Trends in Food Grains Production: A Study of Pre- Reforms Period in India

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Abstract

Agriculture plays an essential role in the process of economic development of less developed countries like India. Besides providing food to nation, agriculture releases labour, provides saving, contributes to market of industrial goods and earns foreign exchange. In India, agriculture was the main source of national income and occupation at the time of Independence. Agricultural sector occupies a key position in the Indian economy, mainly because of three reasons. First, agriculture constitutes largest share of country's national income though the share has declined from 55 percent in early 1950s to about 14.6 percent by the turn of the century. Second, more than half of India's work force is employed in agriculture sector. Third, growth of other sectors and overall economy depends on performance of agriculture to a considerable extent. Because of these reasons agriculture continues to be the dominant sector in Indian Economy. Through this paper, we tried to show the trends in production, area and yield of food grains in the pre economic reforms period. The entire period has been divided into three sub periods for analytical convenience and to facilitate comparison i.e. (1) 1951-52 to 1965-66 (2) 1966-67 to 1979-80 and (3)1980-81 to 1990-91. The study uses the Average Compound Growth Rate (ACGR) for analyzing the data.

Keywords: Agriculture; Productivity; Food Grains; Pre Economic Reforms Period; ACGR.

Introduction

Agricultural development treated as precursor to industrial development in nations across the world, passes through distinct but relatively definite phases of modernization. It is always worthwhile to understand these phases and their prime features so as to learn from the experiences of the nations which have successfully passed these phases and the strategies adopted to do away with the complications, tackle the challenges and exploit. Agricultural development in nations passes through the following phases.

Traditional Agricultural

This is the primary and the most backward state of development of agriculture, which exists where the nation is in primary state of development. In this phase, technique of production is not just

obsolete, it is even primitive and labour intensive.

Technologically Dynamic Agriculture – Low Capital Technology

In this phase, agricultural remains the main stay of the population with still more than 60 percent of the population depending on it for their livelihood, agriculture also contributes more than between one –third and one half of the national income through its contribution consistently falls in this phases capital for industrial development is particularly scarce and returns are rising. Unfavorable labour –capital cost relationship rules out the possibility of increased use of labour saving mechanization in agriculture. The most distinguishing features of the second phases is the constant generation and application of technology.

Technologically Dynamic Agriculture – High Capital Technology

This is the most advanced phase of agricultural that exists in mostly the advanced nations. The significance of agricultural sector in terms of the dependence of the population on it as source of livelihood and contribution to national incomes goes down and the secondary and tertiary sectors of the Food grains production occupies the most dominant position in India's agriculture, covering over 65 per cent of the gross cropped area. Since the beginning of the green revolution in the mid sixties, the country has shown impressive growth in food grains production. Just after independence, there was enough brought for increasing production of food grains through expansion of the cultivated area.

In this study, we mainly concentrated on Rice, Wheat, Coarse cereals and Pulses because India contribute major share in these types of food grains in the world. As India's food security vitally depends upon wheat and rice production. Rice, which is the predominant food grain crop in India, is extensively cultivated in almost all parts of the country. In India, rice cultivation has a long history marked by a series of technological break-through and has the largest area under rice in the world. India ranks second next to china and the country contributes nearly 22 percent of the global rice production. The principal rice producing states in India are West Bengal, Uttar Pradesh and Punjab. Rice, India's preeminent crop is the staple food of the people of the eastern and southern parts of the country. In context of wheat, in which India holds the second position among the wheat producing countries of the world, next to China. Uttar Pradesh, Punjab, Haryana and Madhya Pradesh are the major wheat producing states in India. Coarse cereals are a group of six cereals, namely jawar, Bajra, maize, ragi, barley and millets. In the production of coarse cereals, India holds the sixth position in the world next to US, China, Brazil, the Russian Federation and France. In India, coarse cereals are grown mainly in the rain fed areas where the coverage of irrigation is only about 12 per cent. In context of Pulses production, India ranks first in the world. The leading producer states of pulses in the country are Madhya Pradesh, Uttar Pradesh and Rajasthan. Sorghum and millet, the principal coarse grains, are dry land crops most frequently grown as staples in central and western India. Corn and barley are staple foods grown mainly near and in the Himalayan region. As the result of increased yields, the production of coarse grains has doubled since 1950; there was hardly any change in the area sown for these grains. Pulses are an important source of protein in the vegetarian diet; the small improvement in production along with the increase in population meant a reduced availability of pulses per capita. Before the Green Revolution, coarse grains showed satisfactory rates of growth but afterward lost cultivated areas to wheat and rice, and their growth declined.

Review of Literature

Mitra (1968) estimated the compound growth rates of food grains production of India for the period 1950-51 to 1967-68. He divides the entire period into two sub –periods 1950-51 to 1958-59 to 1967-68 and computed the growth rates for each of these two periods separately by comparing with the entire period. This study also concludes that food grains production has declined after the second five year plan. Gangwar and Singh (1972) in their study pertaining the trends in agriculture production of Haryana and India, exhibit that the growth rates of area and production of principle crops (Wheat, Rice, Jawar, Bajra, Gram, Pulses and oilseeds) in Haryana are much higher than the rest of the country. However, the situation in case of gram, pulses and oilseeds was not promising in Haryana; indicate an unbalanced growth rate of agriculture. Aiyasamy, P.K. and Subramanian, V. (1979) estimated the compound growth rates in area, production and productivity of rice in different district of Tamil Nadu for the two period's viz. pre green revolution period (1965-66 to 1973-74). Their study also concludes that the green revolution had ushered in a phase of breakthrough in Tamil Nadu's rice production through the growth rates of productivity were not uniform among the districts. Pandy, U.K., Suhag, K.S. and Manocha, V. (1983) investigates the factor shares of output in Haryana agriculture under three periods: pre green revolution period (1956-57 to 1965-66), Green revolution period (1966-67 to 1973-74) and post Green revolution period (1974-75 to 1981-82) with the help of secondary data. In this study an attempt has been made to study the impact of the technology change on factor proportions and their share in output based on total factor productivity approach. Their study reveals that the traditional inputs accounted for the bulk of total factor inputs during pre- Green revolution period, while in the subsequent periods. The shares of modern inputs has considerably increased among districts which had better resources had

realized the benefit of technological change in the state of Haryana. Singh and Singh (1991) in their study pertaining to the changes in cropping pattern and production pattern in Haryana agriculture between 1966-67 to 1988-89 based on secondary data. The study reveals that the area under rice and wheat has been increasing at the rate of 9.29 percent and 6.34 percent respectively during the 1966-67 to 1988-89. The area under food grains like Jowar, Bajra, Maize, Barley and the area under important pulses crops has been increasing at the rate of 11.60% per annum during this period. The total production of Jowar, Maize, Barley gram and the other pulses crops has been declining. In a study by Bhalla and Singh (1997) examine the results of an analysis of state level data on area and output of 43 crops for the 30 years from 1962-65 to 1992-95. Their study reveals that the period 1980-83 to 1992-95 is characterize by significant changes in the cropping pattern. The most important feature of changes are that at all India, the proportion of area under which has remained almost constant during 1962-65 to 1980-83, registered a sharp decline of 4.42 percent from 76.63 percent of total area in 1980-83. Most of these changes took place because of a decline in the share of area under course cereals of 5.27% from 25.08% in 1980-83 to 19.81% in 1992-95. On the other hand, the area under both rice and wheat actually registered a notable increase. The main shifts took place from course cereals of to oil seeds whose share in cropped area increasing from 10.92% in 1980-83 to 15.31 percent in 1992-95. They also conclude that the cropping pattern changes in Haryana are similar total India level. The area under food grains crops decline sharply, primarily as a result of sharp decline in area under coarse cereals as well as pulses and area under oil seeds recording a significant increase. Varghese (2004) in his study related to the trends in the area, production, and productivity of cardamom in Kerala and the behavior of price from (1970-71 to 2002-03) and states that the massive shifting of cardamom to other crops is mainly due to recurrent fluctuation in prices. The author's findings suggest that there is need to reformulate spices price policy for the benefits of small and marginal growers of cardamom. Narayana and Moorthy (2007) in their study related to the reasons for deceleration in agricultural growth in India. The authors suggested that there are many reason for the declaration in agricultural growth are (1) Reduction of public investment in agriculture (2) Inadequate institutional credit (3) Reduction in the use of various yield increasing input. (4) Price policy that recover the cost of cultivation (5) Irrigation Fatigue, but the technology Fatigue is the main reasons for this. This study also suggest that the policy makers must make effort to convert agriculture into a professional enterprises by making adjustments in the minimum support price of various crops in consonance with the cost of cultivations. Tupe and Kamat (2010) in their treatise pertaining to the determinants of agricultural gross domestic production for the pre and post economic reforms period stated that institutional credit sources, consumption of fertilizer and net sown area are major determinants of AGDP (Agricultural gross domestic production) for the, the pre-reforms period, India's membership of WTO is the significant determinants of AGDP in the post reforms periods. This study also reveals that the Indian agriculture sector witness decreasing return's to scale phase during the seventies, eighties and nineties and there is need to increase the abundant and continuous flow of inputs so that the problems such as food security, poverty reduction, unemployment, and increasing price level of food grains can be minimized.

Objectives of the study

The main objective of this study is to show the trends in production, area and yield of food grains in the pre economic reforms period. The study also shows the commodity-wise compound growth rate of various food grains.

Research Methodology

The present study is based on time series data (1951-52 to 1990-91), on production, area, and yield of such food grains production such as, rice, wheat, coarse cereals and pulses, available on the website of handbook of RBI, source of ministry of agriculture. The total time period is classified into three decade, namely pre-green revolution period (1951-52 to 1965-66), green revolution period (1966-67 to 1979-80), the maturing period of green revolution period (1980-81 to 1990-91). The study uses the Average Compound Growth Rate (ACGR).

The average compound growth rate is computed by employing formula:

$Y = abt$

By using logarithm, it may be written as:

$\text{Log } y = \log a + t \log b$

$Y^* = a^* + t.b^*$ (where $\log y = y^*$, $\log a = a^*$ and $\log b = b^*$)

The value of b* is computed by using OLS Method. Further, the value of ACGR can be calculated by followed method:

$ACGR = (\text{Antilog } b - 1) \times 100$

Data Analysis and Interpretation

Indian agricultural in the period from 1951-1991 ushered in the age of dynamism where latest agricultural technology became the order of the day in a defined portion of the economy, scale of production increased tremendously, institutional reforms carried in a way, well planned and thought out strategies were followed, researchers in the field of agriculture were carried out and were promoted through the establishment of agricultural universities and research institutes and schemes intensive and extensive agriculture

were carried out and from a net importer of food grains the Indian economy emerged as a food surplus economy and stared economy and started even exporting food grains.

The First Phase (Pre Green Revolution Period) 1951-52 to 1965-66

The first phase of agricultural policy witnessed tremendous agrarian reforms, institutional changes, development of major irrigation project and strengthens of cooperative credit institution. The most important contribution of land reforms was abolition of intermediaries and giving land titles to the actual cultivators. This released productive forces and the owner cultivators put in their best to augment production on their holdings. Land reforms were important in increasing agricultural production during this phase. The Community Development Programmes, decentralized planning and the Intensive Area Development Programmes were also initiated for regenerating Indian agriculture that had stagnated, during the British period. In order to encourage the farmers to adopt better technology, incentive price policy was adopted in 1964 and the Agricultural Price Commission was setup to advice the Government on the fixation of support prices of agricultural crops. Despite the institutional changes and development programs introduced by the Government during this phase, India remained dependent upon foreign countries for food to feed the rising population.

The Second Phase (Green Revolution Period) 1966-67 to 1979-80

The second phase in Indian agriculture started in mid 1960s with the adoption of new agricultural strategies. The new agricultural strategy relies on high-yielding varieties of crops, multiple cropping, the package approach, modern farm practices and spread of irrigation facilities. The biggest achievement of this strategy has been attainment of self sufficiency in food grains. Agrarian reforms during this period took back seat while research, extension, input supply, credit, marketing, price support and spread of technology were the prime concern of policy makers (Rao, 1996).

The Third Period (The Maturing Period of Green Revolution)

The third phase in Indian agriculture began in early 1980s. This period started witnessing process of diversification which resulted into fast growth in non-food grains output like milk, fishery, poultry, vegetables, fruits etc which accelerated growth in agricultural GDP during the 1980s (Chand, 2003). There has been a considerable increase in subsidies and support to agriculture sector during this period while public sector spending in agriculture for infrastructure development started showing decline in real term but investment by farmers kept on moving on a rising trend (Mishra and Chand, 1995; Chand, 2001).

Table: 1 Trends in Pre Green Revoluti on Period (1951-52 to 1965-66) (million tons)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total Cereals	Pulses	Total Food grains
1951-52	21.3	6.18	16.09	43.57	8.42	51.99
1952-53	22.9	7.5	19.61	50.01	9.19	59.2
1953-54	28.21	8.02	22.97	59.2	10.62	69.82
1954-55	25.22	9.04	22.82	57.08	10.05	68.03
1955-56	27.56	8.76	19.49	55.81	11.04	66.85
1956-57	29.04	9.4	19.87	58.31	11.55	69.86
1957-58	25.53	7.99	21.23	54.75	9.56	64.31
1958-59	30.85	9.96	23.18	63.99	13.15	77.14
1959-60	31.68	10.32	22.87	64.87	11.8	76.67
1960-61	34.58	11	23.74	69.32	12.7	82.02
1961-62	35.66	12.07	23.22	70.95	11.76	82.71
1962-63	33.21	10.78	24.63	68.62	11.53	80.15
1963-64	37	9.85	23.72	70.57	10.07	80.64
1964-65	39.31	12.26	25.37	76.94	12.42	89.36
1965-66	30.59	10.4	21.42	62.41	9.94	72.35

Source: Ministry of Agriculture, Government of India

The above table 1 related to production major reveals that the trends in food grains production through the actual data of food grains production .This table reveals that the production of food grains has been continuously increasing from 51.99 (MT) in 1951-52 to 72.35 (MT) in 1965-66. It can be seen from the table, the production of major fooodgrains crops such as rice, wheat, coarse cereals, pulses has been also increasing from 21.3, 6.18, 16.09, 8.42, (MT) in 1965-66. It can be clearly seen from the table in 1964-65 is the peak point of food grains production. A larger number of factor responsible for this increases in food grains production but increases in net sown area and irrigation facilities are main factor during this period (Bhalla, 2007).The production of food grains witness a precious fall in 1965-66, this was due to drought in 1965-66.

Table: 2 Trends in Area Cultivation: (Pre - Green Revolution Period (1951 -52 to 1965 -66)

(Million Hectares)

	Cereals					
Year	Rice	wheat	Coarse Cereals	Total	Pulses	Total Food grains
1951-52	29.83	9.47	38.88	78.18	18.78	96.96
1952-53	29.97	9.83	42.45	82.25	19.84	102.09
1953-54	31.29	10.68	45.37	87.34	21.73	109.07
1954-55	30.77	11.26	43.92	85.95	21.91	107.86
1955-56	31.52	12.37	43.45	87.34	23.22	110.56
1956-57	32.28	13.52	42.02	87.82	23.32	111.14
1957-58	32.30	11.73	42.91	86.94	22.54	109.48
1958-59	33.17	12.62	44.66	90.45	24.31	114.76
1959-60	33.82	13.38	43.79	90.99	24.83	115.82
1960-61	34.13	12.93	44.96	92.02	23.56	115.58
1961-62	34.69	13.57	44.73	92.99	24.24	117.23
1962-63	35.69	13.59	44.29	93.57	24.27	117.84
1963-64	35.81	13.5	43.93	93.24	24.18	117.42
1964-65	36.46	13.42	44.35	94.23	23.88	118.11
1965-66	35.47	12.57	44.34	92.38	22.72	115.1

Source: Ministry of Agriculture, Government of India

The above table 2 related to the area under the cultivation of food grains from (1951-52 to1965-66) shows that the area under the cultivation of food grains has been slightly increasing from 96.96 (mh) in 1951-52 to 115.1 (mh) in 1965-66. The area under the cultivation of major food grains such as rice, wheat, coarse cereals and pulses has increasing from 29.83, 9.47, 38.88 and 18.78 (mh) respectively in 1951-52 to 35.47, 12.57, 44.34 and 22.72(mh) respectively in 1965-66. Since 1965-66 was a drought year, area under cultivation also declined as compared to 1964-65.

Table: 3 Trends in Yield of Food grains: The Period of Green Revolution Period (1951-52 to 1965-66) (kg. /hectares)

	Cereals					
Year	Rice	wheat	Coarse Cereals	Total Cereals	Pulses	Total Food grains
1951-52	714	653	414	557	448	536
1952-53	764	763	462	608	463	580
1953-54	902	750	506	678	489	640
1954-55	820	803	520	664	500	631
1955-56	874	708	449	639	476	605
1956-57	900	695	473	664	495	629
1957-58	790	682	495	630	424	587
1958-59	930	789	519	707	541	672
1959-60	937	772	522	713	475	662
1960-61	1013	851	528	753	539	710
1961-62	1028	890	519	763	485	706
1962-63	931	793	556	733	475	680
1963-64	1033	730	540	757	416	687
1964-65	1078	913	514	817	520	757
1965-66	862	827	483	676	438	629

Source: Ministry of Agriculture, Government of India

The above table 3 related to the yield of major food grains production from (1951-52 to 1965-66) pertains that the yield of major food grains during the pre- green revolution period. The table clearly indicates that the yield of per hectare of major food grains has been continuously fluctuating with increasing trend from 536 kg in 1951-52 to 629 kg in 1965-66. The yield per hectare of major food grains such as, rice, wheat, coarse cereals and pulses has been also fluctuating and increases from 714, 653, 414, and 448 kg respectively in 1951-52 to 862, 827, 483 and 438 kg respectively in 1965-66. But if we compare the year 1965-66 to 1964-65, the table reveals that yield in case of total cereals and total food grains has been declined due to the drought.

Table: 4 Trends in Production of Food grains : The Gr een Period (1966 -67 to 1979 -80)

(million tons)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total	Pulses	Total Food grains
1966-67	30.44	11.39	24.05	65.88	8.35	74.23
1967-68	37.61	16.54	28.8	82.95	12.1	95.05

1968-69	39.76	18.65	25.18	83.59	10.42	94.01
1969-70	40.43	20.09	27.29	87.81	11.69	99.5
1970-71	42.22	23.83	30.55	96.6	11.82	108.42
1971-72	43.07	26.43	24.6	94.08	11.09	105.17
1972-73	39.24	24.74	23.14	87.12	9.91	97.07
1973-74	44.05	21.78	28.83	94.66	10.01	114.67
1974-75	39.58	24.1	26.13	89.81	10.02	99.83
1975-76	48.74	28.84	30.41	107.99	13.04	121.03
1976-77	41.92	20.01	28.88	99.81	11.36	111.17
1977-78	52.67	30.75	30.02	114.44	11.96	126.41
1978-79	53.77	35.51	30.44	119.72	12.81	131.9
1979-80	42.33	31.83	26.97	101.13	8.57	109.7

Source: Ministry of Agriculture, Government of India

The above table 4 related to production of major food grains from 1966-67 to 1979-80 decipher that the production of food grains has been increasing from 74.23 (MT) in 1966-67 to 109.7 (MT) in 1979-80. The production of principal food grains like as rice, wheat, coarse cereals and pulses has been increasing from 30.44, 11.39,24.05, and 8,35 (mt) respectively in 1966-67 to 42.33, 31.83, 26.97 and 8.57 (mt) respectively in 1979-80. In cereals, the production of wheat is maximum this is mainly due to the reason the new technology was confined only to wheat. Hence, the production of food grains could rapidly grow only if new technology was also extended to rice and coarse cereals percentage share of pulses in total food grains has been declining from 13.74% in 1965-66 to 8.57 in 1979-80. Although production of major has been increased in 1979-80 but it has been declined in 1979-80 as compared to 1978-79 because of area and yield of food grains has decreased.

Table: 5 Trend in A rea Cultivation The green revolu tion period (1966 -67 to 1979-80)

(million hectares)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total cereals	Pulses	Total Food grains
1966-67	35.25	12.84	45.09	93.18	22.12	115.3
1967-68	36.44	14.99	47.34	98.77	22.65	121.42
1968-69	36.97	15.96	46.24	99.17	21.26	120.43
1969-70	37.68	16.63	47.24	101.55	22.02	123.57
1970-71	37.59	18.24	45.95	101.78	22.54	124.32
1971-72	37.76	19.14	43.75	100.47	22.15	122.62

1972-73	36.69	19.46	42.25	98.36	22.92	119.28
1973-74	38.29	18.58	46.24	103.11	23.43	126.54
1974-75	37.89	18.01	43.15	99.05	22.03	126.08
1975-76	39.48	20.45	43.8	103.73	24.45	128.18
1976-77	38.51	20.92	41.94	101.37	22.98	124.35
1977-78	40.28	21.46	42.28	104.02	23.5	127.52
1978-79	40.48	22.64	42.23	105.35	23.66	129.01
1979-80	39.42	22.14	41.36	102.95	22.26	125.21

Source: Ministry of Agriculture, Government of India

The above table 5 related depicts to the area under the cultivation of food grains from 1966-67 to 1979-80 shows that the area under the cultivation has been increasing from 129.59 (mh) in 1965-66 to 176.39 (mh) in 1979-80. The area under the cultivation of major food grains such as rice, wheat and pulses has slightly increased from 35.25, 12.84 and 22.12 respectively in 1965-66 to 39.42, 22.17, and 22.12 respectively in 1979-80, except coarse cereals.

Table: 6 Trends in Yield of Major Food grains: The Green Revolution Period (1966 -67 to 1979-80) (kg. /hectares)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total	Pulses	Total Food grains
1966-67	863	887	533	707	377	644
1967-68	1032	1103	608	840	534	783
1968-69	1076	1059	545	843	490	781
1969-70	1073	1208	578	865	531	805
1970-71	1123	1307	665	949	524	872
1971-72	1141	1380	564	936	501	858
1972-73	1070	1271	548	886	474	813
1973-74	1151	1172	623	918	427	827
1974-75	1045	1338	606	907	455	824
1975-76	1235	1410	694	1041	533	944
1976-77	1089	1387	689	985	494	894
1977-78	1308	1480	710	1100	510	991
1978-79	1328	1568	721	1136	515	1022
1979-80	1074	1436	652	928	385	876

Source: Ministry of Agriculture, Government of India

The above table 6 related to the yield of major food grains production from 1966-67 to 1979-80 indicates that the yield per hectares of food grains has been increasing from 644 kg in 1965-66 kg in 1965-66 to 876 in 1979-80. The yield of major food grains such as, rice, wheat, coarse cereals and pulses has been also increasing from 863, 887, 533, and 377 kg respectively in 1966-67 to 1074, 1436,652 and 876 kg respectively in 1979-80. But there are most wide fluctuations in yield per hectare of wheat. Also the yield of major food grains has been decline in 1979-80 because of Indian economy face a natural hazards in the form of droughts and seasonal variation during this period.

Table: 7 Trends in Production of Food grains: The Maturing Period of Green Revolution (1980-81 to 1990-91) (million tons)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total	Pulses	Total Food grains
1980-81	53.63	36.31	29.02	118.96	10.63	129.59
1981-82	53.25	37.45	31.09	121.79	11.51	133.3
1982-83	47.12	42.79	27.75	117.86	11.86	129.52
1983-84	60.1	45.48	33.9	139.41	12.89	152.37
1984-85	58.35	44.07	31.17	133.58	11.96	145.54
1985-86	63.83	47.05	26.2	137.08	13.36	150.44
1986-87	60.56	44.32	26.83	131.71	11.71	143.42
1987-88	56.86	46.17	26.36	129.39	10.96	140.35
1988-89	70.49	54.11	31.47	156.07	13.85	169.92
1989-90	73.57	49.85	34.76	158.18	12.86	171.04
1990-91	74.29	55.14	32.7	162.13	14.26	176.39

Source: Ministry of Agriculture, Government of India

The above table 7 related to production of major food grains production from 1980-81 to 1990-91 indicates that the production of food grains has been increasing from 129.58 (mt) in 1980-81 to 176.39 (mt) in (1990-91). The production of major food grains such as, rice wheat, coarse cereals and pulses has been also increasing from 53.63, 36.31, 29.02, and 10.63 (mt) respectively in 1980-81 to 74.29, 55.14, 32.7 and 14.26 (mt) respectively in 1990-91.

Table: 8 Trends in Area Cultivation : The Maturing Period of Green Revolution (1980-81 to 1990-91) (Million hectares)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total	Pulses	Total Food grains
1980-81	40.15	22.28	41.78	104.21	12.46	126.67
1981-82	40.71	22.14	42.45	105.3	23.84	129.14
1982-83	38.26	23.57	40.43	102.26	22.83	125.09
1983-84	41.24	24.67	41.71	107.62	23.54	131.16
1984-85	41.16	23.56	39.21	103.93	22.74	126.67
1985-86	41.14	23	39.47	103.61	24.42	128.03
1986-87	41.17	23.13	39.74	104.04	23.16	127.2
1987-88	38.81	23.06	36.55	98.42	21.27	119.69
1988-89	41.73	24.11	38.68	104.52	23.15	127.67
1989-90	42.17	23.5	37.68	103.36	23.41	126.77
1990-91	42.69	24.17	36.32	103.18	24.66	127.84

Source: Ministry of Agriculture, Government of India

The above table 8 related to the under the cultivation of major food grains from 1980-81 to 1990-91 clearly indicate that during period area under the cultivation of food grains has been slightly increasing from 126.67 (mh) in 1980-81 to 127.84 (MH) in 1990-91. The area under the cultivation of major food grains cops like as rice, wheat and pulse has been slightly increasing from 40.15, 22.28, and 22.46 (mh) respectively in 1990-91 to 42.69, 24.17, and 24.66 (mh) respectively in 1990-91, except, coarse cereals. The area under the cultivation of coarse cereals has declined from 41.78 (mh) in 1980-81 to 36.32 (mh) in 1990-91.this was mainly due to increase in income, extension of urbanization and changing in consumption pattern.

Table: 9 Trends in Yield of Major Food grains : The Maturing Period of Green Revolution (1980-81 to 1990-91) (kg. /hectares)

	Cereals					
Year	Rice	Wheat	Coarse Cereals	Total	Pulses	Total Food grains
1980-81	1336	1630	695	1142	473	1023
1981-82	1308	1691	733	1157	483	1032
1982-83	1231	1816	685	1151	519	1035
1983-84	1457	1843	813	1296	548	1162
1984-85	1417	1870	795	1285	526	1149
1985-86	1552	2046	664	1323	547	1175
1986-87	1471	1916	675	1266	506	1128
1987-88	1465	2002	721	1315	515	1173
1988-89	1689	2244	814	1493	598	1331
1989-90	1745	2121	922	1530	549	1349
1990-91	1740	2281	900	1571	578	1380

Source: Ministry of Agriculture, Government of India

The above table 9 related to the yield of major food grains from 1980-81 to 1990-91 shows that yield per hectare of food grains in maturing green revolution period. This table clearly indicates that the yield per hectare of food grains has been increasing from 1023 kg in 1980-81 to 1380 kg in 1990-91. The yield per hectare of major food grains such as rice, wheat, coarse cereals and pulses has been increasing from 1336, 1630, 695 and 473 kg. in 1980-81 to 1740, 2281, 900 and 578 kg respectively in 1990-91. The yield per hectare of wheat is also maximum like the green revolution phase.

Table: 10 Ann ual Compound Growth Rate of Major Food gr ains Crops in Pre -Reform Period (1951-52 to 1990-91) (in Percentage)

Crops	1 PHASE (1951-52 to 1965-66)	2 PHASE (1966-67 To 1979-80)	3 PHASE (1980-81-1990-91)
Rice	2.44	2.38	3
Wheat	3.53	7.61	3.87
Coarse cereals	1.92	0.82	1.09
Total cereals	2.42	3.1	2.85
Pulse	1.11	0.18	2.7
Total food grains	2.22	2.82	2.84

Note: Phase I (1951-52 to 1965-66)
Phase II (1966-67 to 1979-80)
Phase III (1980-81 to 1990-91)

The above table 10 deciphers that compound growth rate of major food grains production in three phases of pre economic reforms period.

Table: 11 Area Wise Annual Compound Growth Rate of Major Food grains in Pre - Reform Period (1951-52 to 1990-91) (in Percentage)

Crops	1 PHASE	2 PHASE	3 PHASE
Rice	1.16	0.8	0.55
Wheat	1.9	3.97	0.74
Coarse Cereals	0.88	-0.61	-1.26
Total Cereals	1.11	0.71	-0.99
Pulse	1.28	0.04	6.4
Total Food grains	1.14	0.59	0.08

Note: Phase I (1951-52 to 1965-66)
Phase II (1966-67 to 1979-80)
Phase III (1980-81 to 1990-91)

The above table 11 deciphers that compound growth rate of area under cultivation of major food grains production in three phases of pre economic reforms period (1951-52 to 1990-91).

Table: 12 Yield Wise Annual Compound growth Rate of Major Food grains (in Percentage)

Crops	1 PHASE	2 PHASE	3 PHASE
Rice	1.26	1.57	2.43
Wheat	1.58	3.5	3.1
coarse cereals	1.03	1.44	2.37
total cereals	1.29	1.96	2.94
Pulse	-0.15	0.15	1.83
total food grains	1.07	2.22	2.73

Note: Phase I (1951-52 to 1965-66)
Phase II (1966-67 to 1979-80),
Phase III (1980-81 to 1990-91)

The above table 12 deciphers that compound growth rate of yield of major food grains production in three phases of pre-economic reforms period.

Commodity-wise Compound Growth Rate:

Rice: it can be seen from the table (1) the compound growth rate of rice is stagnant in pre- green revolution, green revolution period. It has increased in the maturing period of green revolution. Table (2) reveals that the compound growth of rice has been declining from 1.16 percent in (1951-52 to 1965-66) to 0.55 percent in (1980-81 to 1990-91). Table (3) depicts that compound growth rate of yield of rice, which has been increasing from 1.26 percent to 2.43 percent in (1990-91). It can be easily shown from the table, the decline in area of rice is offset by increase in yield of rice.

Wheat: Table (1) shows that the compound growth rate of wheat production has increased in pre- green revolution period to green revolution period and declined in period

third. Table (2) reveals the variation in growth rate of area, which increased in pre- green revolution period and declined in third phase. Table (3) reveals that variation in compound growth rate of yield of wheat. It increased in pre- green revolution period to post green revolution period and it declined in period in the maturing period of green revolution. It can show from the table, there is positive relationship among area and production and yield.

Coarse Cereals: table (1) represents variation in compound growth rate of production of coarse cereals. It has declined from pre-green revolution to green revolution period and it increase in the maturing period of green revolution. Table (2) clearly show that the variation in compound growth rate of area of coarse cereals , which is positive in pre- green revolution period after that it decline in green revolution period and the maturing period of green revolution. Table (3) reveals that of yield of coarse cereals. It has been increasing from 1.03 percent in (1951-52) to 2.37 percent in (1990 91). The decline in area of coarse cereals is accompanied by increase in yield.

Total Cereals: table (1) clearly indicate the variation in compound growth rate of production of total cereals. The compound growth rate of production of cereals production increase in pre- green revolution period to green revolution period and it decline in the third phase. Table (2) clearly shows that the variation in compound growth rate of area of total cereals production. The growth rate of area of total cereals has been declining from first to second period and become negative in third period. Table (3) depicts that the yield of total cereals has been increasing from pre-green revolution period to the maturing period of green revolution period.

Pluses: Table (1) clearly indicate that the variation in compound growth rate of production of pulses. The compound growth rate of production of pulses decrease in pre green revolution to green revolution period and it increase in third period. Table (2) clear depicts that the compound growth of area of pulses decline in pre- green revolution to green revolution period and it increase in the maturing period of green revolution. Table (3) shows that the variation in yield of pulses. It is negative in the pre-green revolution and after that it increases from .15 percent in (1966-67 to 1979-80) to 1.83 percent in (1980-81 to 1990-91). It is clearly shown from the table decline in area of pulses is accompanied by increase in yield.

Total Food grains: Table (1) clearly indicates the compound growth rate of production of total food grains. It has been increasing from 2.33 percent in (1951-52 to 1965-66) to 2.84 percent (1980-81 to 1990-91). Table (2) shows that the compound growth of area of total food grains, which decline from 1.14 percent in (1951-52 to 1965-66) to .88 percent in (1980-81 to 1990-91). Table (3) shows that the variation of yield of total food grains. The compound growth rate of yield of total food grains has been increasing from 1.07 percent in (1951-52 to 1965-66) to 2.73 percent in (1980-81 to 1990-91). It is clearly shown from the table the decline in area of total food grains has been offset by increase in yield.

Conclusion

It is clear that the increasing compound growth rate of area and yield have an positive impact on the growth rate of production and the decrease in area is offset by increasing growth of yield. It is also clear from the table that there is only wheat, which has positive compound growth rate in all three period. It means that the success of green revolution was thus limited only to wheat because the government promoted the use of new agricultural strategy in areas, which were more suitable for the cultivation of wheat and areas where assured irrigation facility was available.

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