to 437 lakh hectares and 314 lakh hectares respectively in 2019-20 from 429 lakh hectares and 291 lakh hectares in 2010-11. The area under coarse cereals has decreased from 283 lakh hectares in 2010-11 to 240 lakh hectares in 2019-20 whereas the area under pulses has increased from 264 lakh hectares to 280 lakh hectares in the same period.

Change in production of foodgrains

Table 2 depicts the change in the production of foodgrains from the period 2010-11 to 2019-20. It is evident from the table that the production of rice has continuously increased from 2010-11 to 2019-20 with a minor fluctuation.

There is negative growth of pulses and coarse cereals in the two fiscal years 2011-12 and 2012-13. However, wheat and rice showed negative growth in 2011-12 whereas positive growth in 2012-13. The total production of coarse cereals increased from 434 lakh tonnes to 477.5 whereas pulses production increased from 182.4 lakh tonnes to 230.3 lakh tonnes from 2010-11 to 2019-20 respectively.

Change in foodgrain yield

The change in the foodgrain yield in India from 2010-11 to 2020-21 was shown in table 3. A perusal

Table 1: Area under cultivation for foodgrain production in India (In Lakh hectares)

Year	Rice	Wheat	Coarse Cereals	Pulses	Total Foodgrains
2010-11	429 (--)	291 (--)	283 (--)	264 (--)	1267 (--)
2011-12	440 (2.56)	299 (2.74)	264 (-6.71)	245 (-7.19)	1248 (-1.49)
2012-13	428 (-2.72)	300 (0.33)	248 (-6.06)	233 (4.89)	1207 (-3.28)
2013-14	440 (2.80)	312 (4.00)	257 (3.62)	252 (8.15)	1260 (4.39)
2014-15	439 (-0.22)	310 (-0.64)	242 (-5.83)	231 (-8.33)	1220 (-3.17)
2015-16	435 (-4.00)	304 (-1.93)	244 (0.82)	249 (7.79)	1232 (0.98)
2016-17	440 (1.14)	308 (1.31)	250 (2.45)	294 (18.07)	1292 (4.87)
2017-18	438 (-0.45)	297 (-3.57)	243 (-2.80)	298 (1.36)	1275 (-1.31)
2018-19	442 (0.91)	293 (-1.34)	221 (-9.05)	292 (-2.01)	1248 (-2.11)
2019-20	437 (-1.13)	314 (7.16)	240 (8.59)	280 (-4.10)	1270 (1.76)

Source: RBI Handbook of Statistics on the Indian Economy 2020-21.

Note: Figures in parenthesis indicate the percentage change over the previous year.

Table 2: Production of foodgrains in India (In Lakh Tonnes)

Year / Crop	Rice	Wheat	Coarse Cereals	Pulses	Total Foodgrains
2010-11	959.8 (--)	868.7 (--)	434.0 (--)	182.4 (--)	2444.9 (--)
2011-12	1053.0 (9.71)	948.8 (9.22)	420.1 (-3.20)	170.9 (-6.30)	2592.9 (6.05)
2012-13	1052.4 (-0.09)	935.1 (-1.44)	400.4 (-4.68)	183.4 (-7.31)	2571.3 (-0.83)
2013-14	1066.5 (1.33)	958.5 (2.50)	432.9 (8.11)	192.5 (4.96)	2650.4 (3.07)
2014-1	1054.8 (-1.09)	865.3 (-9.72)	428.6 (-0.99)	171.5 (-10.9)	2520.2 (-4.91)
2015-16	1044.1 (-1.01)	922.9 (6.65)	385.2 (-10.1)	163.5 (-4.66)	2515.7 (-0.17)
2016-17	1097.0 (5.06)	985.1 (6.73)	437.7 (13.6)	231.3 (41.46)	2751.1 (9.35)
2017-18	1127.6 (2.78)	998.7 (1.38)	469.7 (7.31)	254.2 (9.90)	2850.1 (3.59)
2018-19	1164.8 (3.29)	1036.0 (3.73)	430.6 (-8.32)	220.8 (-13.13)	2852.1 (0.07)
2019-20	1188.7 (2.05)	1078.6 (4.11)	477.5 (10.89)	230.3 (4.30)	2975.0 (4.30)

Source: RBI Handbook of Statistics on the Indian Economy 2020-21.

Note: Figures in parenthesis indicate the percentage change over the previous year.

Table 3: Foodgrains yield in India (In Lakh Tonnes)

Year / Crop	Rice	Wheat	Coarse Cereals	Pulses	Total Foodgrains
2010-11	2239 (--)	2988 (--)	1531 (--)	691 (--)	1930 (--)
2011-12	2393 (6.8)	3177 (6.32)	1590 (3.85)	699 (1.15)	2078 (7.66)
2012-13	22461 (2.84)	3117 (-1.88)	1617 (1.69)	789 (12.87)	2129 (2.45)
2013-14	2424 (-1.5)	3075 (-1.34)	1677 (3.71)	764 (-3.16)	2101 (-1.31)
2014-15	2390 (-1.40)	2872 (-6.60)	1729 (3.10)	744 (-2.61)	2070 (-1.47)
2015-16	2400 (0.41)	3034 (5.64)	1579 (-8.67)	656 (-11.82)	2056 (-0.67)
2016-17	2494 (3.91)	3200 (5.47)	1750 (10.82)	786 (19.81)	2129 (3.55)
2017-18	2576 (3.28)	3368 (5.25)	1934 (10.51)	853 (8.52)	2235 (4.97)
2018-19	2638 (2.40)	3533 (4.89)	1944 (0.51)	757 (-11.25)	2286 (2.28)
2019-20	2722 (3.18)	3440 (-2.63)	1991 (2.44)	823 (8.71)	2343 (2.49)

Source: RBI Handbook of Statistics on the Indian Economy 2020-21; **Note:** Figures in parenthesis indicate the percentage change over the previous year.

Table 4: Production of foodgrains in the three largest producing states in India in 2020
(Production In Million Tonnes)

Foodgrains	States	Production	Percentage Share of Production to All India
Rice	West Bengal	15.57	13.15
	Uttar Pradesh	15.52	13.11
	Punjab	11.78	9.95
Wheat	Uttar Pradesh	32.59	30.29
	Madhya Pradesh	19.61	18.22
	Punjab	17.57	16.33
Coarse Cereals	Rajasthan	7.29	15.35
	Karnataka	6.45	13.59
	Madhya Pradesh	4.82	10.16
Pulses	Rajasthan	4.49	19.41
	Maharashtra	4.03	17.40
	Madhya Pradesh	3.80	16.41
Total Foodgrains	Uttar Pradesh	55.03	18.55
	Madhya Pradesh	33.03	11.13
	Punjab	29.99	10.11

Source: Economic Survey 2020-21b.

of the table showed that there was a greater variation in the yield of foodgrains during the years 2010-11 to 2019-20. The yield of total foodgrains has increased from 1930 lakhtonnes to 2343 lakh tonnes in this period. The yield of the rice crop has increased from 2239 lakh tonnes in 2010-11 to 2722 lakh tonnes in 2019-20 whereas the yield of the wheat crop increased from 2988 lakh tonnes to 3440 lakh tonnes in the same period. The yield of coarse cereals has increased from 1531 lakh tonnes to 1991 lakh tonnes whereas pulses production increased from 691 lakh tonnes to 823 lakh tonnes. The calculations of percentage change over the last year show minor fluctuation in the yields of wheat, rice, coarse cereals, and pulses during the study period.

Production of foodgrains in the highest-producing states in 2020

Table 4 shows the production of foodgrains in the three largest producing states in India in 2020. The table also depicts the percentage share of production to all India in these states. The results highlight that West Bengal is the highest rice-producing state with a share of 13.15 percent in the all-India production of rice during the year 2020. Uttar Pradesh is the highest wheat-producing state with an all-India share of 30.29 percent. Rajasthan experienced a higher production of coarse cereals and pulses with all India's share of 15.35 percent and 19.41 percent respectively. However, total foodgrain production is highest in Uttar Pradesh with an all-India share of 18.55 percent.

Current foodgrains production in India

The status of foodgrain production in 2020-21 is depicted in table 5. According to the 4th Advance Estimates, wheat production is expected to reach a record 109.52 million tonnes, up by 1.66 million tonnes from the previous year's total of 107.86 million tonnes. Rice production is expected to reach a record 122.27 million tonnes in 2020-21. Furthermore, coarse cereal output is expected to reach a record 51.14 million tonnes in 2020-21 whereas the production of total pulses is expected to reach a record 25.71 million tonnes.

Table 5: Production of foodgrains in 2020-21 in India as Per 4th advance estimates (In million tonnes)

Foodgrains	Production
Rice	122.27
Wheat	109.52
Coarse Cereals	51.14
Pulses	25.71
Total Foodgrains	308.64

Source: RBI Handbook of Statistics on the Indian Economy 2020-21.

Current state-wise foodgrains production in India

Table 6 displays the state-wise production of foodgrains for the period 2020-21 according to the 4th advance estimate in India. A perusal of the table shows that the total production of foodgrains in the country is estimated at 303532.9 thousand tonnes. Production of rice is estimated at 119079.3 thousand tonnes and Uttar Pradesh is projected to take a higher position with the production of 15663.5 thousand tonnes of rice whereas wheat production is estimated at 108832.8 thousand tonnes and again Uttar Pradesh is projected to take a higher position with the 35503.0 thousand tonnes wheat production. From the estimated total production of coarse cereals, Rajasthan takes the first position in the production of coarse cereals estimated at 8334.7 thousand tonnes. Total pulses production during 2020-21 is estimated at 25531.4 thousand tonnes from which Uttar Pradesh is projected to produce a higher production of pulses of about 58318.3 thousand tonnes.

Table 6: State-wise production of foodgrains in 2020-21 as per 4th advance estimates (In Thousand Tonnes)

STATES	Rice	Wheat	Coarse Cereals	Pulses	Total Foodgrains
Andhra Pradesh	7887.2	—	2445.5	1086.0	11418.7
Assam	5255.4	20.4	128.5	119.0	5523.4
Bihar	6881.8	6336.9	2246.4	381.3	15846.3
Chhattisgarh	7161.2	248.4	369.2	447.4	8226.2
Gujarat	2147.2	3258.5	1726.6	1764.2	8896.5
Haryana	4424.9	12358.9	1417.7	72.8	18274.2
Himachal Pradesh	145.7	630.7	759.0	46.2	1581.5
Jharkhand	3023.5	523.0	669.6	935.9	5152.1
Karnataka	4053.5	281.4	7730.5	2121.7	14187.0
Kerala	651.0	—	0.7	1.9	653.6
Madhya Pradesh	4414.6	17615.8	4633.9	5299.3	31963.6
Maharashtra	3448.0	2327.7	5995.1	4298.5	16069.2
Odisha	8765.3	0.3	282.9	410.6	9459.0
Punjab	12176.8	17143.4	415.9	34.7	29770.8
Rajasthan	634.0	11035.4	8334.7	4309.0	24313.1
Tamil Nadu	7283.2	—	3668.7	494.4	11446.4
Telangana	7699.7	13.0	1949.2	661.1	10323.0
Uttar Pradesh	15663.5	35503.0	4587.1	2564.7	58318.3
Uttarakhand	714.4	956.3	270.1	62.7	2003.5
West Bengal	16648.5	580.0	2458.2	420.0	20106.7
TOTAL	119079.3	108832.8	50089.3	25531.4	303532.9

Source: RBI Handbook of Statistics on the Indian Economy 2020-21.

Determinants of foodgrain production

Quality of seeds

The seeds are essential to agriculture since they serve as a carrier of a variety's genetic potential (Parimala *et al.* 2013). The use of traditional seed varieties without seed replenishment results in a lower level of foodgrain production. Thus, the improvement in the quality of seeds is an important element of the agricultural production system. The adoption of enhanced seeds leads to increased foodgrain crop productivity as well as farm income. The Indian Council of Agricultural Research (ICAR) has the responsibility of regulating improved varieties of foodgrain crops in India. According to the Economic Survey of India, ICAR has generated 115707 quintals of breeder seed of 1330 different types of 51 different field crops (Economic Survey, 2020-21a).

Fertilizer usage

Fertilizers are critical agricultural inputs for achieving higher growth in the production of food grains. Crop yields and agricultural output would be severely lowered if fertilizers were not used. Fertilizers replenish the nutrients lost by crops in the soil. Crop productivity often increases when fertilizer applications are made more frequently (Schulz and Glaser, 2012). About eight kilograms of cereals can be produced by one Kilogramme of fertilizer in terms of nutrients. Increased fertilizer use helped in the increased foodgrain production and productivity in the country.

Agricultural infrastructure

Agricultural infrastructure is very important for boosting the production and productivity of food crops as well as for agricultural development. There is a significant correlation between the amount of per hectare foodgrain yield in rural areas and both the value of agricultural output and rural infrastructural development. Irrigation facilities, rural electrification, roadways, bridges, and transport facilities come under agricultural infrastructure (Bhatia, M.S. 1999). Adequate infrastructure increases farm production and decreases farming expenses. Rural literacy also impacts the nature and volume of agricultural output in India. A study demonstrated

that improvements in irrigation and rural literacy are the two key drivers of agricultural expansion in India (Bhattarai and Narayanamoorthy, 2003). The government of India established a variety of organizational, physical, and institutional infrastructures to expand agriculture. Significant progress has been made in providing credit facilities to the farmers.

Technological change

The use of sophisticated farm technology is critical to the proper seeding and harvesting of foodgrain crops. Farm productivity has increased significantly as a result of technological advancement in India. Machine advancement has also increased the productivity of farming equipment, allowing for more land to be cultivated more efficiently and assisting farmers in enhancing harvests. Mechanization will increase farmers' interest in farming operations due to lower expenses, minimization of manual labour, and higher harvest in the end (Rather, 2014). The scope has expanded with the advent of digital technologies. Modern technologies like Artificial Intelligence, analytical tools, networked sensors, data, and connection, etc., have the potential to raise input efficiency, enhance water and boost the output of food crops.

Climate and weather factors

Wheat and Paddy produce are mainly dependent on the climate conditions of the area. It also depends on the good and bad rainfall in the area. Rainfall has a large impact on the production of foodgrains. Generally, rain precipitation is variable, unpredictable, and unevenly distributed in India. The major rainy season in the country occurs between June and September. This monsoon season brings more than 70 percent of the country's rainfall. The amount of rain that falls during this period has a direct effect on crop productivity (Kumar *et al.* 2014). Sometimes high rainfall in several states of the country generated water-logging conditions that were particularly detrimental to food crops and hampered the production of foodgrains. If rainfall is very low during a year, then it has a negative influence on foodgrain output. Flower drops and bud abortion arise in food crops as a result of high temperatures and low rainfall. A study examined the growth and instability in foodgrain production

with an interstate time series analysis for the period 1960-61 to 1884-85 and found that the growth rate of foodgrains is high in Gujarat over 3 percent per annum due to the favourable climate in the state during the study period (Mahendradev, 1987).

Natural calamities

Natural disasters are to blame for environmental damage in some states, compromising agricultural sustainability. Many times, natural catastrophes devastate vital agricultural assets and alter the production cycle. Foodgrain output falls as a result of natural disasters such as floods, cyclones, and drought. Farmers have suffered massive losses due to the damage to foodgrain crops in floods frequently. A study conducted in Orissa has evaluated the losses incurred by several natural disasters and highlighted that drought caused far more losses than flood and cyclone during the period 1965-66 to 2008-09 in Orissa (Samal & Patra, 2012). It is critical to support local preparedness strategies to increase farmers' resilience to natural disasters.

CONCLUSION AND IMPLICATIONS

Rice and wheat are the major food crops grown in India. The production of rice crops has increased significantly during the study period. Wheat production also shows significant improvement during the research period. The analysis shows that the emphasis of the government was on increasing the output of rice and wheat only rather than other foodgrains in India. The increase in the area under cultivation of wheat and rice crops has resulted in the reduced area under cultivation of coarse cereals and pulses. The state-wise current status of foodgrains shows that the highest production of wheat, rice, and pulses is estimated in Uttar Pradesh whereas production of coarse cereals is estimated to be higher in Rajasthan. Higher productivity can be achieved by the implementation of input management policies. The adoption of better-quality seeds, and fertilizers, increased irrigation area, and expansion of seed testing facilities will all assist to alleviate worries about the low production and productivity of food grains. Foodgrains production is heavily reliant on nature and weather conditions in India. Infrastructure is recognized to play a

crucial role in developing the agriculture sector. Foodgrain production can be accomplished through farming on a larger scale.

Appropriate attention is essential to increase agricultural revenues to increase the production of foodgrains in India. When this goal will be achieved, the persisting discrepancy between the farm and non-farm income will also decrease and farmers will be encouraged for inclusive growth. Research institutes should develop technological breakthroughs to change production frontiers and improve input efficiency. Modern biotechnology approaches like insect and pest management approaches can play key roles in the production of foodgrains in the country. Foodgrain production and yield should be maximized through the use of scientific management approaches. Improving irrigation facilities may be prioritized for the foodgrain crop production in a rain-deficient year. Farmers must be educated on how to use current technologies and novel techniques to boost the production and productivity of foodgrains. However, there is a greater risk of causing irreparable harm to the natural resources due to the more extensive use of resources, by using chemical fertilizers and advanced technologies. It is critical that we expand foodgrains production without harming our ecosystem or disrupting the delicate balances that keep it in place. Agriculture requires urgent reforms before and after production to ensure long-term and steady growth. Government policies should also be re-examined for the effective and efficient management of food grains in the country.

REFERENCES

- Ahmad, M.F. and Haseen, S. 2012. The Performance of India's Food Grains Production: A Pre and Post Reform Assessment, *Int. J. Scientific and Res. Pub.*, 2(3): 1-6.
- Annual Report. 2020-21. Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, Available: https://agricoop.nic.in/sites/default/files/Web%20copy%20of%20AR%20%28Eng%29_3.pdf
- Bhatia, M.S. 1999. Rural infrastructure and growth in agriculture, *Econ. and Pol. Weekly*, 34(13): A43-A48.
- Bhattarai, M. and Narayanamoorthy, A. 2003. Irrigation Impact on agricultural growth and poverty alleviation: macro level impact analysis in India, A research paper presented at the IWMI-TATA annual workshop in Anand, Gujarat, India. Available: <https://ininet.org/irrigation-impact-on-agricultural-growth-and-poverty-alleviation.html>

- Economic Survey. 2020-21a. Agriculture & Food Management, Chapter 7, Vol. 2, Government of India, 230-260, Retrieved on 14 November 2021, Available: https://www.indiabudget.gov.in/economicsurvey/doc/echapter_vol2.pdf
- Economic Survey. (2020-21b), Statistical Appendix, Vol. 2, Retrieved on 15th November 2021. Available: Statistical-Appendix-in-English.pdf
- Gadgil, S., Abrol, Y.P. and Rao, P.R.S. 2005. On growth and Fluctuation of Indian foodgrain Production, Available: <https://core.ac.uk/download/pdf/291521918.pdf>
- Joshi, P.K. 2015. Has Indian Agriculture Become Crowded and Risky? Status, Implications and the Way Forward, *Indian J. Agril. Econ.*, **70**(1): 1-41.
- Kulakarni. S.D. 2009. Available: <https://www.un-csam.org/Activities%20Files/A09105thTC/PPT/in-doc.pdf>
- Kumar, A., Sharma, P. and Ambrammal, S. K. 2014. Climate Effects on Food Grain Productivity in India, *J. Stud. in Dyna. and Change*, **1**(1): 38-48.
- Kumari, N., Mehta, V.P. and Bhatia, J.K. 2020. Foodgrains Production in India: Trends and Decompositions Analysis, *Econ. Aff.*, **65**(3): 333-342.
- Kumari, V. and Prasad, R.K. 2018. An analysis of Production and Consumption Pattern in India, *Int. J. Curr. Microb. and Appl. Sci.*, **7**: 3923-3931.
- Mahendradev, S. 1987. Growth and Instability in Foodgrains Production: An Interstate Analysis, *Econ. and Pol. Weekly*, **22**(39): A82-A92.
- Ministry of Agriculture and Farmers Welfare 2021. Third Advance Estimates of Principal Crops for 2020-21, Press Release, Available: <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1721692>
- Parimala, K., Subramanian, K., Kannan, S.M. and Vijayalakshmi, K. 2013. A manual on seed production and certification center for Indian knowledge systems, Chennai Revitalising Rainfed Agriculture Network, Available: https://agritech.tnau.ac.in/seed_certification/pdf/A%20Manual%20on%20Seed%20Production%20and%20Certification.pdf
- Priscilla, L., Balakrishnan, A. and Chauhan, A.K. 2017. A Study on the Performance of Agricultural Sector in India, *Indian J. Agril. Res.*, **51**(3): 282-286.
- Rather, S. 2014. Issues of Food Self-sufficiency in Jammu and Kashmir, *Int. J. Business Quantitative Economics and Appl. Manage. Res.*, **1**(1): 111-122.
- RBI Handbook of Statistics on the Indian Economy. 2020-21. Department of Statistics and Information Management, Reserve Bank of India, Available: <https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/0HBF2021322AC51D15B74324858EEA2C7989B5E2.PDF>
- RBI Annual Report. 2020-21. Reserve Bank of India, Available: https://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/0RBIAR202021_F49F9833694E84C16AAD01BE48F53F6A2.PDF
- Samal, P. and Patra, R. 2012. Natural Calamities, Rice Production Loss and Risk Crop Strategies: Evidence from Orissa, *The IUP J. Agril. Econ.*, **9**(1): 1-13.
- Schulz, H. and Glaser, B. 2012. Effects of biochar compared to organic and inorganic fertilizers on soil quality and plant growth in a greenhouse experiment, *J. Plant Nutrition and Soil Sci.*, **175**: 410-422.
- Sharma, H.R., Singh, K. and Kumari, S. 2006. Extent and Source of Instability in Foodgrains Production in India, *Indian J. Agric. Econ.*, **61**(4): 647-666.
- State of Indian Agriculture. 2015-16. Indian Agriculture: Performance, Challenges and the Way Forward, State of Indian Agriculture 2015-16, Government of India, Ministry of Agriculture and Farmers Welfare, Directorate of Economics & Statistics, New Delhi.