

**ANALYSIS OF GROWTH AND CROPPING PATTERN CHANGES OF
INDIAN AGRICULTURE SINCE INDEPENDENCE: CRITICAL
ACCOUNT ON THE SUSTAINABLE DEVELOPMENT PERSPECTIVES**

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ABSTRACT

Agriculture, land use and food security are at the main subject of the debates in the 2015 development goals and targets. However, hunger and food insecurity remain major development priorities in the recent decades. Nevertheless, the existing agriculture, changes in land use patterns and food systems are critical to sustaining poor people's life and livelihoods. The 2015 Sustainable Development goals and agendas need to support for more productive, environmentally sustainable and resilient while safeguarding and augmenting life and livelihood of the mass through agricultural sustainability. With this background, the present research paper attempted to analyze, the trend of the agricultural sector in terms of growth rates of area production, quantity production, yield of selected crops and its share to national income towards achieving food security towards zero hunger over the last seven decades since its Independence in India and examine the relative contribution of area yield, output changes in relation to other related variable like rainfall, fertilizers and land use pattern in India. The study findings indicate a notable trend in the agricultural sector: the proportion of agricultural imports within the realm of agricultural commodities saw a steady rise, climbing from 2.79 percent to 5.07 percent spanning the years from 1990-91 to 2021-22. Conversely, the proportion of agricultural commodity exports relative to the overall national export share experienced a gradual decline, diminishing from 18.47 percent to 11.94 percent over the same period. Moreover, data reveals significant growth in key agricultural metrics. The total cultivated area for food grain production expanded substantially, surging from 97.32 million hectares in 1950-51 to 129.34 million hectares by 2020-21. Concurrently, the quantity of food grain produced exhibited remarkable

growth, escalating from 50.8 million tonnes in 1950-51 to an impressive 310.7 million tonnes by 2020-21. Furthermore, the productivity of food grain production demonstrated a noteworthy increase, rising from 522 kg per hectare in 1950-51 to 2394 kg per hectare by 2020-21. In spite of the fact that, when compared with the growth of population during the last seven population census, it needs to grow more to meet the needs of the over and ever growing population, in general and for achieving food security and zero hunger, in particular, in India.

Key words: food security, production, productivity, zero hunger.

Introduction:

The present world countries, irrespective of developed, underdeveloped or developing are facing numerous economic, environmental, social and political problems for attaining sustainable development goals, in general and fulfilling the demand and desires of the global mass, in particular. These problems may vary from country to country and they may also vary within the country and between regions. One such major concern and consideration of the world economies, even including countries like India, is to achieve the Sustainable Development Goals, in general, and food security towards Zero Hunger, in particular. The United National organization aims to create a world free of hunger by 2030. In a critical review conducted by Bizikova et al. (2017), examining 69 publications regarding the effects of public interventions on food security, it was determined that public investment in agriculture yields a positive influence on food security. Their analysis revealed that approximately 70 percent of the 87 agricultural interventions scrutinized in their study demonstrated a favorable impact on food security. Conversely, only 7 percent of these interventions exhibited a negative effect, with 24 percent showing no discernible impacts. The most robust evidence comes from research on the effectiveness of input subsidies, value chain development and extension services. Juliane Dame (2018) study portray that the changes in agricultural land use lead to a remarkable reduction in regional food production. Access to food depends on the overall household income and the amount of payment made by households on consumption of goods and services in their daily life and livelihood activities.

With this backdrop, the present research paper attempted to analyze the growth pattern of agricultural sector in terms of area growth, yield growth and cropping pattern changes and other relevant parameters to identify the chief sources of growth in Indian economy over the last seven decades from its independence and to suggest suitable remedial measures to attain the SDGs in general and food security towards Zero Hunger, in particular.

Materials and Methods

This research paper provides a descriptive and analytical investigation into the shifting cropping and growth patterns within Indian agriculture spanning the period from 1950-51 to 2021-2022. It relies on secondary data sourced from reports issued by reputable entities such as the Directorate of Economics and Statistics, Ministry of Agriculture, Department of Agriculture, Cooperation and Farmers Welfare, Government of India, Annual Report for 2021-2022, as well as data from the Registrar General of India. The study meticulously examines the evolution of decadal and quinquennial average areas devoted to various crops, alongside their relative contributions to overall output, yield, and gross cropped area. To facilitate data interpretation, the study employs percentages and charts.

Results and Discussion

This section delves into various aspects of land utilization, crop production, rainfall patterns, chemical fertilizer usage, demographic changes, and agriculture's contribution to India's GDP over the past seven decades. A change in land utilization pattern signifies alterations in the proportion of land under different uses at specific points in time or over periods. Table 1 outlines the land utilization pattern in India from 1950-51 to 2019-20, illustrating variations across different categories and the relatively narrow fluctuations in the proportion of net area sown to the total geographical area since 1950-51. The total forest area was 40.48 million hectares in 1950-51, constituting approximately 14.24 percent of the total geographical area, which increased to 71.75 million hectares, or 23.41 percent, by 2019-20. Meanwhile, land allocated for non-agricultural purposes, including housing and industry, expanded from 9.36 million hectares in 1950-51 to 27.78 million hectares in 2019-20, reflecting a 5.77 percent increase over the observed period. Conversely, the area designated as barren and unculturable decreased from 38.16 million hectares (13.42 percent of the total geographical area) in 1950-51 to 16.54 million hectares (5.40 percent) in 2019-20, indicating a negative growth rate of 8.02 percent. Permanent pastures and other grazing land experienced a minor proportionate increase from 2.35 percent in 1950-51 to 3.42 percent in 2019-20, with the area growing from 6.68 million hectares to 10.48 million hectares during the same period.

The miscellaneous category, excluding the net area sown, witnessed a decline from 19.83 million hectares to 3.13 million hectares between 1950-51 and 2019-20, marking a decrease from 6.79 percent to 1.02 percent of the total geographical area. Similarly, the land under culturable waste decreased from 22.94 million hectares (8.07 percent) in 1950-51 to 11.95 million hectares (3.90 percent) in 2019-20. Additionally, fallow land other than current fallow decreased from 17.45 million hectares to 11.24 million hectares over the same period, representing a decline from 6.14 percent to 3.67 percent. However, current fallow land area marginally increased from 10.68

million hectares in 1950–51 to 13.77 million hectares in 2019–20, with a corresponding rise from 3.75 percent to 4.49 percent. The net area sown experienced a marginal increase from 118.75 million hectares in 1950–51 to 142.87 million hectares in 1990–91, followed by a slight decline, reaching 139.90 million hectares in 2019–20. This accounted for 42 percent of the total geographical area in 1950–51, increasing to 47 percent in 1990–91 before dropping to 45.64 percent in 2019–20.

Table 1: Nine-Fold Land Utilization Statistics in India, 1950-51 to 2019-20 (Million Hectares)

Year	Geographical area	Forests	Non agricultural uses	Barren & Unculturable land	Permanent pasture & other grazing land	Miscellaneous category not included in net area sown	Culturable wasteland	Fallow lands other than current fallows	Current fallows	Net area sown
1950-51	328.73	40.48 (14.24)	9.36 (3.29)	38.16 (13.42)	6.68 (2.35)	19.83 (6.97)	22.94 (8.07)	17.45 (6.14)	10.68 (3.76)	118.75 (41.77)
1960-61	328.73	54.05 (18.11)	14.84 (4.97)	35.91 (12.03)	13.97 (4.68)	4.46 (1.49)	19.21 (6.44)	11.18 (3.75)	11.64 (3.90)	133.20 (44.63)
1970-71	328.73	63.83 (21.01)	16.48 (5.42)	28.13 (9.26)	13.26 (4.37)	4.37 (1.44)	17.50 (5.76)	8.73 (2.87)	10.60 (3.49)	140.86 (46.37)
1980-81	328.73	67.46 (22.18)	19.60 (6.44)	19.96 (6.56)	11.99 (3.94)	3.58 (1.18)	16.74 (5.51)	9.72 (3.20)	14.83 (4.88)	140.29 (46.12)
1990-91	328.73	67.70 (22.20)	21.22 (6.96)	19.51 (6.40)	11.41 (3.74)	3.81 (1.18)	15.00 (4.92)	9.66 (3.17)	13.84 (4.54)	142.87 (46.88)
2000-01	328.73	69.84 (22.88)	23.75 (7.78)	17.48 (5.73)	10.66 (3.49)	3.44 (1.13)	13.63 (4.47)	10.27 (3.36)	14.78 (4.84)	141.34 (46.02)
2010-11	328.73	71.59 (23.30)	26.42 (8.60)	16.99 (5.53)	10.30 (3.35)	3.20 (1.04)	12.64 (4.12)	10.32 (3.36)	14.38 (4.68)	141.37 (46.02)
2019-20	328.73	71.75 (23.41)	27.78 (9.06)	16.54 (5.40)	10.48 (3.42)	3.13 (1.02)	11.95 (3.90)	11.24 (3.67)	13.77 (4.49)	139.90 (45.64)

Source: Annual Report-2021-2022, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

Table 2: Land Use Pattern in India, 1950-51 to 2019-20 (Million Hectares)

Year	Geographical Area	Forests	Not Available for Cultivation	Other Uncultivated land excluding Fallow Land	Fallow Lands	Net Area Sown
1950-51	328.73	40.48 (14.24)	47.52 (14.46)	49.45 (15.04)	28.12 (8.55)	118.75 (41.77)
1960-61	328.73	54.05 (18.11)	50.75 (15.44)	37.64 (11.45)	22.82 (6.94)	133.20 (44.63)
1970-71	328.73	63.83 (21.01)	44.61 (13.57)	35.13 (10.69)	19.33 (5.88)	140.86 (46.37)
1980-81	328.73	67.46 (22.18)	39.55 (12.03)	32.31 (9.82)	24.55 (7.47)	140.29 (46.12)
1990-91	328.73	67.7 (22.20)	40.73 (12.39)	30.22 (9.19)	23.50 (7.15)	142.87 (46.88)
2000-01	328.73	69.84 (22.88)	41.23 (12.54)	27.74 (8.43)	25.04 (7.62)	141.34 (46.02)
2010-11	328.73	71.59 (23.30)	43.41 (13.21)	26.15 (7.95)	24.70 (7.51)	141.37 (46.02)
2019-20	328.73	71.75 (23.41)	44.32 (13.48)	25.56 (7.77)	25.01 (7.61)	139.90 (45.64)

Source: Annual Report-2021-2022, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

Over the past seven decades, India's land use dynamics have undergone significant transformations, reflecting shifts in the economy. The forested area has exhibited notable improvement, rising from 14.27 percent in 1950-51 to 23.41 percent in 2019-20. Conversely, the proportion of uncultivated land has experienced a marginal decline, decreasing from 14.46 percent to 13.48 percent between 1950-51 and 2019-20. Uncultivated land, excluding fallow land, which comprised 15.04 percent of the total geographical area in 1950-51, saw a reduction to 7.8 percent by 2019-20. Additionally, the area under fallow lands witnessed a negligible decrease, declining from 8.55 percent to 7.61 percent during the period spanning from 1950–51 to 2019–20. The net area sown has only seen marginal growth, expanding from 118.75 million hectares to 142.87 million hectares between 1950-51 and 1990-91, followed by a decline to 139.90 million hectares in 2019-20. This increase can be attributed to land reforms and the green revolution, which have played pivotal roles in shaping agricultural practices and land utilization patterns.

Table 3: Selected categories of land use classification in India, 1950-51 to 2019-20 (Million Hectares)

Year (1)	Net area sown (2)	Area sown more than once (4-2) (3)	Total cropped area (4*)	Net irrigated area (5)	Area irrigated more than once (7-5) (6)	Gross irrigated area (7**) (8)	Cropping intensity (8)
1950-51	118.75 (86.11)	13.15 (13.89)	131.89 (40.12)	20.85	1.71	22.56 (17.11)	111.07
1960-61	133.20 (87.19)	19.57 (12.81)	152.77 (46.47)	24.66	3.32	27.98 (18.32)	114.69
1970-71	140.86 (84.96)	24.93 (15.04)	165.79 (50.43)	31.10	7.09	38.20 (23.04)	117.70
1980-81	140.29 (81.27)	37.56 (18.73)	172.63 (52.51)	38.72	11.06	49.78 (28.84)	123.05
1990-91	142.87 (76.92)	45.27 (23.08)	185.74 (56.50)	48.02	15.18	63.20 (34.03)	130.01
2000-01	141.34 (76.26)	56.76 (23.74)	185.34 (56.38)	55.20	20.98	76.19 (41.11)	131.13
2010-11	141.37 (71.35)	56.76 (28.65)	198.13 (60.27)	63.87	25.45	89.32 (45.08)	140.15
2019-20	139.90 (65.86)	71.46 (34.14)	211.36 (64.30)	75.46	36.77	112.23 (53.10)	151.08

Source: Annual Report-2021-2022, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

* *Percentage to the total geographical area*; ** *Percentage to the total cropped area*.

Table 3 outlines the growth of both the total cropped area and the area irrigated by various sources in India from 1950-51 to 2019-20. Over this period, the total cropped area surged from 131.89 million hectares to 211.36 million hectares, representing a substantial increase. Specifically, the net area sown experienced remarkable growth, expanding from 118.75 million hectares in 1950-51 to 139.90 million hectares in 2019-20. This notable increase primarily resulted from the reclamation of old fallow lands and culturable wasteland, along with the conversion of groves into cultivable areas. Moreover, the net area irrigated witnessed significant expansion, escalating from 20.85 million hectares in 1950-51 to 75.46 million hectares in 2019-20. This transformation has had a profound impact on food grain production. Additionally, the gross irrigated area saw substantial improvement, rising from 22.56 million hectares to 112.23 million hectares over the same period. Furthermore, the area irrigated more than once experienced remarkable growth, increasing from 1.71 million hectares to 36.77 million hectares

between 1950–51 and 2019–20. This represents a 3.6-fold increase in net area irrigated and a 21.5-fold increase in area irrigated more than once over the study period. These advancements in irrigation infrastructure signify the significant role of state intervention in the construction and development of irrigation projects throughout India over the past seven decades. Cropping intensity is crucial for productivity and agriculture growth in India. Between 1950-51 and 2019-20, cropping intensity increased from 111.07 percent to 151.08 percent. Governments' efforts in irrigation projects have contributed to this improvement. The growth of cropped area can be achieved through increased cultivation intensity and short-duration crops. Cropped area recorded a growth rate of 0.51 percent per annum from 1962-65 to 1980-83, while a deceleration occurred from 1980-83 to 1990-93 (Bhalla G. S. and Gurmail Singh, 2010).

Figure 1: Trends in cropping intensity of Indian agriculture during 1950-51 to 2020-21

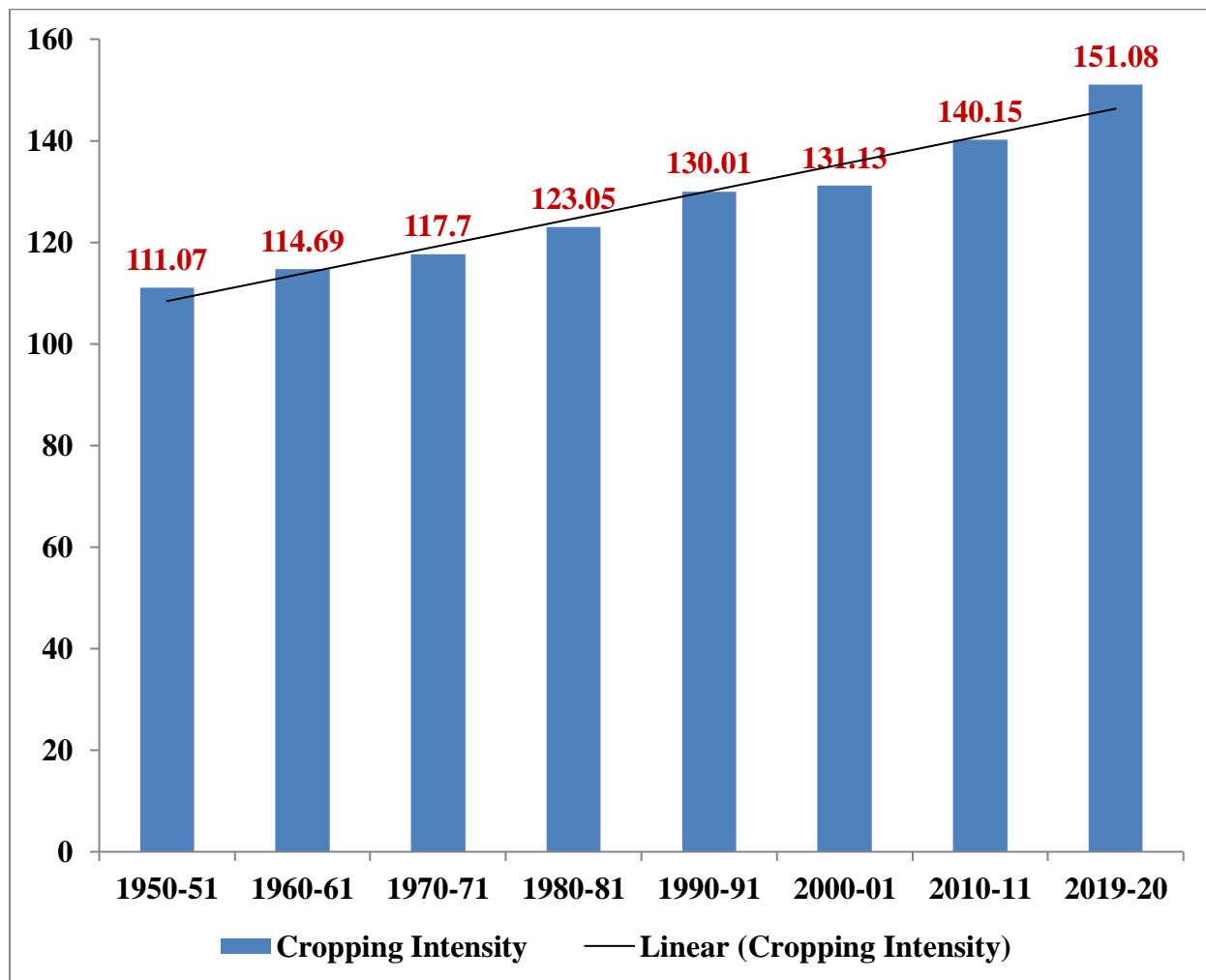


Figure 2: Trends in gross cropped and gross irrigated of Indian agriculture

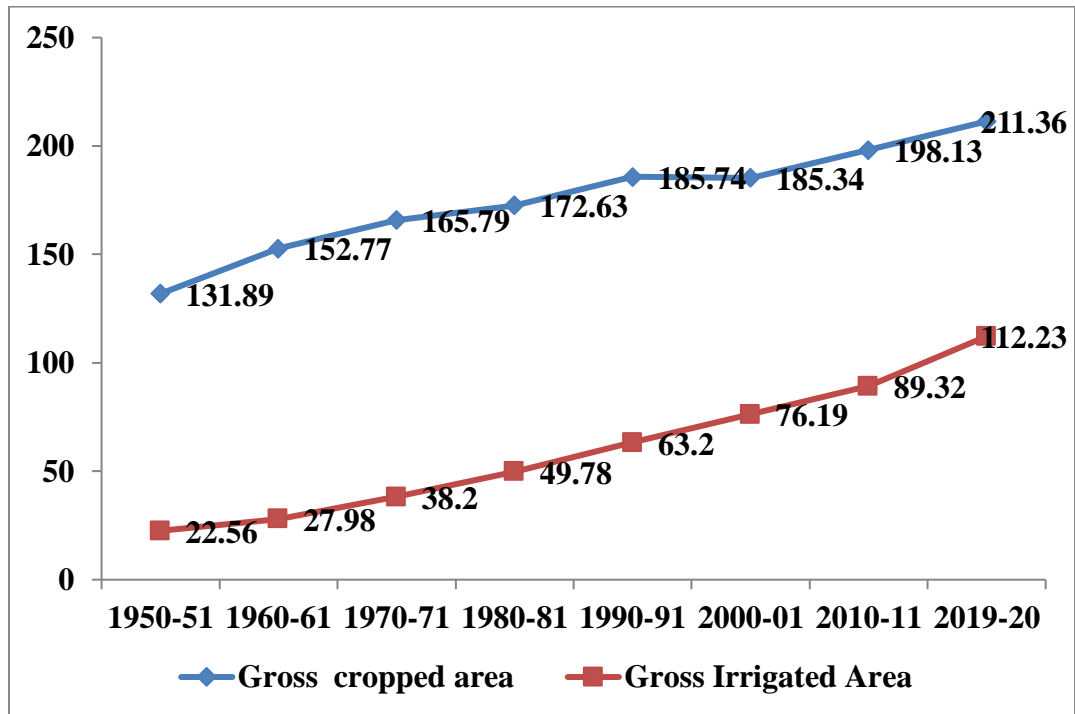
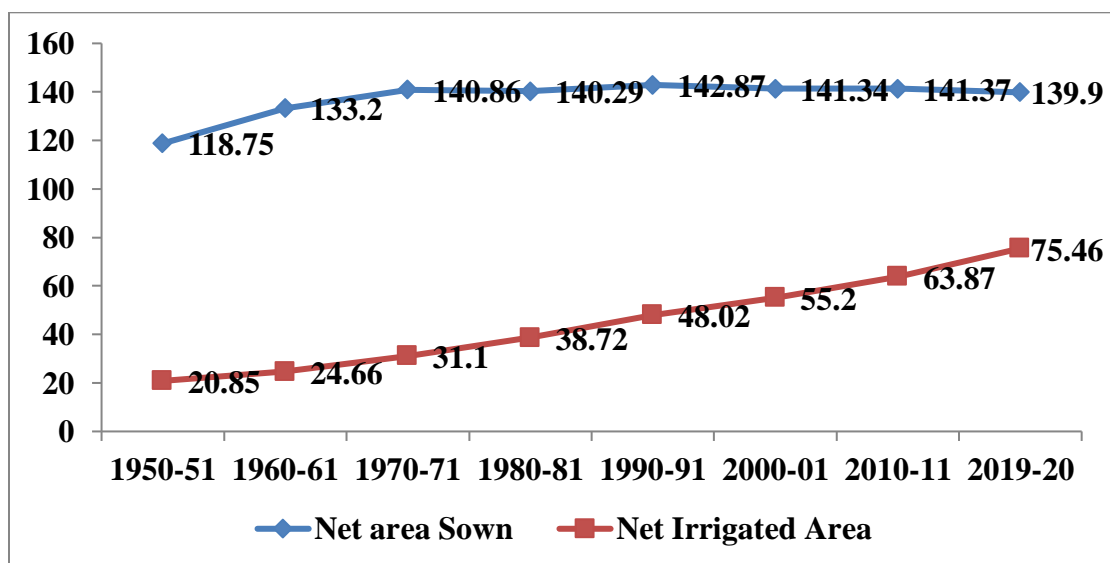


Figure 3: Trends in net area sown and net irrigated area of Indian agriculture



Source: Annual Report-2021-2022, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

The linear trend line shows a significant increase in cropping intensity in Indian agriculture over the past seven decades, with fluctuating gross cropped area and gross irrigated area (Figure 1, 2 & 3). The gross irrigated area revealed a continuous and consistent increase from 22.56 million hectares to 112.23 million hectares during 1950-51 to 2019-20. However, the figure 3 also witnessed that a continuous increase in the net area sown upto 1990-91 and then it starts decline and finally stood it at 140 million hectares in 2019-20. The net area increased from 20.85 million hectares to 75.46 million hectares from 1950-51 to 2019-20, with a decline from 1990-91.

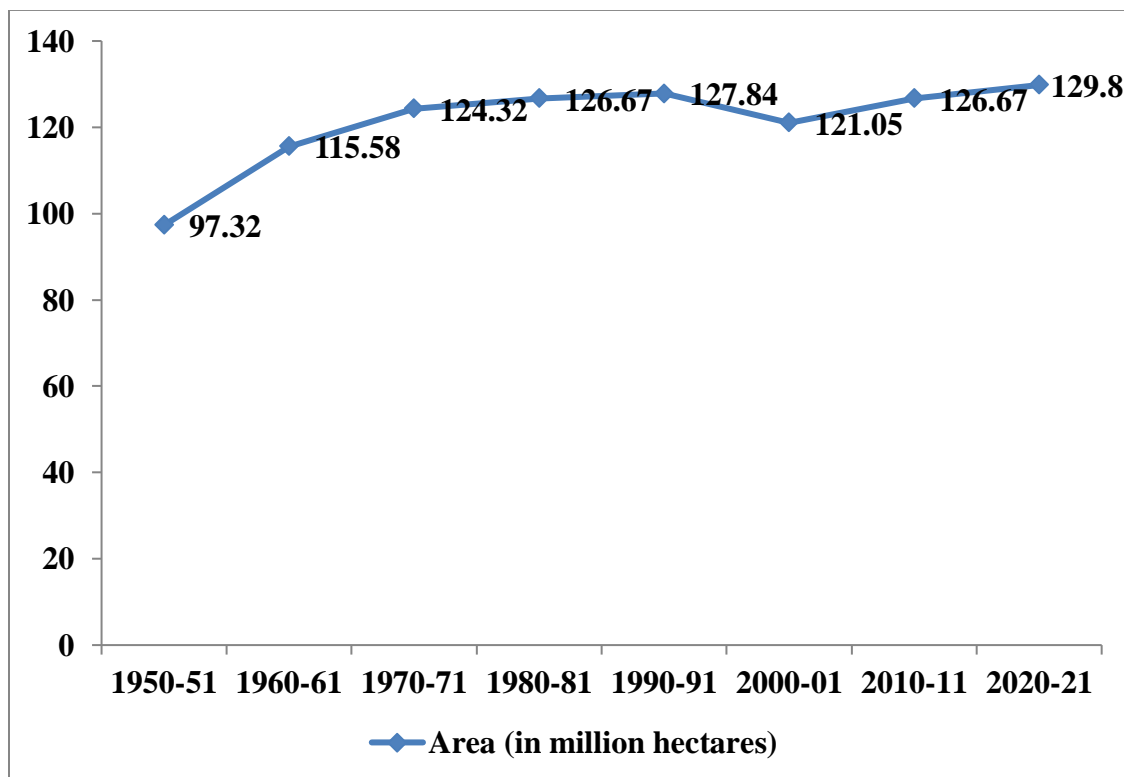
Table 4: Growth in food grains production in India during 1950-51 to 2020-21

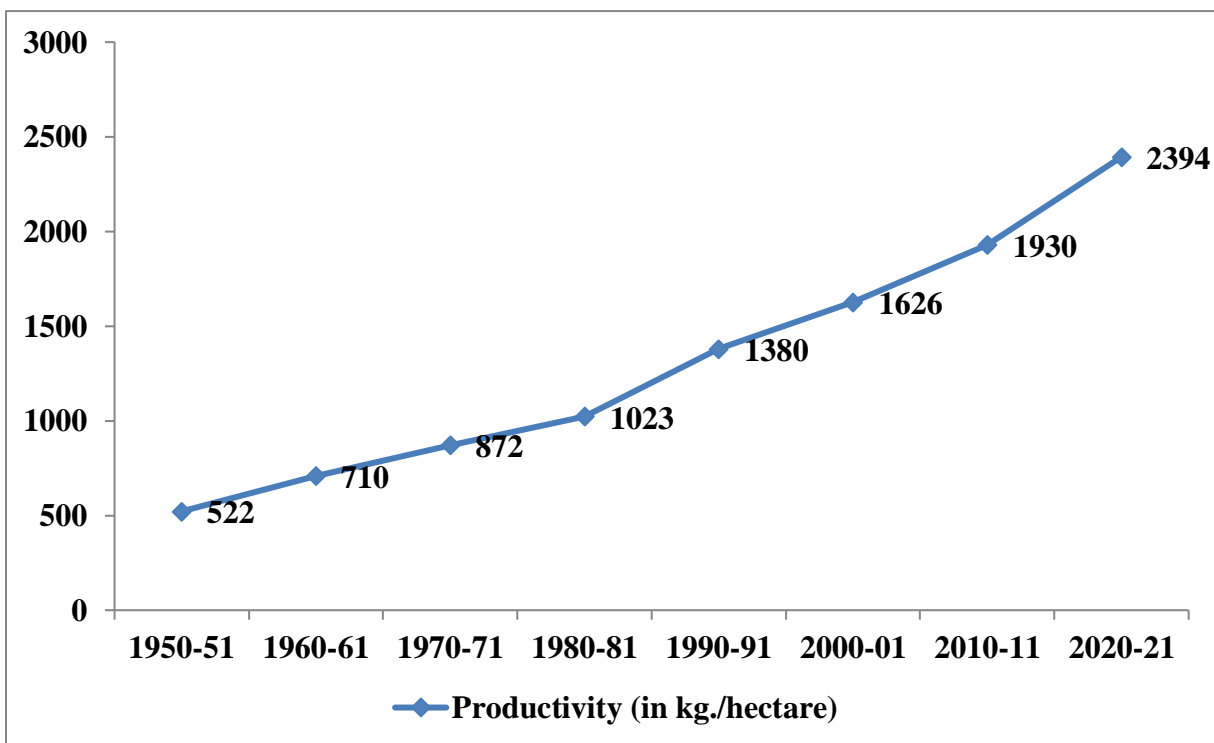
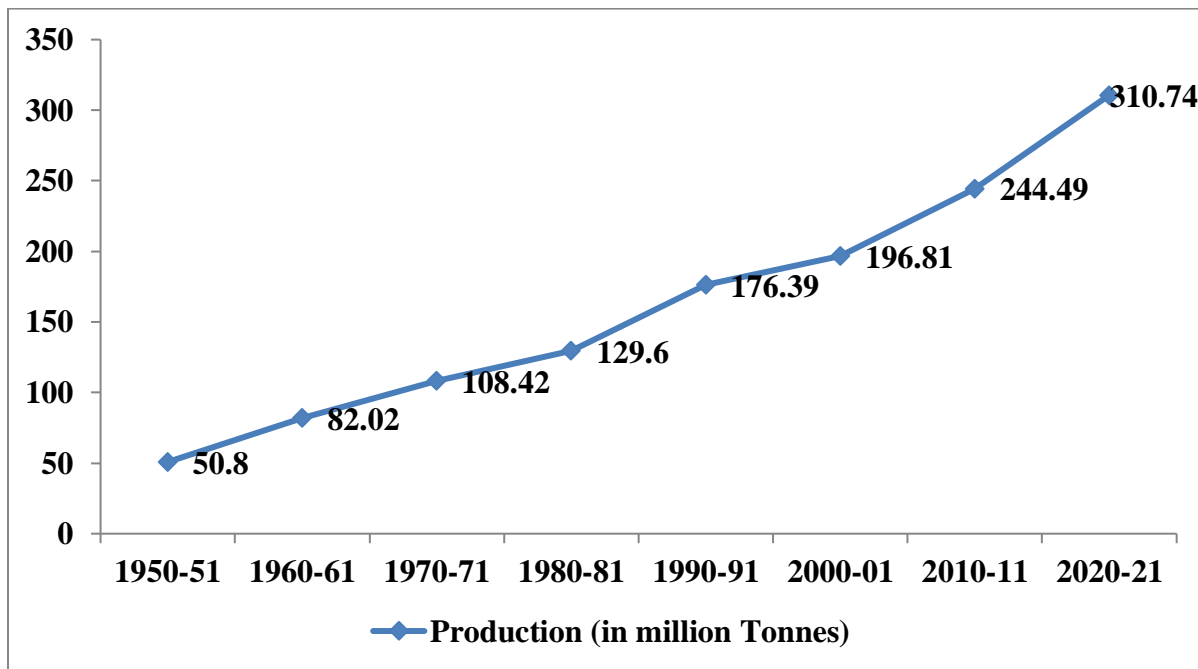
Year	Area (in million hectares)	Production (in million Tonnes)	Productivity (in kg./hectare)
1950-51	97.32	50.8	522
1955-56	110.56	66.85	605
1960-61	115.58	82.02	710
1965-66	115.10	72.35	629
1970-71	124.32	108.42	872
1975-76	128.18	121.03	944
1980-81	126.67	129.6	1023
1985-86	128.02	150.44	1175
1990-91	127.84	176.39	1380
1995-96	121.01	180.42	1491
2000-01	121.05	196.81	1626
2005-06	121.60	208.60	1715
2010-11	126.67	244.49	1930
2015-16	123.22	251.54	2041
2020-21	129.80	310.74	2394

Source: Annual Report-2021-2022, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

Table 4 illustrates India's food grain production growth pattern over the past seven decades. The production area expanded from 97.32 million hectares in 1950-51 to 128.18 million hectares in 1975-76, primarily attributed to the implementation of land reforms and the advent of the green revolution. Subsequently, there was a slight decline to 126.67 million hectares in 1980-81, followed by an increase to 129.80 million hectares by the year 2020-21. The volume of production exhibited a remarkable surge from 50.8 million tonnes in 1950-51 to 310.80 million tonnes in 2020-21, with notable increases occurring post-land reforms and the green revolution. Over the same period, India's agricultural sector witnessed a significant rise in food grain productivity, escalating from 522 kg per hectare in 1950-51 to 2394 kg per hectare in 2020-21. The enhancement can be credited to timely land reforms, the implementation of high-yielding seed varieties, the use of biochemical fertilizers, and the integration of appropriate technologies. Collectively, the agricultural industry experienced a 1.3-fold expansion in the food grain cultivation area, a more than six-fold surge in food grain production volume, and approximately a five-fold rise in food grain productivity during the past seventy years in India.

Figure 4: Trends in area, production and productivity of food grains in India during 1950-51 to 2020-21





Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India

During the study periods, Indian agriculture has shown significant improvements in food grain production, output volume, and productivity per hectare as shown in figure 4.

Table 5: Area, production and productivity of Major Crops from 1950-51 to 2020-21
(Area M.Ha; Production in Lakh Tonnes, Productivity in kg./ha)

Year	Rice			Wheat			Nutri cereals			Pulses		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
1950-51	30.81	20.60	668	9.75	6.5	663	37.67	15.38	408	19.09	8.41	441
1955-56	31.52	27.56	874	12.37	8.76	708	43.45	19.49	449	23.52	11.04	475
1960-61	34.13	34.60	1013	12.93	11.0	851	44.96	23.74	528	23.56	12.70	539
1965-66	35.47	30.59	862	12.57	10.40	827	44.34	25.37	514	22.72	9.94	438
1970-71	37.59	42.22	1123	18.24	23.83	1307	45.95	30.55	665	22.54	11.82	524
1975-76	39.48	48.74	1235	20.45	28.84	1410	43.80	30.41	694	24.45	13.04	533
1980-81	40.15	53.63	1336	22.28	36.31	1630	41.78	29.02	695	22.46	10.63	473
1985-86	41.14	63.83	1552	23.00	47.05	2046	39.47	26.20	664	24.42	13.36	547
1990-91	42.69	74.30	1740	24.17	55.14	2281	36.32	32.7	900	24.66	14.28	578
1995-96	42.84	76.98	1997	25.01	62.10	2483	30.88	29.03	940	22.28	12.31	552
2000-01	44.71	84.98	1901	25.73	69.68	2708	30.26	31.08	1027	20.35	11.08	544
2005-06	43.66	91.79	2102	26.48	69.35	2619	29.06	34.07	1172	22.39	13.38	598
2010-11	42.86	95.98	2239	29.07	86.87	2988	28.34	43.40	1531	26.40	18.24	691
2015-16	43.50	104.41	2400	30.42	93.29	3034	24.39	38.52	1579	24.91	16.32	655
2020-21	45.06	124.37	2717	31.61	109.59	3521	24.72	51.32	2128	28.78	25.46	885

Source: Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, Krishi Bhawan, New Delhi-110 001.

Table 5 shows the growth pattern of Indian agriculture since 1950-51, focusing on major crops like rice, wheat, nutritious cereals, and pulses. Rice cultivation increased from 30.81 million hectares to 45.06 million hectares, with a growth rate of 20.6 million tonnes to 124.4 million tonnes of production and the productivity of rice production was observed during the period increased from 668 kg per hectare to 2717 kg per hectare between 1950–51 and 2020–21. The growth rate of rice cultivation observed during the study period was 1.46 folds, 6.04 folds, and 4.07 folds, respectively, of area, production, and productivity, between 1950–51 and 2020–21. Wheat cultivation also saw a significant increase, from 9.75 million hectares to 31.61 million hectares, with production increasing from 6.5 million tonnes to 109.6 million tonnes and productivity increasing from 663 kg per hectare to 3521 kg per hectare between 1950–51 and 2020–21. There has been a remarkable increase in the growth rate of wheat production, as further evident by the 3.24-fold increase in area under cultivation, the 16.86-fold increase in production, and the 5.31-fold increase in productivity of wheat kg. per hectare observed during the study periods. This growth is attributed to the intensive use of high-yielding seeds, chemical fertilizers, and technical know-how, unlike traditional farming practices.

The study reveals a decline in the cultivation area of nutritious cereals from 37.67 million hectares to 24.72 million hectares between 1950-51 and 2020-21. Despite this decrease, the output surged from 15.4 million tonnes to 51.3 million tonnes, and productivity witnessed a significant increase from 408 kg per hectare to 2128 kg per hectare. Similarly, pulses also experienced growth, with the cultivation area expanding from 19.09 million hectares to 28.78 million hectares over the same period. Production increased from 8.4 million tonnes to 25.5 million tonnes, while yield rose from 441 kg per hectare to 885 kg per hectare between 1950–51 and 2020–21. Research conducted by Bhalla G. S. and Gurmail Singh in 2010 supports these conclusions, linking the significant increase in yield levels of key food grain crops like wheat and rice in India to the introduction of new seed and fertilizer technologies in the mid-1960s.

Table 6: Structural changes in land holdings in India in 1970-71 to 2015-16.

Size Groups	Number of Holdings (in '000 ha)									
	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal (Less than 1 hectare)	36200 (50.98)	44523 (54.58)	50122 (56.39)	56147 (57.79)	63389 (59.44)	71179 (61.58)	75408 (62.87)	83694 (64.77)	92826 (67.10)	100251 (68.45)
Small (1.0 to 2.0 hectares)	13432 (18.91)	14728 (18.05)	16072 (18.08)	17922 (18.45)	20092 (18.84)	21643 (18.72)	22695 (18.92)	23930 (18.52)	24779 (17.91)	25809 (17.62)

Semi-Medium (2.0 to 4.0 hectares)	10681 (15.04)	11666 (14.30)	12455 (14.01)	13252 (13.64)	13923 (13.06)	14261 (12.34)	14021 (11.69)	14127 (10.93)	13896 (10.04)	13993 (9.55)
Medium (4.0 to 10.0 hectares)	7932 (11.17)	8212 (10.06)	8068 (9.07)	7916 (8.15)	7580 (7.11)	7092 (6.14)	6577 (5.48)	6375 (4.93)	5875 (4.25)	5561 (3.80)
Large (10.0 hectares and above)	2766 (3.89)	2440 (2.99)	2166 (2.44)	1918 (1.97)	1654 (1.55)	1404 (1.21)	1230 (1.02)	1096 (0.85)	973 (0.70)	838 (0.57)
All Sizes	71011 (100)	81569 (100)	88883 (100)	97155 (100)	106637 (100)	115580 (100)	119931 (100)	129222 (100)	138348 (100)	146454 (100)

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

The structural changes in landholding in India are explained in tables 6, 7, and 8. For instance, India's landholding structure has seen continuous growth since the 1970-71 Agriculture Census, with operational holdings increasing from 71.01 million to 146.5 million in 2015-16, and marginal farming holdings increasing from 36.2 million to 100 million, resulting in a percentage increase of 51 percent to 68.45 percent during 1970-71 to 2015-16 (Table 6).

The number of operational holdings in the case of small-sized holdings in India has increased from 13.4 million in 1970-71 to 25.8 million in 2015-16, but in percentage terms, it decreased from 18.91 percent in 1970-71 to 17.62 percent in 2015-16. Semi-medium holdings have seen an increase from 10 million to 14 million, but in percentage terms, it decreased from 15.04 percent in 1970-71 to 9.55 percent in 2015-16. while medium- and large-sized holdings have seen a continuous decline since the first agricultural census in 1970-71. It is evident from Table 8 that 7.9 million to 5.56 million and 2.7 million to 0.8 million, respectively, occurred from 1970-71 to 2015-16. In percentage terms, it was witnessing a remarkable reduction from 11.2 percent to 3.8 percent and 3.89 percent to 0.57 percent, respectively Chand, Ramesh, et al. (2011) found that, smallholdings in Indian agriculture still show higher productivity than large holdings, but they have lower per capita productivity and widespread poverty. The lives of smallholding families can be enhanced only by building on their higher per-acre agricultural productivity and by encouraging off-farm rural employment. The authors further pointed out that the growth in rural population is the main factor underlying an increase in number of holdings in India.

Table 7: Operated area of Indian agriculture by different size groups in 1970-71 to 2015-16.

Size Groups	Operated Area (in '000 ha.)									
	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal (Less than 1 hectare)	14599 (8.99)	17509 (10.72)	19735 (12.05)	22042 (13.39)	24894 (15.04)	28121 (17.21)	29814 (18.70)	32026 (20.23)	35908 (22.49)	37923 (24.03)
Small (1.0 to 2.0 hectares)	19282 (11.88)	20905 (12.80)	23169 (14.14)	25708 (15.62)	28827 (17.42)	30722 (18.81)	32139 (20.16)	33101 (20.91)	35244 (22.08)	36151 (22.91)
Semi-Medium (2.0 to 4.0 hectares)	29999 (18.48)	32428 (19.85)	34645 (21.15)	36666 (22.28)	38375 (23.18)	38953 (23.84)	38193 (23.95)	37898 (23.94)	37705 (23.62)	37619 (23.84)
Medium (4.0 to 10.0 hectares)	48234 (29.71)	49628 (30.38)	48543 (29.64)	47144 (28.65)	44752 (27.04)	41398 (25.34)	38217 (23.97)	36583 (23.12)	33828 (21.19)	31810 (20.16)
Large (10.0 hectares and above)	50064 (30.84)	42873 (26.25)	37705 (23.02)	33002 (20.05)	28659 (17.31)	24160 (14.79)	21072 (13.22)	18715 (11.82)	16907 (10.59)	14314 (9.07)
All Sizes	162318 (100)	163343 (100)	163797 (100)	164562 (100)	165507 (100)	163355 (100)	159436 (100)	158323 (100)	159592 (100)	157817 (100)

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

Since 1970-71, the operated area of agricultural land in India has been on a downward trajectory primarily due to the diversion of land for non-agricultural purposes. Initially, the operated area across all sizes stood at approximately 162.3 million hectares in 1970–71. This figure saw a modest increase to 165.5 million hectares by 1990–91. However, subsequent years witnessed a general decline, with the operated area diminishing to 157.8 million hectares by 2015–16, as depicted in Table 7. The marginal size category experienced a significant increase from 14.5 million hectares to 37.9 million hectares, while small holdings' area increased from 19.2 million hectares to 36.1 million hectares. The semi-medium category saw an increase from 30 million hectares to 37.6 million hectares, while medium and large holdings' areas declined from 48.2 million hectares to 32 million hectares and 50 million hectares to 14.3 million hectares, respectively. This trend of decline is consistent across different size groups. In percentage terms, the rate increased from 8.99 percent to 24.03 percent; 12 percent to 23 percent; 18.48 percent to 24 percent; 30 percent to 20.13 percent and 31 percent to just 9.07 percent, respectively of

marginal size, small holdings, semi-medium, medium and large holdings as observed between 1970–71 and 2015–16

Table 8: Average size of holdings of Indian agriculture by different size groups in 1970-71 to 2015-16.

Size Groups	Average (in ha.)									
	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2000-01*	2005-06*	2010-11	2015-16
Marginal (Less than 1 hectare)	0.4	0.39	0.39	0.39	0.39	0.4	0.4	0.38	0.39	0.38
Small (1.0 to 2.0 hectares)	1.44	1.42	1.44	1.43	1.43	1.42	1.42	1.38	1.42	1.4
Semi-Medium (2.0 to 4.0 hectares)	2.81	2.78	2.78	2.77	2.76	2.73	2.72	2.68	2.71	2.69
Medium (4.0 to 10.0 hectares)	6.08	6.04	6.02	5.96	5.9	5.84	5.81	5.74	5.76	5.72
Large (10.0 hectares and above)	18.1	17.57	17.41	17.21	17.33	17.2	17.12	17.08	17.38	17.07
All Sizes	2.28	2	1.84	1.69	1.55	1.41	1.33	1.23	1.15	1.08

Sources: All India Report on Number and Area of Operational Holdings, Agriculture Census Division Department of Agriculture, Co-Operation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India.

The average size of land holdings in India has shown a consistent decline across census periods, particularly impacting marginal, small, semi-medium, and large holdings. This instability in agricultural production and productivity stands as a significant obstacle to achieving food security in India. According to a study by Michael S. Finnin (2016), approximately 65 percent of India's operational farming area and 95 percent of its total farms fall into the category of marginal farming. Much of India's rural population cannot achieve food security due to economic and social barriers to food. Whereas in India, sugarcane is the top agriculture

commodity, followed by cereal grains like wheat and rice. However cereal production has been steadily growing, with wheat production increasing at an annual rate of 4.2 percent from 1961 to 2013. Table 8 shows the average size of holdings in 1970–71 was 2.28 hectares, which declined to 1.08 hectares in 2015–16. It was evident from this table that 0.4 hectares to 0.38 hectares, 1.44 hectares to 1.40 hectares, 2.81 hectares to 2.69 hectares, 6.08 hectares to 5.72 hectares, and 18.1 hectares to 17.07 hectares were marginal, small, semi-medium, and large, respectively, between 1970–71 and 2015–16.

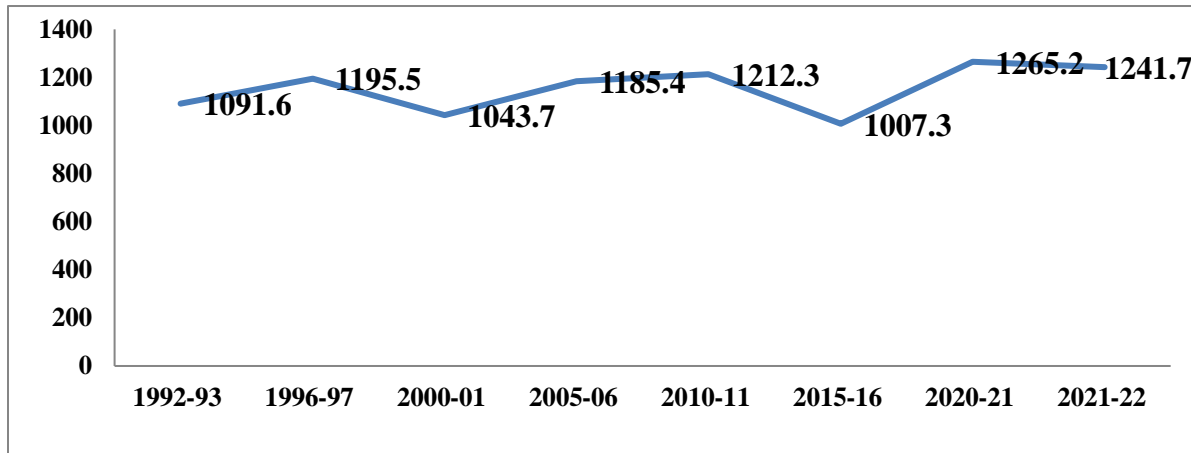
Table 9: All India rainfall distribution from 1992-93 to 2022-23 (In Millimeters)

Year	Actual	Normal	Difference (%)
1992-93	1091.6	1175.6	-7.1
1996-97	1195.5	1190.3	0.4
2000-01	1043.7	1195.5	-12.7
2005-06	1185.4	1196.8	-1
2010-11	1212.3	1191.7	1.7
2015-16	1007.3	1187.6	-15.2
2020-21	1265.2	1176.9	7.5
2021-22	1241.7	1176.9	5.5

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

Rainfall significantly impacts agricultural sectors by increasing cultivation area and yields. However, in India, actual rainfall fluctuates compared to normal, potentially affecting crop area under cultivation, production, and productivity, particularly in food crops, during study periods (Table 9).

Figure 5: Trends in rainfall pattern from 1992-93 to 2022-23 (In Millimeters)



Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

Figure 5 provides a detailed analysis of the fluctuation in actual rainfall in India compared to normal rainfall during the study periods.

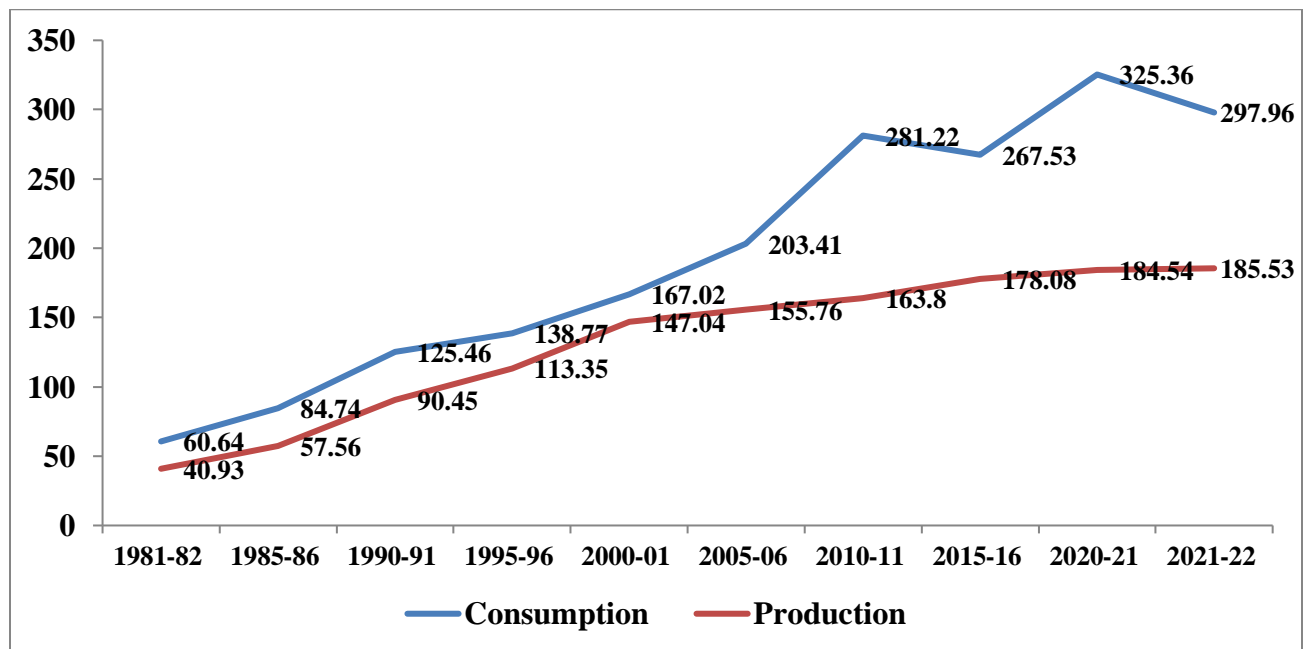
Table 10: Consumption, Production and Import of Fertilizers (Lakh Tonnes)

Year	Consumption	Production	Imports
1981-82	60.64	40.93	20.41
1985-86	84.74	57.56	33.99
1990-91	125.46	90.45	27.58
1995-96	138.77	113.35	39.55
2000-01	167.02	147.04	20.91
2005-06	203.41	155.76	52.53
2010-11	281.22	163.8	123.63
2015-16	267.53	178.08	100.09
2020-21	325.36	184.54	108.46
2021-22	297.96	185.53	97.7

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

In addition to the rainfall, doses of the chemical fertilizer that has been used in farming play a key role in increasing the area under production and also increasing productivity to gain more output from the agricultural lands. Between 1981–82 and 2021–22, the usage of chemical fertilizers in India witnessed a substantial increase, rising from about 60.64 lakh tonnes to 297.96 lakh tonnes. Conversely, production during the same period saw growth, expanding from an estimated 46.93 lakh tonnes to 185.53 lakh tonnes in 2021–22. This significant gap between usage and production has predominantly been filled through imports from other countries, underscoring the necessity for more efficient agricultural practices. A study conducted by Bhalla G. S. and Gurmail Singh in 2010 supports these findings, indicating that during the period from 1980-83 to 1990-93, coinciding with a notable acceleration in the growth rate of agricultural output, the per-hectare consumption of chemical fertilizers more than doubled at the all-India level compared to the preceding period from 1962-65 to 1980-83. Additionally, there was a considerable increase in the percentage of the total cropped area under irrigation, rising from 29 percent during 1980–83 to 36 percent during 1990–93. These trends highlight the evolving dynamics of agricultural practices and inputs over time.

Figure 6: Trends in consumption and production of chemical fertilizer during 1981-82 to 2021-22.



Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India.

Figure 6 shows a significant gap between India's production and consumption of chemical fertilizers, with less gap between 2000-2001 and a wide gap since then. .

Table 11: Per Capita Net Availability of Foodgrains (Per Annum) in India (Kg. p/a)

Year	Rice	Wheat	Other cereals	Cereals	Pulses	Foodgrains
1951	58.0	24.0	40.0	122.0	22.1	144.1
1961	73.4	28.9	43.6	145.9	25.2	171.1
1971	70.3	37.8	44.3	152.4	18.7	171.1
1981	72.2	47.3	32.8	152.3	13.7	166.0
1991	80.9	60.0	29.2	171.0	15.2	186.2
2001	69.5	49.6	20.5	141.0	10.9	151.9
2011	66.3	59.7	23.9	149.9	15.7	170.9
2021	73.3	67.0	30.2	170.5	16.3	186.8

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India

The per capita net availability of food grains in India has exhibited varying trends over the years, largely influenced by population dynamics. For instance, the per capita availability of rice increased from 58 kg in 1951 to 81 kg in 1991, but subsequently decreased to 73.3 kg in 2021. Conversely, wheat showed significant improvement, rising from 24 kg to 67 kg between 1951 and 2021. Table 11 illustrates a negative growth rate in the per capita net availability of other cereals and pulses from 1951 to 2021. However, the per capita net availability of cereals increased from 122 kg in 1951 to 171 kg in 1991, then declined to 141 kg in 2001 before rebounding to 170.5 kg in 2021. Overall, the per capita net availability of food grains saw a notable increase from 144.1 kg in 1951 to 186.8 kg in 2021, highlighting the fluctuations and dynamics of food grain availability in relation to population changes over the years.

Table 12: Population and Agricultural Workers (in Million)

Year (1)	Total population (2)	Average annual exponential growth rate (%) (3)	Rural population (4)	Total workers (5)	Agricultural Workers		
					Cultivators (6)	Agricultural Labourers (7)	Total (8)
1951	361.1	1.25	298.6 (82.7)	139.5	69.9 (71.9)	27.3 (28.1)	97.2 (69.7)
1961	439.2	1.96	360.3 (82.0)	188.7	99.6 (76.0)	31.5 (24.0)	131.1 (69.5)

1971	548.2	2.20	439.0 (80.1)	180.4	78.2 (62.2)	47.5 (37.8)	125.7 (69.7)
1981	683.3	2.22	525.6 (76.9)	244.6	92.5 (62.5)	55.5 (37.5)	148.0 (60.5)
1991	846.4	2.16	630.6 (74.5)	314.1	110.7 (59.7)	74.6 (40.3)	185.3 (59.0)
2001	1028.7	1.97	742.6 (72.02)	402.2	127.3 (54.4)	106.8 (45.6)	234.1 (58.2)
2011	1210.9	1.50	833.7 (68.9)	481.9	118.8 (45.1)	144.3 (54.9)	263.1 (54.6)

Source: Registrar General of India

1. Figures within parentheses in Col.-4 are percentages to the Total Population.
2. Figures within parentheses in Col.-6 and 7 are percentages to Col.-5.
3. Figures within parentheses in Col.-8 is percentage share of Agricultural Workers in Total Workers.

Table 12 illustrates the evolution of the rural population in India, reflecting shifts influenced by factors such as reliance on agriculture for income and sustenance. Between 1951 and 2011, there was a notable decline in the rural population's dependence on agriculture, dropping from 82.7 percent to 68.9 percent. This decline was accompanied by a substantial decrease of 54.6 percent in the dependence of rural labourers on agriculture, with approximately 15.1 percent of the rural workforce transitioning to other sectors. Despite these shifts, the agricultural sector in India has struggled to generate adequate revenue for dependent segments of society. The dependence of landless labourers increased significantly from 28.1 percent in 1951 to 54.9 percent in 2011. However, the proportion of cultivators witnessed a significant decline, decreasing from 71.9 percent in 1951 to 45.1 percent in 2011. It is estimated that during the period from 1951 to 2011, around 26.8 percent of agricultural labourers and cultivators transitioned out of agriculture, accounting for 26.8 percent of the total workforce. This indicates a growing overall dependence on agriculture, despite the declining proportion of cultivators. This underscores the necessity for sustainable agricultural practices. For example, research conducted by Byerlee, Derek et al. (2009) suggests that areas lacking intensification, particularly in Sub-Saharan Africa, face challenges such as deforestation, soil erosion, desertification, and degradation of pastures and watersheds. These issues arise from unsustainable expansion of agricultural areas, as growing rural populations are pushed into increasingly marginal and fragile zones. Therefore, sustainable agricultural practices are imperative to address these challenges and ensure long-term food security and environmental sustainability.

**Table 13: India's share of imports and exports of principal agricultural commodities
(Value in Rs. Crore)**

Year	Imports			Exports		
	Agriculture	National	% share of agriculture	Agriculture	National	% share of agriculture
1990-91	1205.86	43198	2.79	6012.76	32553	18.47
1995-96	5890.1	122678.1	4.8	20397.74	106353.4	19.18
2000-01	12086.23	230872.8	5.24	28657.37	203571	14.08
2005-06	15977.75	574190.9	2.78	45710.97	456417.9	10.02
2010-11	51073.97	1683467	3.03	113046.6	1136964	9.94
2015-16	140289.2	2490304	5.63	215396.3	1716384	12.55
2020-21	154510.7	2915958	5.3	308830	2159043	14.3
2021-22	231850.3	4572775	5.07	375662.5	3147021	11.94

Source: Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India

Table 13 highlights the evolving share of India's agriculture sector in the national GDP through imports and exports of agricultural commodities. The data indicates a notable increase in the sector's contribution to the national GDP through imports of agricultural commodities, rising from 2.79 percent in 1990-91 to 5.07 percent in 2021-22. Conversely, the share of agricultural commodity exports to the total national exports witnessed a decline, dropping from 18.47 percent in 1990-91 to 11.94 percent in 2021-22. This trend suggests a growing reliance on other countries for food security rather than prioritizing domestic production. In many countries, the shortage of foreign exchange for importing substitute cereals leads to frequent shortages, underscoring the importance of maintaining domestic food production to stabilize food prices, which are crucial for economic growth (Byerlee, Derek et al., 2009). Therefore, enhancing domestic agricultural productivity and reducing dependency on imports are essential for ensuring long-term food security and economic stability.

Conclusion and policy recommendations

The major findings of the study are presented here. The study reveals a marginal increase in net area sown between 1950-51 and 2019-20, largely due to land reforms and the green revolution. The net area irrigated also increased, transforming food grain production. Cropping intensity increased from 111.07 percent to 151.08 percent between 1950-51 and 2019-20. Food grain productivity increased from 522 kg per hectare in 1950-51 to 2394 kg per hectare in 2020-21. The agricultural sector also experienced a significant increase in food grain production, with a decline in nutritious cereal cultivation area. Pulses also showed an increase, with production and

yield improving. Chemical fertilizer usage in India has surged from 1981-82 to 2021-22, reaching 297.96 lakh tonnes, despite production at 46.93 lakh tonnes. This highlights the need for efficient agricultural practices. However, fluctuating rainfall could impact crop area and productivity. Rural population growth has declined from 82.7 percent to 68.9 percent, with 54.6 percent of laborers reducing dependence on agriculture for their life and livelihoods. The agricultural sector in India has seen an increase in imports of agricultural commodities from 2.79 percent to 5.07 percent between 1990-91 and 2021-22, while exports have declined from 18.47 percent to 11.94 percent. However, the proportion of cultivators has declined, indicating a growing population dependence on agriculture. Sustainable agricultural practices are needed to achieve food security and zero hunger in India.

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REFERENCES

- Abebe D. Beyene, Alemu Mekonnen, Menale Kassie, Salvatore Di Falco, and Mintewab Bezabih (2017), “Determinants of Adoption and Impacts of Sustainable Land Management and Climate Smart Agricultural Practices (SLM-CSA): Panel Data Evidence from the Ethiopian Highlands”. Environment for Development Initiative (2017), pp. 1-30.
- Barbara Adolph and Maryanne Grieg-Gran (2013) “Agriculture and food systems for a sustainable future: an integrated approach” International Institute for Environment and Development (2013).
- Bhalla G S and Gurmail Singh (2010) “Economic Liberalisation and Indian Agriculture: A Statewise Analysis”, Economic and Political Weekly , December 26, 2009-January 1, 2010, Vol. 44, No. 52 (December 26, 2009-January 1, 2010), pp. 34-44.
- Derek Byerlee, Alain de Janvry and Elisabeth Sadoulet (2009) “Agriculture for Development: Toward a New Paradigm” Annual Review of Resource Economics, 2009, Vol. 1 (2009), pp. 15-18, C1-C3, 19- 31.
- Ebenezer Nana Kwaku Boateng and Collins Adjei Mensah (2021) “Land Use/Land Cover Dynamics and Urban Agriculture In Tarkwa-Nsuaem Municipality, Ghana”, Theoretical

- and Empirical Researches in Urban Management, May 2021, Vol. 16, No. 2 (May 2021), pp. 5-20.
- Gerard Ward. R (2019) "Change in Land Use and Villages—Fiji: 1958–1983", (ed.) Stewart Firth and Vijay Naidu, Understanding Oceania, ANU Press, pp-59-78. <https://www.un.org/sustainabledevelopment/hunger/>
- Jiayi zhou, Lisa Maria Dellmuth, Kevin M. Adams, Tina-Simone Nesetand Nina Von Uexkull (2020) "The Geopolitics of Food Security: Barriers to The Sustainable Development Goal of Zero Hunger", Stockholm International Peace Research Institute (2020), pp-1-15.
- Juliane Dame (2018) "Food Security and Translocal Livelihoods in High Mountains: Evidence From Ladakh, India", Mountain Research and Development , Nov 2018, Vol. 38, No. 4 (Nov 2018), pp. 310-322.
- Livia Bizikova, Stefan Jungcurt, Kieran McDougal and Carin Smaller (2017) "Effective Public Investments to Improve Food Security" International Institute for Sustainable Development, pp. 1-11.
- Michael S. Finnin (2016) "Food Security in India", "Food Security in India, China, and the World", Institute for Defense Analyses (2016), pp-4-1 to 4-6.
- Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Economics & Statistics Division, Government of India, Krishi Bhawan, New Delhi-110 001
- Ramesh Chand, P A Lakshmi Prasanna, Aruna Singh (2011), "Farm Size and Productivity: Understanding the Strengths of Smallholders and Improving Their Livelihoods", Economic and Political Weekly, June 25-July 8, 2011, Vol. 46, No. 26/27, Supplement: Review of Agriculture, pp. 5-11
- Valentin Zahrnt (2011), "Food Security and the EU's Common Agricultural Policy: Facts Against Fears", European Centre for International Political Economy (2011), pp-1-23.