

Recent Trend in Agricultural Growth: We are Running OR Creeping? Evidences from Past Experiences

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ABSTRACT: *The new Borlaug seed-fertiliser technology introduced in the mid-sixties has major impact on raising yield and output levels of some crops and of aggregate crop output in India and it was confined to wheat in the irrigated northern region of India. But over time, it covered rice and some other crops and its geographical coverage extended from the north region to other parts of the country. The real fact about the increase in aggregate crop output after the introduction of Green Revolution is that the increase in crop output was not only due to the application of seed-fertilizer technology, but it was the area allocation to particular crops like wheat and rice, which boosted the crop output. Though the yield had improved and contributed a lot for increasing crop output after the use of new Borlaug seed-fertilizer technology, but over the year growth rate in yield has come down as it is natural phenomena and there is no scope for increasing acreage. This article is focussing on this crucial component i.e. Growth in Yield and Area under important agricultural crops.*

Key Words: *production, productivity, green revolution, high yielding variety, growth rate*

INTRODUCTION

India accounts for only about 2.4% of the world's geographical area and 4% of its water resources, but has to support about 17% of the world's human population and 15% of the Livestock. Agriculture is an important sector of the Indian economy, accounting for 14% of the nation's GDP, about 11% of its exports, about half of the population still relies on agriculture as its principal source of income and it is a source of raw material for a large number of industries. Accelerating the growth of agriculture production is therefore necessary not only to achieve an overall GDP target of 8 per cent during the 12th Plan and meet the rising demand for food, but also to increase incomes of those dependent on agriculture to ensure inclusiveness. During 2011-12, there was record production of food grains at 259.32 million tonnes, of which 131.27 million tonnes was during Kharif season and 128.05 million tonnes during the Rabi season. Of the total foodgrains production, production of cereals was 242.23 million tonnes and pulses 17.09 million tonnes. As per 2nd advance estimates for 2012-13, total foodgrains production is

estimated at 250.14 million tonnes (124.68 million tonnes during Kharif and 125.47 million tonnes during Rabi seasons). As the data shows that now we had improved our crop production and over the year we had achieved new targets in crop output and this had been possible only due to introduction of Borlaug seed-fertiliser technology. The other side of coin is showing that the increase in crop output is not only the result of Borlaug seed-fertiliser technology, but the shift in area allocation to particular crops had also played an important role in increasing crop output. Because over the year area had shifted from one crop to another crops as the yield is improving.

This article briefly reviews the growth in production, yield and area of crops, especially after Green Revolution, and also presents what could be the way forward, given our objectives of accelerated growth of agriculture.

METHODOLOGY AND SOURCE OF DATA

The study relies on secondary data compiled from various published sources. Data on area, production and yield were collected from the Directorate of

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Economics and Statistics (DES), Ministry of Agriculture. Data were collected for 7 major Foodgrain and Commercial crops of India for the period 1950-51 to 2011-12. Compound annual growth rates have been calculated by using the semi-log method. Data on value of crop output were compiled from the Central Statistical Organisation, Government of India. Since the study covers all major crops grown across major states, a method was devised to identify their relative importance in the cropping pattern. For this purpose, the Crop Concentration Ratio (CCR) defined as the ratio of share of area under a crop in share of area under a crop in the country (Deshpande et al., 2004). The crops with CCR above 0.40 have been identified as major crops and are included in the analysis. The year 1950 has been taken as base year.

CHANGES IN CROPPING PATTERN AND CROP OUTPUT AT NATIONAL LEVEL

The cropping pattern in India has undergone significant changes over time. As the cultivated area remains more or less constant, the increased demand for food because of increase in population and urbanisation puts agricultural land under stress resulting in crop intensification and substitution of food crops with commercial crops. In fact, it is striking to observe that area under food grains in gross cropped area (GCA) declined by 12.02 per cent mainly due to fall in area under coarse cereals by 13.34 per cent between triennium ending (TE) 1970-71 and TE 2007-08 (Table 1). Wheat has gained importance with area allocation of only 10.42 per cent in TE 1970-71, and it steadily increased to 14.18 per cent in TE 2007-08. Area under rice remained more or less constant during the period under study.

Interestingly, area lost by food grains was used for the cultivation of oilseeds, fruits, vegetables and non-food crops to the extent of 4.0 per cent, 2.86 per cent and 7.02 per cent, respectively, between TE 1970-71 and TE 2007-08. Although the shift from coarse cereals to high value crops is likely to increase farm output and income to farmers, in dry land regions it will expose cultivators to serious weather born risks because high value crops have a high water requirement (Bhalla and Singh, 2009).

Increase in area under total oilseeds is not reflective of general rise in area across all oilseed crops, but seemed to be limited only to rapeseed and mustard, sunflower and soybean. Favourable market conditions for refined oil and protein-rich soya food might have been responsible for inducing farmers to allocate larger areas for these crops (Srinivasan, 2005).

Table 1
Share of Area under Major Crops in India
(Percentage of GCA)

Crops	TE	TE	TE	TE	TE
	1970-71	1980-81	1990-91	2000-01	2007-08
Rice	23.02	23.18	23.00	23.82	22.57
Wheat	10.42	12.98	13.04	14.28	14.18
Coarse Cereals	28.48	24.25	20.48	16.17	15.14
Total Cereals	61.93	60.41	56.53	54.27	51.88
Total Pulses	13.50	13.23	12.94	11.49	11.93
Total Food grains	75.54	73.67	69.47	65.32	63.52
Total Oilseeds	9.85	10.11	12.51	12.96	13.93
Groundnut	4.42	4.14	4.64	3.68	3.20
Cotton	4.70	4.27	4.08	4.70	4.68
Jute	0.42	0.51	0.39	0.45	0.41
Total Fibres	5.41	5.08	4.64	5.27	5.18
Sugarcane	1.62	1.62	1.90	2.23	2.47
Tobacco	0.27	0.25	0.22	0.21	0.19
Condiments and Spices	1.04	1.23	1.32	1.52	1.55
Potatoes	0.31	0.43	0.51	0.69	0.76
Onions	-	0.14	0.17	0.24	0.36
Total Fruits & Vegetables	2.24	2.77	3.57	4.35	5.10
Fodder Crops	4.15	4.50	4.59	4.55	4.26
Total Non-Food grains	19.39	20.13	23.60	25.44	26.41
Gross Cropped Area (GCA)	100.00	100.00	100.00	100.00	100.00

Source: Directorate of Economics and Statistics, Government of India

The area under groundnut came down from 4.42 per cent in TE 1970-71 to 3.20 per cent in TE 2007-08. However, the area under commercial crop like cotton almost remained constant at 4.5 per cent and that of sugarcane registered marginal increase from 1.62 per cent in TE 1970-71 to 2.47 per cent in TE 2007-08. It is quite understandable from the above discussion that commercial crops are taking the lead in terms of area share.

GROWTH PERFORMANCE OF MAJOR CROPS AT NATIONAL LEVEL

It is well documented in the literature that growth in area was the major source of production growth until early 1960s (Bhalla and Singh, 2001; Vaidyanathan, 2010). The high yielding varieties introduced in wheat and rice during the late Sixties heralded India's green revolution. Along with technology, new institutional structures enabled the farmers to adopt improved methods of cultivation. The major changes included provision of better irrigation facilities, government procurement system, guaranteed support price and input subsidies. As evident from the Table 3, wheat production registered compound annual growth of 14 per cent during the early green revolution period

(1965-70). Both yield and area contributed to higher growth in production. In the case of rice, growth in yield contributed to production growth of 3.03 per cent per annum. For food grains as a whole, the growth in area and yield were 1.68 per cent and 6.79 per cent, respectively and resulted in production growth of 8.60 per cent.

Performance of Total Food Grain

Table 2
Annual Growth Rates of Production, Yield and Area of Total Food Grain in India

Year	Production	Yield	Area
1950-55	6.92	3.86	2.96
1955-60	4.33	3.16	1.12
1960-65	-1.1	-1.09	-0.006
1965- 70	8.609	6.79	1.685
1970-75	1.35	0.83	0.499
1975-80	0.98	1.06	-0.078
1980-85	3.4	3.28	0.121
1985-90	4.42	4.28	0.135
1990- 95	1.512	2.17	-0.653
9195- 2000	1.85	1.85	0.002
2000-05	0.79	0.68	0.105
2005-11	2.74	2.44	0.295

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

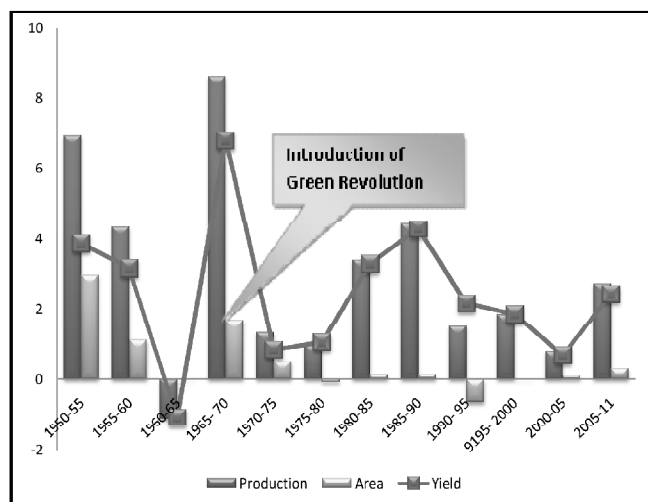


Figure 1: Growth Rates of Production, Yield and Area of Total Food Grain in India

However, it is interesting to observe a relatively higher growth in yield of all major crops during 1980-81 to 1990-95, i.e., the mature green revolution period. It indicates that crops other than rice and wheat shared the technological benefits. With decline in area, impressive growth in production of most crops was mainly contributed by growth in yield.

Table 2
Growth Rates of Production, Yield and Area of Wheat Crop in India

Year	Production	Yield	Area
1950-55	7.62	2.7	5.25
1955-60	2.56	4.02	0.76
1960-65	1.199	-0.43	-0.52
1965- 70	14.03	9.8	8.03
1970-75	1.66	0.59	0.98
1975-80	6.2	2.57	1.89
1980-85	7.21	4.42	1.22
1985-90	3.12	2.75	0.98
1990- 95	4.85	1.85	1.42
9195- 00	3.24	1.68	1.01
2000-05	-1.5	-0.87	0.58
2005-11	3.91	1.98	1.98

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

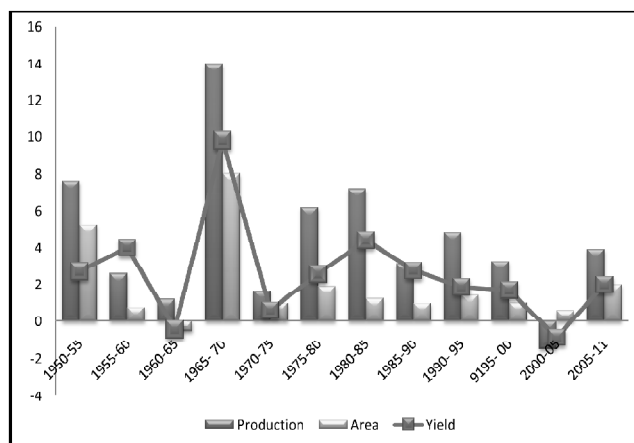


Figure 2: Growth Rates of Production, Yield and Area of Wheat Crop in India

Table 3
Growth Rates of Production, Yield and Area of Rice Crop in India

Year	Production	Yield	Area
1950-55	4	5.25	0.72
1955-60	3.93	2.16	1.62
1960-65	3.52	-1.59	0.94
1965- 70	3.31	5.93	1.45
1970-75	-0.21	0.82	0.86
1975-80	2.48	1.05	0.46
1980-85	5.35	3.36	0.66
1985-90	4.06	3.57	0.95
1990- 95	2.14	1.45	0.13
9195- 2000	2.32	1.3	1.04
2000-05	-1.14	1.55	-0.83
2005-11	0.31	1.47	-0.42

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

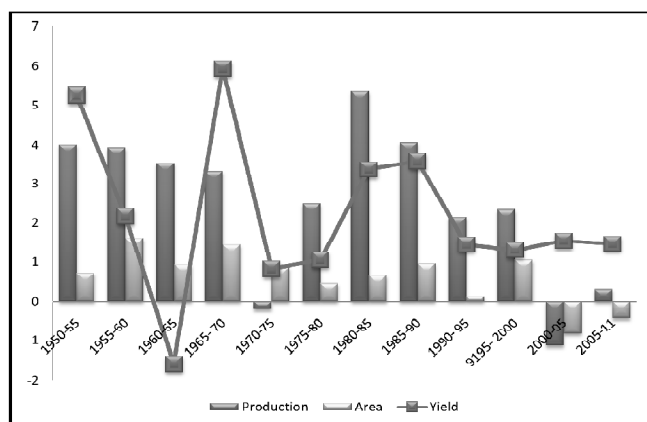


Figure 3: Growth Rates of Production, Yield and Area of Rice Crop in India

Rice registered production and yield growth rate of 5.35 per cent and 3.38 per cent, respectively. Wheat yield also showed splendid growth of 4.42 per cent. Growth in yield of pulses and coarse cereals was appreciable.

Table 4
Growth Rates of Production, Yield and Area of Total Pulses in India

Year	Production	Yield	Area
1950-55	6.59	3.65	4.48
1955-60	2.048	2.14	0.96
1960-65	-1.305	-2.71	0.66
1965- 70	0.06	5.39	-0.33
1970-75	-3.87	-0.88	1.45
1975-80	-2.63	-3.74	-1.46
1980-85	6.72	3.01	0.88
1985-90	1.16	1.93	0.47
1990- 95	0.85	0.62	-1.27
9195- 2000	0.73	0.11	-1.73
2000-05	1.72	1.37	2.06
2005-11	4.76	-1.39	2.87

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

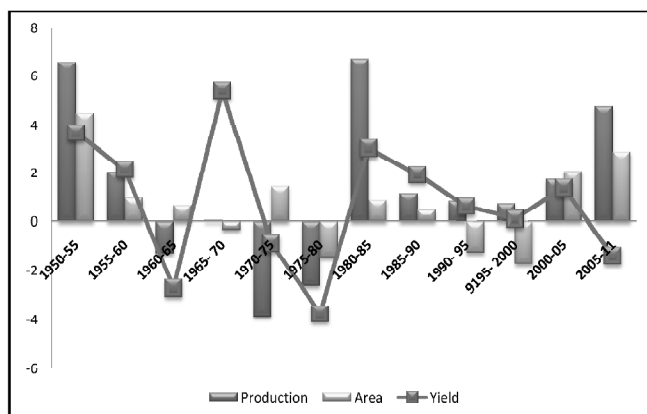


Figure 4: Growth Rates of Production, Yield and Area of Total Pulses in India

However, negative growth was reflected in the decline in area under food grains. Despite this, production of food grains was high at 2.74 per cent, which was contributed by yield growth of 2.44 per cent.

Table 6
Growth Rates of Production, Yield and Area of Coarse Cereals in India

Year	Production	Yield	Area
1950-55	8.71	3.65	3.33
1955-60	1.72	3.35	0.97
1960-65	1.66	-1.43	-0.29
1965- 70	2.99	5.07	0.85
1970-75	-1.28	1.6	-0.51
1975-80	0.57	-0.41	-0.76
1980-85	3.12	0.54	-1.39
1985-90	1.13	7.64	-1.47
1990- 95	-1.68	1.8	-2.74
9195- 2000	0.54	1.19	-1.12
2000-05	2.36	2.76	-0.35
2005-11	3.37	4.23	-1.32

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

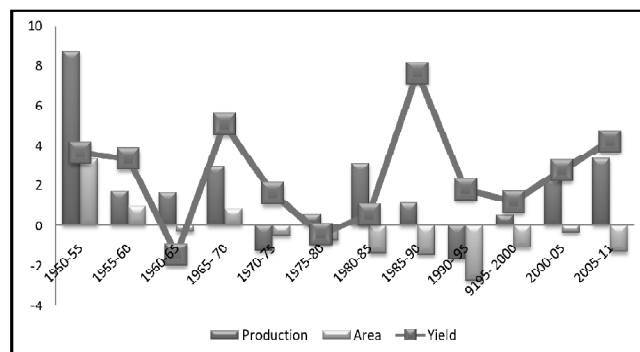


Figure 6: Growth Rates of Production, Yield and Area of Coarse Cereals in India

Table 7
Growth Rate of Area in Major Cereal Crops in India

Year	Wheat	Rice	Total Pulses	Coarse Cereals
1950-55	5.25	0.72	4.48	3.33
1955-60	0.76	1.62	0.96	0.97
1960-65	-0.52	0.94	0.66	-0.29
1965- 70	8.03	1.45	-0.33	0.85
1970-75	0.98	0.86	1.45	-0.51
1975-80	1.89	0.46	-1.46	-0.76
1980-85	1.22	0.66	0.88	-1.39
1985-90	0.98	0.95	0.47	-1.47
1990- 95	1.42	0.13	-1.27	-2.74
9195-2000	1.01	1.04	-1.73	-1.12
2000-05	0.58	-0.83	2.06	-0.35
2005-11	1.98	-0.42	2.87	-1.32

Despite recording almost the same level of growth in yield, the negative growth in area resulted in a fall

in production for coarse cereals. In the case of pulses, the decline in the growth of yield and negative growth in area led to fall in production. Consequently, growth in food grain production declined to 2.7 per cent during 2005-06 to 2011 period when compared to 4.47 per cent in the mature green revolution period i.e. 1985 to 1990 as it is depicted clearly In Table 2. There was slight improvement in production and yield of some crops during 2000-01 to 2005-06 and 2005-06 to 2011-12.

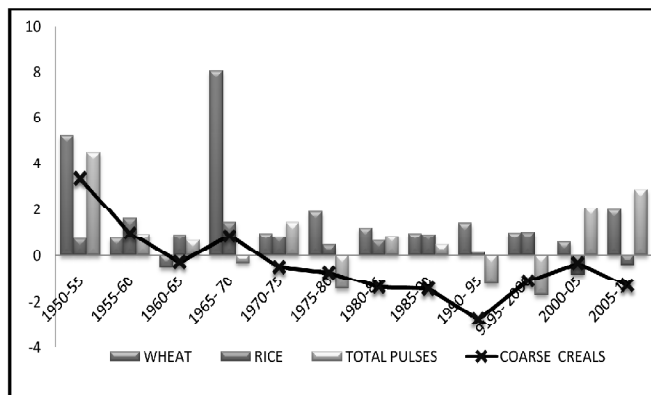


Figure 7 Growth Rate of Area in Major Cereal Crops in India

Oilseeds recorded a growth rate of 13 per cent in production and 7.07 per cent in yield during 1985-86 to 1990-91 as it is depicted in Table 8. This could be attributed to technology emissions on oilseeds launched in mid-1980s, which laid emphasis on increasing productivity of oilseeds and bridging yield gaps between experimental stations and farmers' fields by adopting improved package of practices.

Table 8
Growth Rates of Production, Yield and Area of Total Oilseed crop in India

Year	Production	Yield	Area
1950-55	0.041	1.68	2.269
1955-60	3.544	0.59	2.92
1960-65	0.047	-1.609	1.653
1965-70	7.108	6.181	0.91
1970-75	2.258	1.78	0.45
1975-80	-1.33	-2.22	0.89
1980-85	3.402	2.126	1.26
1985-90	13.009	7.075	5.53
1990-95	3.905	2.82	1.022
1995-2000	-3.502	-0.988	-2.522
2000-05	9.283	4.116	4.94
2005-11	3.522	3.299	-0.117

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

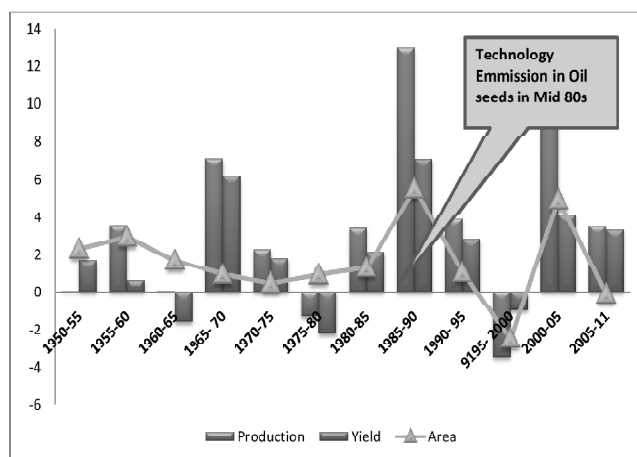


Figure 8: Growth Rates of Production, Yield and Area of Total Oilseed crop in India

Similarly, cotton showed high growth in production by 5.05 per cent, yield by 2.49 and 2.42 per cent in area during the year 1975-1980. The impressive growth in crop production observed during the 1980s was not sustained during the 1990s. Growth in the yield of almost all crops declined during 1990-91 to 1999-00 period. This was, in fact, a disturbing scenario, which resulted in low growth in crop output. However, there was increase in area for rice and wheat during this period. This occurred particularly in North West India where market incentives were in force in terms of price support, assured government procurement for wheat and rice and favourable policy environment for providing inputs to farmers at subsidised rates (Umali-Deiningner *et al.*, 2005).

Table 9
Growth Rates of Production, Yield and Area of Cotton Crop in India

Year	Production	Yield	Area
1950-55	8.08	1.741	6.28
1955-60	1.656	3.415	-1.684
1960-65	-0.11	-1.24	1.2
1965-70	0.024	0.834	-0.906
1970-75	3.783	4.747	-0.802
1975-80	5.05	2.49	2.42
1980-85	3.381	4.827	-1.34
1985-90	7.16	6.024	1.066
1990-95	5.53	2.47	2.97
1995-2000	-5.582	-4.54	-1.07
2000-05	16.27	16.37	-0.1
2005-11	2.8	2.8	5.98

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

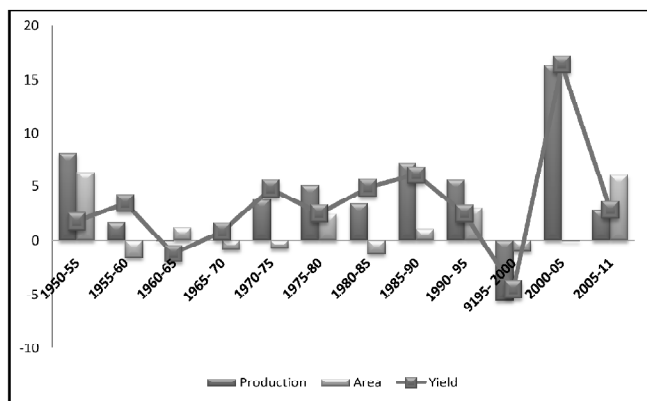


Figure 9 Growth Rates of Production, Yield and Area of Cotton crop in India

Growth in area under sugarcane also increased during this period. Just after the introduction of Green revolution the production of Sugarcane increase at the rate of 4.33 per cent, 3.73 per cent yield and 0.98 per cent in area as it is depicted in Table 10.

Table 10
Growth Rates of Production, Yield and Area of Sugarcane Crop in India

Year	Production	Yield	Area
1950-55	0.041	1.05	-1
1955-60	10.123	5.79	4.117
1960-65	3.49	0.63	2.812
1965- 70	4.33	3.73	0.986
1970-75	3.99	1.176	2.739
1975-80	-0.59	0.774	-1.334
1980-85	0.43	0.372	0.041
1985-90	6.9	2.027	4.792
1990- 95	2.957	1.312	1.63
9195- 2000	1.48	0.725	0.765
2000-05	-3.2	-0.879	-2.37
2005-11	0.01	0.65	-0.83

Source: compiled from Directorate of Economics & Statistics, GoI 2011-12

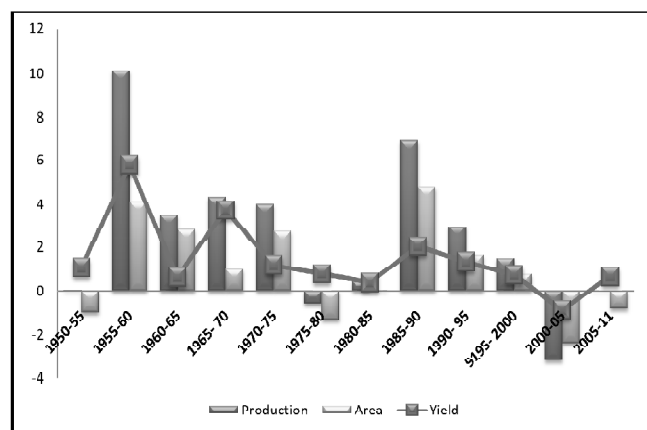


Figure 10: Growth Rates of Production, Yield and Area of Sugarcane crop in India

Likewise other crops, Sugarcane also showed a declining trend in the growth rate of yield and production, it implies that the growth in all most all the major crops of India after 80s or we can say during 90s and present trend are not sustained.

Other crops that showed respectable growth in production were wheat, cotton, coconut, sugarcane and rice. Further, growth in food grain production was 2.74 per cent, which was only a little higher than the annual population growth of 1.64 per cent as per Census 2011. This implies that production of food grains has to be enhanced to achieve long-term food security in the country. It is also discernible from the long term growth that area shifts have been taking place from coarse cereals and pulses towards high value crops like sugarcane, potato and the more remunerative oilseeds and fibres. Policy interventions are required to encourage production of pulses and coarse cereals. Further, crop productivity has to be improved through better soil and water management, profitable crop rotation, innovative marketing and investment in farm education and rural infrastructure. Among these factors, the former two are essential in ensuring sustainability of agricultural production through effective maintenance of soil fertility and controlling pests and diseases. The latter factors are important in making agriculture profitable through efficient marketing, access to and adoption of new technologies and providing incentives for making on-farm investment.

CONCLUSIONS

The present study has discussed the trends and patterns in the growth of the crop sector at the national levels. The cropping pattern in India has undergone significant changes with a significant shift from the cultivation of food grains to commercial crops. The area under coarse cereals, which is generally cultivated in dry regions, has declined by 13.3 per cent between TE 1970-71 and TE 2007-08. The performance of pulses in terms of area and output was not impressive during the study period. Nevertheless, increase in crop yield has been a major factor for accelerating crop production in the country since late 1960s. The use of modern varieties, irrigation and fertilisers were important aspects of higher growth in crop production in the country. However, technological and institutional support for a few crops like rice and wheat have brought significant changes in crop area and output composition in some regions. Rice accounted for only 15.4 per cent of GCA in TE 1962-65 and it increased to 23 per cent in TE 2003-06.

India's Position in World Agriculture

Table 11
Yield Per hectare of Different Crops in Selected Countries- 2010

Continent/Country	Paddy	Wheat	Maize	Total cereals	Total pulses	Potato	Soybean	Coffee Green
Africa								
Algeria	1924	1598	3423	1654	952	25076	N.A.	N.A.
Egypt	10000	6448	7904	7571	3170	27586	3686	N.A.
Morocco	7307	2149	628	1911	562	23810	1000	N.A.
Senegal	3602	N.A.	1553	1135	402	13453	N.A.	N.A.
South Africa	2723	3048	4964	4414	1486	33077	2170	N.A.
Tunisia	N.A.	2059	N.A.	1813	958	15278	N.A.	N.A.
North & Central America								
Canada	NA.	2786	8372	3301	1992	31313	2535	N.A.
Cuba	2612	N.A.	1494	2069	736	22324	N.A.	300
Mexico	4850	4969	3237	3434	995	27737	1868	319
USA	7941	2989	10339	7239	1990	46274	2958	1424
South America								
Argentina	6884	1747	5614	3167	1143	29411	1848	N.A.
Brazil	4405	2080	3715	3533	847	24830	2637	1219
Chile	5376	4081	10496	5472	1429	20510	N.A.	N.A.
Peru	7404	1418	3004	3910	1173	13175	1710	744
Venezuela	5320	293	3733	3695	835	19091	1786	378
Asia								
Bangladesh	4203	2149	5683	4140	871	13337	1466	N.A.
China	6582	4739	5259	5450	1567	14417	1630	1688
India*	3195	2907	2002	2572	694	18814	1027	844
Indonesia	4999	N.A.	4237	4813	1029	16475	1348	714
Iran	4206	2029	7280	2289	584	26674	2468	N.A.
Israel	N.A.	2065	25185	3182	3095	32044	N.A.	N.A.
Japan	6523	3237	2539	5920	1601	31973	1581	N.A.
Korea Dem. Rep.	4105	2262	3390	3513	896	11729	1167	N.A.
Korea Rep. of	7601	3667	5133	7238	1250	30476	1986	N.A.
Myanmar	4085	1884	3554	3949	1114	14112	1500	591

Source: * FAO Regional office of Asia and Pacific Bangkok.

*Agricultural Statistics at a glance, 2012 Directorate of Economics & Statistics, Agriculture Govt. of India.

Similarly, wheat area almost doubled in these periods. The expansion of area under these two crops resulted in a contraction of area under coarse cereals, pulses and oilseeds in that region. Apart from this, the annual growth in yield during 1967-68 to 2011-12 for major crops was worked out to be low. In comparison with the FAO data, yield per hectare of rice in China was 6582 kg/ha and in USA it was 7941 kg/ha against the all-India average of 3195kg/ha. Similarly, the yield of wheat in China was 4739 kg/ha and in USA it was 2989 kg/ha against the all-India average of 2907kg/ha. Similarly for other crops also, we are far below in comparison to China, USA, Japan and Egypt, as it is depicted in Table 11. Hence, there is potential for enhancing yield of major crops through better soil and water management, profitable crop rotation, innovative marketing, genetic engineering and investment in farm education and rural infrastructure.

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