

Economic Liberalisation and Indian Agriculture: A Statewise Analysis

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This study of the performance of agriculture at the state level in India during the post-reform period (1990-93 to 2003-06) and the immediate pre-reform period (1980-83 to 1990-93) shows that the post-reform period has been characterised by deceleration in the growth rate of crop yields as well as total agricultural output in most states. By ending discrimination against tradable agriculture, economic reforms were expected to improve the terms of trade in favour of agriculture and promote its growth. The paper also discusses the cropping pattern changes that have taken place in area allocation as well as in terms of value of output. The slowdown in the process of cropping pattern change means that most government efforts to diversify agriculture have failed to take off.

The initiation of economic reforms in India in 1991 brought about major changes in the macroeconomic policy framework of the planned economy that existed in India during 1950-51 to 1990-91. Although no direct reference was made to agriculture, it was argued that the new macroeconomic policy framework, in particular, changes in exchange and trade policy, devaluation of the currency, gradual dismantling of the industrial licensing system and reduction in industrial protection would benefit tradable agriculture by ending discrimination against it and by turning the terms of trade in its favour. This, in turn, was supposed to promote exports leading to rapid agricultural growth.

But despite these changes in the macroeconomic policy framework and trade liberalisation, the agricultural sector in India neither experienced any significant growth subsequent to the initiation of economic reforms in 1991 nor did it derive the expected benefits from trade liberalisation. As a matter of fact, when compared with the immediate pre-liberalisation period (1980-83 to 1990-93), agricultural growth in India recorded a visible deceleration during the post-liberalisation period (1990-93 to 2003-06). The reasons for this deceleration need to be carefully analysed.

Quite a few researchers have tried to study the impact of economic liberalisation on Indian agriculture at the national level.¹ The present study analyses the impact of economic reforms on the levels and growth of land yields and agricultural output at the state and regional levels. The main components of agricultural output – area growth, yield growth and cropping pattern changes – are also analysed with a view to identifying the chief sources of growth in each period. The relationship, if any, between the levels and growth of agricultural output and the use of modern inputs like irrigation, fertilisers, etc, is also examined.

Cropwise data on area and output of 44 reporting crops² for 17 major states have been obtained from the government of India (GOI) publication.³

For all crops, the triennium averages of area and output have been worked out for all states for 1962-65, 1970-73, 1980-83, 1990-93 and 2003-06. The value of crop output has been obtained by using all-India prices for the triennium ending 1993. Land yield or land productivity has been obtained by dividing the value of crop output as obtained above by the area under 44 crops. Intensity of cultivation is defined as gross cropped area (GCA) divided by net sown area.

Growth rates are annual compound growth rates. For analysis, all states have been clubbed into the following four regions:

(1) The north-western region comprising Haryana, Himachal Pradesh, Jammu and Kashmir (J&K), Punjab and Uttar Pradesh;

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(2) the eastern region comprising Assam, Bihar, Orissa and West Bengal; (3) the central region comprising Gujarat, Madhya Pradesh, Maharashtra and Rajasthan; and (4) the southern region comprising Andhra Pradesh, Karnataka, Kerala and Tamil Nadu.

The article is divided into six sections. Section 1 analyses the growth performance of agricultural output at the state and regional levels during 1962-65 to 2003-06 and three sub-periods, namely, 1962-65 to 1980-83 (the initial period of Green Revolution), from 1980-83 to 1990-93 (maturing of Green Revolution), and the post-reform period from 1990-93 to 2003-06. Section 2 is devoted to a discussion of regional patterns of yield levels and growth. This is followed by a discussion about changes in GCA and its contribution to output growth in Section 3. Section 4 contains a brief discussion of the association between output levels and growth with the level of use of modern agricultural inputs. Section 5 is an analysis of cropping patterns changes over the study period. Finally, Section 6 summarises the paper with some policy suggestions.

1 Growth Rate of Crop Output

The new Borlaug seed-fertiliser technology introduced in the mid-1960s made a major impact on raising yield and output levels of some crops and of aggregate crop output in India. In the beginning, the new technology was confined to wheat in the irrigated north-western region of India. But over time, it covered rice and some other crops and its geographical coverage extended from the north-western region to many other parts of the country. By 2003-06, despite considerable interstate variation, most states in India were able to share the gains of the new technology. The

deepening and extension of new technology led to significant growth of agricultural output.

Taking the entire period from 1962-65 to 2003-06, the total agricultural output (value of 44 crops at 1990-93 constant prices) increased at an annual growth rate of 2.36% (Table 1). During this period, the highest output growth rate, 2.85% per annum (pa), was recorded by the north-western region followed by the central and the southern regions and the lowest growth rate of only 1.76% pa was registered by the highly populated eastern region.

1.1 Initial Period of Green Revolution (1962-65 to 1980-83)

The new seed-fertiliser technology, introduced in the irrigated states in the north-west during the mid-1960s, gradually spread to new areas. During 1962-65 to 1980-83, all the states in the north-western region, in particular Punjab and Haryana, registered high growth rates of agricultural output. In the eastern region, except for Assam, the growth performance of other states was rather modest with Bihar recording a very low growth rate of 0.27% pa. Crop output in the dry rainfed states in the central region was hardly influenced by new technology and agricultural production in that region was characterised by sharp weather-induced year to year fluctuations (Table 1). In the southern region, all states, except Tamil Nadu, were able to register medium growth rates of output.

1.2 Maturing of Green Revolution (1980-83 to 1990-93)

The period from 1980-83 to 1990-93 marks a turning point in India's agricultural development. At the all-India level, the growth rate of crop output accelerated from 2.24% pa during 1962-65 to 1980-83 to 3.37% pa during 1980-83 to 1990-93. An interesting feature of the 1980s was that agricultural growth permeated to all regions in India. In the north-western region, while there took place a slight slowdown of growth in Punjab, during the period 1980-83 to 1990-93, as compared with the earlier period, there was a significant acceleration in the growth rate of output in Haryana and in Uttar Pradesh.

An important development was the acceleration of growth in the eastern region. In West Bengal, the growth rate increased to 5.98% pa during 1980-83 to 1990-93 compared with a growth rate of 1.43% pa during 1962-65 to 1980-83. Bihar and Orissa also recorded an acceleration in their output growth rates during this period, but there was only a marginal increase in output growth rate in Assam.

The acceleration of the growth in the highly populated but hitherto agriculturally stagnant states of eastern India was a development of major significance because rapid agricultural growth in this region is likely to benefit to large workforce dependent on agriculture, thereby making a significant dent on rural poverty.

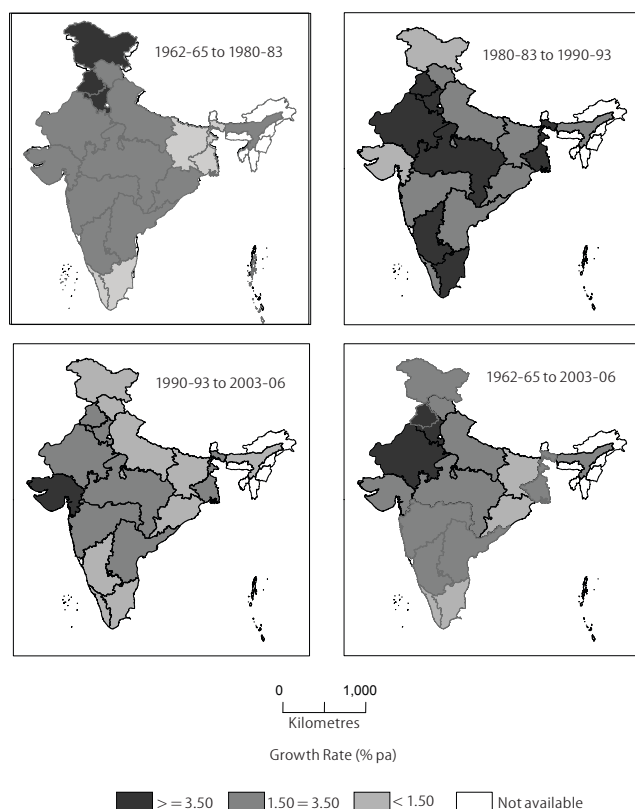
The central region also recorded an accelerated growth during this period although, for individual

Table 1: State and Regionwise Level and Growth of Value Output
(1962-65, 1970-73, 1980-83, 1990-93 and 2003-06) (44 crops)

Sl No	State	Average Value of Output (in Rs Million)					Annual Compound Growth Rate (%)			
		1962-65	1970-73	1980-83	1990-93	2003-06	1980-83/ 1962-65	1990-93/ 1980-83	2003-06/ 1990-93	2003-06/ 1962-65
1	Haryana	16,303	23,445	31,556	51,576	69,278	3.74	5.04	2.30	3.59
2	Himachal Pradesh	2,488	3,233	3,557	4,663	5,315	2.01	2.74	1.01	1.87
3	J and K	2,428	3,690	5,192	5,278	5,772	4.31	0.17	0.69	2.13
4	Punjab	22,079	36,898	58,654	88,635	1,09,510	5.58	4.22	1.64	3.98
5	Uttar Pradesh	93,628	1,14,461	1,50,373	2,03,292	2,43,514	2.67	3.06	1.40	2.36
	North-West Region	1,36,926	1,81,727	2,49,331	3,53,444	4,33,389	3.39	3.55	1.58	2.85
6	Assam	15,039	17,419	22,964	29,154	31,798	2.38	2.42	0.67	1.84
7	Bihar	39,332	42,993	41,276	50,648	52,413	0.27	2.07	0.26	0.70
8	Orissa	24,391	26,389	34,268	45,436	41,660	1.91	2.86	-0.67	1.31
9	West Bengal	32,536	39,230	41,980	75,035	1,02,047	1.43	5.98	2.39	2.83
	Eastern Region	1,11,298	1,26,032	1,40,488	2,00,274	2,27,919	1.30	3.61	1.00	1.76
10	Gujarat	33,174	38,209	51,959	56,842	1,11,692	2.52	0.90	5.33	3.01
11	Madhya Pradesh	48,073	56,214	63,846	99,386	1,37,294	1.59	4.52	2.52	2.59
12	Maharashtra	52,069	38,698	73,149	88,453	1,16,293	1.91	1.92	2.13	1.98
13	Rajasthan	24,153	33,788	38,276	68,932	1,03,960	2.59	6.06	3.21	3.62
	Central Region	1,57,469	1,66,909	2,27,231	3,13,613	4,69,240	2.06	3.27	3.15	2.70
14	Andhra Pradesh	49,878	53,718	76,565	1,06,962	1,34,279	2.41	3.40	1.76	2.44
15	Karnataka	33,176	40,854	51,372	73,573	83,424	2.46	3.66	0.97	2.27
16	Kerala	25,169	34,678	31,651	37,736	33,978	1.28	1.77	-0.80	0.73
17	Tamil Nadu	47,007	58,441	55,208	82,184	67,869	0.90	4.06	-1.46	0.90
	Southern Region	1,55,230	1,87,691	2,14,796	3,00,455	3,19,549	1.82	3.41	0.48	1.78
	All-India	5,65,643	6,66,706	8,43,474	11,74,471	14,69,719	2.24	3.37	1.74	2.36
	Coefficient of Variations (%)						54.19	51.07	118.59	43.95

Source: Calculated from MoA&C (various years).

Figure 1: Statewise Growth of Agricultural Output (44 Major Crops)



states there was a mixed picture. While growth rate accelerated significantly in Rajasthan and Madhya Pradesh, growth rates recorded a sharp deceleration in Gujarat primarily as a result of persistent drought during the late 1980s.

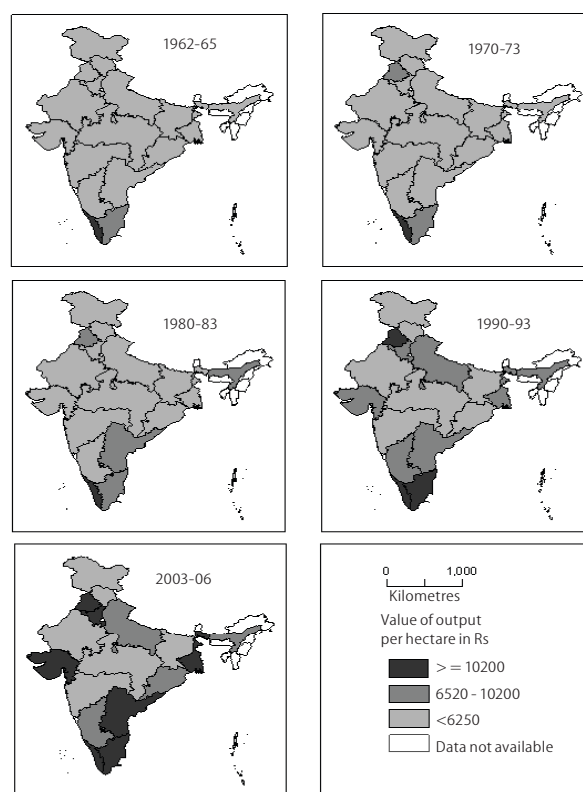
Among the southern states, the growth rate accelerated significantly during this period. But the most interesting development was the unprecedented rate of growth of 4.06% recorded by Tamil Nadu during 1980-83 to 1990-93 compared with a paltry growth rate of 0.90% pa registered during 1962-65 to 1980-83. Whereas Andhra Pradesh and Karnataka recorded a significant acceleration in their growth rates during 1980-83 to 1990-93 compared with the earlier period 1962-65 to 1980-83, Kerala registered only a slight acceleration in its growth rate.

1.3 Post-Liberalisation Period (1990-93 to 2003-06)

Agricultural growth during 1990-93 to 2003-06 reflects the impact of economic reforms on agricultural performance. The most important feature of this period is that agricultural growth decelerated sharply at the all-India level and in all regions. At the all-India level, the output growth decelerated to 1.74% pa during 1990-93 to 2003-06 compared with a growth rate of 3.37% pa during 1980-83 to 1990-93. At the regional level, during the same period, the growth rate of agricultural output decelerated from 3.55% to 1.58% pa in the north-western region, from 3.61% to 1.00% pa in the eastern region, from 3.27% to 3.15% pa in the central region and from 3.41% to only 0.48% pa in the southern region.

All states except Gujarat, and to some extent, Maharashtra registered a sharp decline in their output growth rates in the

Figure 2: Statewise Levels of Agricultural Productivity (44 Major Crops)



post-reform period. Gujarat was an exception because this state registered a very high output growth rate of 5.33% pa during the post-reform period compared with a growth rate of only 0.90% pa during the immediate pre-reform period. This remarkable performance was primarily because of the very rapid spread of Bt cotton in the state during the last triennium (Figure 1).

The main reason for the deceleration of growth during the post-reform period was a visible deceleration in investment in irrigation and other rural infrastructure.

2 Changes in Land Yields (1962-65 to 1980-83)

One of the key contributions to output growth in recent years has been the increases in levels and growth of crop yields. However, during the period 1962-65, prior to the advent of the green revolution at the all-India level, the average yields levels were quite low although there were large regional variations (Figure 2).

Since the levels and growth rates of yields were low, the area growth was the major source of growth of output in India during the pre-green revolution period. For example, during 1949-50 to 1964-65, the contribution of area growth to output growth was 50.16%, while that of yield growth was only 38.41% (DES 2008). The introduction of new technology during the mid-1960s resulted in raising the yield levels of major crops, particularly wheat and rice, thereby making the yield growth the dominant source of growth of output. Thus during 1962 to 2003-06, the yield growth accounted for 85.2% of growth of output, while the contribution of area growth was only 14.41%.

During 1962-65 to 1980-83, the north-western states that had pioneered the green revolution registered significant increases in

Table 2: State and Regionwise Level and Growth of Crop Yield (1962-65, 1970-73, 1980-83, 1990-93 and 2003-06)

Sl No	State	Value of Output (Rs Per Hectare of GCA)					Annual Compound Growth Rate (%)			
		1962-65	1970-73	1980-83	1990-93	2003-06	1980-83/ 1962-65	1990-93/ 1980-83	2003-06/ 1990-93	2003-06/ 1962-65
1	Haryana	3,927	5,090	6,229	9,682	11,569	2.60	4.51	1.38	2.67
2	Himachal Pradesh	3,048	3,734	3,918	5,187	6,176	1.40	2.85	1.35	1.74
3	J and K	2,987	4,481	5,759	5,432	5,985	3.71	-0.58	0.75	1.71
4	Punjab	5,396	7,476	9,708	13,215	15,373	3.32	3.13	1.17	2.59
5	Uttar Pradesh	3,970	4,590	5,805	8,355	9,894	2.13	3.71	1.31	2.25
	North-West Region	4,093	5,025	6,423	9,244	10,958	2.53	3.71	1.32	2.43
6	Assam	5,728	6,241	6,907	7,998	8,989	1.05	1.48	0.90	1.11
7	Bihar	3,680	4,010	4,049	5,278	5,670	0.53	2.69	0.55	1.06
8	Orissa	4,114	4,073	4,375	5,740	6,690	0.34	2.75	1.19	1.19
9	West Bengal	5,075	5,615	5,944	9,507	12,142	0.88	4.81	1.90	2.15
	Eastern Region	4,338	4,671	4,944	6,894	8,314	0.73	3.38	1.45	1.60
10	Gujarat	3,673	4,327	5,693	6,640	11,836	2.47	1.55	4.55	2.90
11	Madhya Pradesh	2,603	2,836	3,070	4,406	5,640	0.92	3.68	1.92	1.90
12	Maharashtra	2,899	2,344	3,795	4,490	5,960	1.51	1.70	2.20	1.77
13	Rajasthan	1,740	2,217	2,335	3,809	5,095	1.65	5.02	2.26	2.65
	Central Region	2,654	2,763	3,464	4,551	6,367	1.49	2.77	2.62	2.16
14	Andhra Pradesh	4,065	4,363	6,276	8,728	11,537	2.44	3.35	2.17	2.58
15	Karnataka	3,208	4,267	4,990	6,342	6,994	2.49	2.43	0.76	1.92
16	Kerala	11,376	12,958	12,334	14,655	13,858	0.45	1.74	-0.43	0.48
17	Tamil Nadu	6,690	7,900	8,756	13,037	13,117	1.51	4.06	0.05	1.66
	Southern Region	4,873	5,873	6,848	9,178	10,244	1.91	2.97	0.85	1.83
	All-India	3,738	4,257	5,090	6,957	8,460	1.73	3.17	1.52	2.01
	Coefficient of Variations (%)	50.13	50.19	42.75	42.59	36.98	57.93	49.87	78.28	35.41

Source: As in Table 1.

the yield levels and growth (Table 2). As compared with a yield growth rate of 1.73% pa at the all-India level, the north-western region recorded a growth rate of 2.53% pa. The growth of yield was 1.91% in the southern region, 1.49% in the central region and only 0.73% pa in the eastern region.

It is also clear that since yield growth rates were the main source of output growth, yield growth rates in various states were highly associated with their output growth rates in all periods (Tables 1 and 2).

2.1 1980-83 to 1990-93

Along with agricultural output, the growth rates of yields accelerated significantly during 1980-83 to 1990-93 as compared with the period 1962-65 to 1980-83 not only at the all-India level, but in most states and regions.

In particular, the eastern region recorded a very high yield growth rate of 3.38% compared with only 0.57% pa achieved during the earlier period. West Bengal achieved an unprecedented yield growth rate of 4.81% pa during 1980-83 to 1990-93. Similarly, during 1980-83 to 1990-93, all the states in the southern region and all the states in the central region, with the exception of Gujarat, recorded an acceleration in their yield growth rates.

2.2 Post-Liberalisation Period

During the post-liberalisation period (1990-93 to 2003-06), the growth rates of both agricultural output and of land yields slowed down as compared with the pre-liberalisation period. At the all-India level, while the output growth rate decelerated to 1.74% pa from 3.37% pa, the yield

growth rate decelerated to 1.52% pa from 3.17% pa in the earlier period.

All regions recorded a deceleration in their yield growth rates of during 1990-93 to 2003-06 compared with 1980-83 to 1990-93 (Table 2). Most of the states also recorded a deceleration in their yield growth rates, the only exception being Gujarat which recorded a high yield growth rate of 4.55% during 1990-93 to 2003-06 compared with a yield growth of 1.55% recorded by it during the previous period. As noted earlier, this was primarily because of the introduction and rapid spread of high value Bt cotton in the state. Gujarat seems to have reaped the benefits of a cotton revolution in the post-reform period.

Since the yield growth rates are now the predominant source of growth of agricultural output, a steep deceleration in the growth rates of yields in most parts of India should be a matter of great concern for the policymakers. A major reason seems to be the decline in public investment in irrigation and non-availability of yield-raising cost-reducing new technology.

The coefficient of variation (cv) of yield levels brings out that over the period 1962-65 to 2003-06, there has been a tendency for regional disparity in yield levels to come down (Table 3 and Figure 2). But despite this decline, it is important to underline that the disparities continue to be very high and are a product of more rigid climatic, structural and institutional factors like variations in rainfall and irrigation, and those in the level of infrastructural and technological investments in various regions.

3 Net Sown Area and GCA (Area under 44 Crops)

3.1 Net Sown Area

In India, there are competing demands on area available for cultivation from increase in rural habitations, forestation, urbanisation and industrialisation. Consequently, net sown area in the country has registered a rapid deceleration in its growth over time.

During 1962-65 to 1980-83, net area sown rose at a rate of 0.15% pa at the all-India level – its growth rate decelerated to 0.11% pa during 1980-83 to 1990-93 and further to -0.05% pa during 1990-93 to 2003-06. All the regions except the central region recorded a deceleration in their net sown area during

Table 3: Regionwise Level and Growth of Net Sown Area (1962-65 to 1980-83, 1980-83 to 1990-93 and 1990-93 to 2003-06) (44 crops)

Regions	Average Net Sown Area (000 Hectares)					Annual Compound Growth Rate (%)			
	1962-65	1970-73	1980-83	1990-93	2003-06	1980-83/ 1962-65	1990-93/ 1980-83	2003-06/ 1990-93	2003-06/ 1962-65
North-West Region	25,860	26,031	26,356	26,306	26,516	0.11	-0.02	0.06	0.06
Eastern Region	22,041	21,687	22,287	21,935	21,262	0.06	-0.16	-0.24	-0.09
Central Region	58,139	60,150	61,918	63,149	63,978	0.35	0.20	0.10	0.23
Southern Region	30,021	29,958	28,877	29,423	27,851	-0.22	0.19	-0.42	-0.18
All-India	1,36,981	1,39,044	1,40,716	1,42,289	1,41,279	0.15	0.11	-0.05	0.08

Source: As in Table 1.

this period. Thus, except for the central region, net sown area has ceased to be a source of growth of agricultural output in most parts of India.

3.2 Total Cropped Area

Notwithstanding the fact that yield growth has become the dominant contributor to growth of output after the advent of green revolution, growth of GCA continues to be an important source of growth of output in some states and regions of India (Table 4).

Table 4: State and Regionwise Level and Growth of Gross Cropped Area (1962-65 to 1980-83, 1980-83 to 1990-93 and 1990-93 to 2003-06) (44 crops)

State	Average Area (000 Hectares)					Annual Compound Growth Rate (%)			
	1962-65	1970-73	1980-83	1990-93	2003-06	1980-83/ 1962-65	1990-93/ 1980-83	2003-06/ 1990-93	2003-06/ 1962-65
1 Haryana	4,151	4,606	5,066	5,327	5,988	1.11	0.50	0.90	0.90
2 Himachal Pradesh	816	866	908	899	861	0.59	-0.10	-0.33	0.13
3 J and K	813	824	902	972	964	0.58	0.75	-0.06	0.42
4 Punjab	4,092	4,935	6,042	6,707	7,124	2.19	1.05	0.46	1.36
5 Uttar Pradesh	23,583	24,937	25,903	24,331	24,612	0.52	-0.62	0.09	0.10
North-West Region	33,455	36,168	38,821	38,236	39,549	0.83	-0.15	0.26	0.41
6 Assam	2,625	2,791	3,325	3,645	3,538	1.32	0.92	-0.23	0.73
7 Bihar	10,689	10,722	10,195	9,597	9,244	-0.26	-0.60	-0.29	-0.35
8 Orissa	5,928	6,480	7,833	7,916	6,227	1.56	0.11	-1.83	0.12
9 West Bengal	6,412	6,987	7,063	7,893	8,405	0.54	1.12	0.48	0.66
Eastern Region	25,655	26,980	28,416	29,050	27,413	0.57	0.22	-0.45	0.16
10 Gujarat	9,032	8,831	9,126	8,561	9,437	0.06	-0.64	0.75	0.11
11 Madhya Pradesh	18,465	19,823	20,799	22,554	24,342	0.66	0.81	0.59	0.68
12 Maharashtra	17,964	16,512	19,277	19,700	19,512	0.39	0.22	-0.07	0.20
13 Rajasthan	13,878	15,240	16,394	18,095	20,406	0.93	0.99	0.93	0.94
Central Region	59,338	60,406	65,596	68,911	73,697	0.56	0.49	0.52	0.53
14 Andhra Pradesh	12,270	12,312	12,199	12,256	11,639	-0.03	0.05	-0.40	-0.13
15 Karnataka	10,343	9,574	10,295	11,602	11,928	-0.03	1.20	0.21	0.35
16 Kerala	2,213	2,676	2,566	2,575	2,452	0.83	0.03	-0.38	0.25
17 Tamil Nadu	7,026	7,398	6,305	6,304	5,174	-0.60	0.00	-1.51	-0.74
Southern Region	31,852	31,960	31,366	32,736	31,193	-0.09	0.43	-0.37	-0.05
All-India	1,51,315	1,56,622	1,65,698	1,68,817	1,73,718	0.51	0.19	0.22	0.34

Source: As in Table 1.

The area under crops can grow either through increases in net area sown or through increases in intensity of cultivation. Since a limit has been reached with regard to the possibility of increasing net sown area on a substantial scale, the only method of increasing GCA is through increased intensity of cultivation brought about through irrigation and through the introduction of short duration crops.

During 1962-65 to 1980-83, cropped area recorded a growth of 0.51% pa at the all-India level. Whereas, its growth rate was 0.83% pa in the north-western region, and 0.57% and 0.56% pa, respectively in the eastern and central regions, the growth rate of cropped area was negative in the southern region. Cropped area registered a rapid growth in Punjab, Haryana and some other north-western states primarily because in addition to some increase in net sown area, the introduction of short duration crops resulted in substantial increases in the intensity of cultivation in these states.

During 1980-83 to 1990-93, there was a deceleration in the growth rate of cropped area to 0.19% compared with 0.51% during 1962-65 to 1980-83. The only states where the growth rate in cropped area was reasonably high were Punjab, Haryana, J and K in the north-western region, Assam and West Bengal in the east,

Madhya Pradesh and Rajasthan in the central region and Karnataka in the southern region.

Finally, during 1990-93 to 2003-06, GCA recorded a paltry growth rate of 0.22% pa, but net sown area actually declined, recording a growth rate of (-) 0.05% pa. During this period, at the regional level, among the north-western states, Punjab and Haryana continued to record a medium growth in GCA, while in the eastern region only West Bengal recorded a medium growth of GCA and in the central region, Gujarat, Madhya Pradesh and

Rajasthan recorded a fairly high growth in their GCA. As growth of net sown area had ceased to be an important factor, most of the increase in GCA at the all-India and state levels was because of increase in cropping intensity (Table 5, p 39).

4 Inputs and Agricultural Output

The essence of the new seed-technology, in fact, is that the new high yield variety (HYV) seeds are highly amenable to the use of modern inputs like fertilisers in irrigated conditions and result in achieving much higher yield levels.

Table 5 brings out the clear association between the levels of land productivity and use of modern inputs. Thus all the high productivity states like Punjab and Haryana in the north-western region, Kerala, Tamil Nadu and Andhra Pradesh in the southern region, West Bengal in the eastern region and Gujarat in the central region had been using large doses of modern inputs during all the periods of the study.

On the other hand, during all periods, the use of modern inputs continued to be at abysmally low in the very low yield states of Rajasthan,

Madhya Pradesh, Maharashtra, and Orissa. Thus, compared with 412 kg per hectare of fertiliser used in Punjab during 2003-06, the use of fertilisers was just 58 kg, 61 kg, 80 kg and 94 kg per hectare in Rajasthan, Orissa, Madhya Pradesh and Maharashtra, respectively (Table 5). This situation holds for other inputs as well.

The role of inputs in raising yields is confirmed by the fairly high correlation between quantum and intensity of inputs used and yield levels across states. For instance, during 2003-06, the "Pearson coefficient of correlation" (r) between state level yields and use of fertilisers, pumpsets and irrigation turned out to be 0.70, 0.69 and 0.50, respectively. Furthermore, the association between the levels of yields and use of inputs has got strengthened overtime. For instance, the correlation between yield levels and pumpsets improved from 0.32 during 1962-65 to 0.69 during 2003-06, that for tractors from 0.14 to 0.40 and for irrigation from 0.31 to 0.50, over the same period.

One also sees an association between the growth rates of output and the use of modern inputs at the all-India level and in various states of India although in the case of output growth the relationship is not as strong as for yield levels. During 1980-83 to 1990-93, when the growth rate of agricultural output accelerated

significantly, at the all-India level, per hectare consumption of fertilisers more than doubled as compared with the period 1962-65 to 1980-83. Again, there was a substantial increase in the percentage of GCA under irrigation from 29% during 1980-83 to 36% during 1990-93.

Finally, the deceleration in the growth rates of output and yield during the post-liberalisation period, as compared with the pre-liberalisation period is also reflected in decelerated growth in the use of almost all inputs. For example, compared with more than 100% growth in fertiliser consumption per hectare during 1980-83 to 1990-93, its growth rate was just 50% over the period 1990-93 to 2003-06. Similarly, pumpsets increased only by 41% in the later period compared with an increase of 61% during the earlier period.

Table 5 also brings out that in India, the inter-state disparity in the use of modern inputs is declining over time. Over the 1962-65 to 2003-06, the coefficient of variations among states declined from 398 to 152 for tractors used, from 733 to 62 for number of tubewells, from 531 to 118 for fertiliser consumption, and from 251 to 88 for irrigation intensity.

One of the important questions that has been raised is whether it is sustainable in the long run to maintain the tempo of agricultural growth through increasingly higher use of costly and heavily subsidised inputs that not only impose a high fiscal burden, but also lead to soil and environmental degradation.

5 Cropping Pattern Changes⁴

In India, area allocation among various crops has shown a measure of structural rigidity that reflects the traditional character of Indian agriculture, wherein foodgrain has remained the predominant crop accounting for two-thirds to three-fourths of the

gross cropped area since the early 1950s. This also reflects the impact of the prevalent demand structure. However, within the foodgrain sector, substantial changes have taken place.

Policymakers in India have been stressing the need for crop diversification to higher value crops as major strategy of agricultural development. This is because, with a rise in per capita income, whereas the demand for foodgrain is likely to grow at a slow rate, that for oilseeds, fibres, sugarcane, livestock and horticulture products is projected to grow at a much faster rate. The planners feel that such diversification not only offers opportunities for raising farm incomes significantly, these are also likely to put less pressure on natural resources.

Most of the foodgrain crops that account for a major share of total cultivated area, in particular coarse cereals, and to some extent, pulses, have remained low yield low value crops for a very long time. The introduction of new seed fertiliser technology during the mid-1960s resulted in substantially raising the yield levels of some of the major foodgrain crops like wheat and rice (Table 6, p 40). This combined with a positive price climate resulted in increasing area allocation to these crops. The new technology was able to impact on the yield levels of non-foodgrain crops like oilseeds, fibre crops, sugar cane and fruit and vegetables after some time lag thereby resulting in significant cropping pattern changes over time.

5.1 Initial Phase of Green Revolution

During the 18 years from 1962-65 to 1980-83, the process of cropping pattern changes was slow and halting. Foodgrains, which accounted for 74.7% of the GCA in 1962-65, still claimed 73.0% of area during 1980-83. Again, the share of foodgrains in the total value of crop output (at 190-93 constant prices) also came

Table 5: Statewise Use of Various Input (1962-65, 1980-83, 1990-93 and 2003-06)

Sr No	States	Tractors (Nos/0000Hc)				Pumpsets (Nos/000Hc)				Fertiliser Consumption (Kg/Hc)				% of Total Cropped Area Irrigated				Cropping Intensisty (%)			
		1962	1982	1992	2003	1962	1982	1992	2003	1962	1980	1990	2003	1962-65	1980-83	1990-93	2003-06	1962-65	1980-83	1990-93	2003-06
1	Haryana	7	170	444	549	2	71	143	155	2	71	175	307	31	62	76	84	131	153	164	181
2	Himachal Pradesh	0	16	45	130	0	3	4	20	1	33	62	87	17	17	18	19	162	166	170	179
3	J and K	2	11	18	70	0	1	5	28	2	36	65	119	36	40	41	41	125	137	146	147
4	Punjab	24	254	508	704	8	158	170	170	8	209	318	412	58	87	95	97	129	158	180	189
5	Uttar Pradesh	5	82	201	397	1	64	132	191	4	75	129	205	27	47	62	70	128	143	148	150
	North-West Region	8	118	274	451	2	77	133	175	4	93	160	245	32	56	67	75	129	147	156	161
6	Assam	3	1	3	5	0	1	2	0	0	5	16	89	20	17	15	5	119	128	142	139
7	Bihar	2	18	19	130	1	47	89	117	3	24	77	108	18	34	43	48	141	133	133	133
8	Orissa	1	2	4	28	0	3	6	19	1	14	33	61	16	22	26	30	121	141	152	150
9	West Bengal	2	3	12	34	1	37	54	119	5	49	136	226	23	25	54	52	118	132	160	176
	Eastern Region	2	8	11	62	1	27	46	76	3	26	74	123	19	27	30	39	128	134	146	149
10	Gujarat	3	29	70	150	9	59	67	92	4	41	75	120	8	23	29	37	105	113	114	114
11	Madhya Pradesh	1	13	24	130	1	22	47	107	1	14	50	80	6	12	21	28	113	116	121	130
12	Maharashtra	1	12	50	60	7	33	66	62	2	27	69	94	7	13	15	17	105	109	117	128
13	Rajasthan	3	35	90	184	1	28	54	88	1	10	30	58	13	21	27	32	107	117	118	126
	Central Region	2	21	55	128	4	32	57	88	2	21	55	86	8	16	22	27	108	114	118	126
14	Andhra Pradesh	2	19	52	85	5	62	101	148	10	56	137	185	29	36	40	39	111	115	120	122
15	Karnataka	2	20	37	60	4	30	58	79	3	37	82	118	9	13	23	25	104	108	115	119
16	Kerala	2	6	9	10	4	45	88	196	15	49	111	98	20	13	12	15	122	132	135	137
17	Tamil Nadu	4	26	52	102	32	211	212	210	12	80	136	153	45	49	48	50	119	119	121	115
	Southern Region	2	20	44	73	10	78	106	137	8	54	116	149	26	29	33	34	111	114	119	121
	All-India	3	37	86	167	5	49	79	111	4	44	91	136	19	29	36	41	115	124	130	135
	Coefficient of variations (%)	398	544	636	152	554	259	128	62	531	347	143	118	251	175	111	88	13	15	18	19

Source: As in Table 1.

down only marginally from 57.6% during 1962-65 to 57.4% during 1980-83.

But a significant diversification took place within the foodgrain segment during 1962-65 to 1980-83. At the all-India level, whereas the area under high yielding wheat increased from 8.6% during 1962-65 to 13.0% of GCA by 1980-83, area under coarse cereals and pulses recorded a notable decline (Table 7, p 41).

The change was most marked in the north-western region where the share of area under wheat increased from 20.1% in 1962-65 to 33.9% in 1980-83 and the share of area under rice to total cropped area in the region increased from 15.4% to 19.0%. On the other hand, the share of area under coarse cereals and pulses registered a sharp decline. The shift from low value coarse cereals and pulses to high value wheat and rice resulted in increasing the share of foodgrains in the total value of output from 62.2% during 1962-65 to 68.74% during 1980-83.

5.2 Maturing of the Green Revolution

The cropping pattern changes became more pronounced during 1980-83 to 1990-93 when a notable acceleration took place in the yield levels and the growth rates of output of many crops across all states and regions of India as compared with the earlier period, 1962-65 to 1980-83.

At the all-India level, the proportion of area under foodgrains which had remained almost unchanged during 1962 to 1980-83, registered a sharp decline from 73.0% of total area in 1980-83 to 67.3% of GCA during 1990-93. It is the first time since 1962 that area under foodgrains declined in absolute terms from 126.97 million hectares during 1980-83 to 124.29 million hectares during 1990-93. The shift away from foodgrains occurred mainly from area under coarse cereals.

During 1980-83 to 1990-93, the main area shift that took place was from coarse cereals towards oilseeds. At all-India level, the

Table 6: All-India Compound Annual Growth Rates of Area, Production and Yield of Major Crops (1962-65 to 2003-06)

Sl No	States	1962-65 to 1980-83			1980-83 to 1990-93			1990-93 to 2003-06			1962-65 to 2003-06		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1	Rice	0.55	1.91	1.36	0.65	3.72	3.05	0.06	1.33	1.27	0.42	2.16	1.74
2	Wheat	2.93	7.33	4.26	0.58	3.73	3.13	0.76	1.73	0.97	1.66	4.63	2.92
3	Coarse cereals	-0.34	1.01	1.35	-1.91	0.77	2.73	-1.11	0.69	1.82	-0.97	0.85	1.84
4	Pulses	-0.25	0.06	0.31	1.41	1.32	-0.09	-1.13	0.49	1.64	-0.13	0.50	0.63
5	Foodgrains	0.42	2.27	1.84	0.01	2.94	2.92	-0.34	1.26	1.60	0.08	2.11	2.03
6	Groundnut	-0.03	0.38	0.41	1.60	2.84	1.21	-1.99	-0.09	1.94	-0.26	0.82	1.09
7	Rapeseed and mustard	1.71	3.53	1.79	1.14	8.72	4.39	0.60	2.54	1.92	1.95	4.45	2.46
8	Nine oil seeds	0.89	1.58	0.69	3.11	5.56	2.38	0.54	2.28	1.73	1.31	2.76	1.43
8	Fibre crops	-0.21	1.27	1.48	-0.61	3.14	3.78	0.60	3.31	2.69	-0.05	2.36	2.42
9	Cotton	-0.13	1.46	1.59	-0.48	3.33	3.82	0.80	3.54	2.72	0.08	2.57	2.49
10	Sugar cane	1.47	2.88	1.39	1.88	3.15	1.25	0.52	0.30	-0.22	1.27	2.12	0.84
11	Plantation crops	2.19	3.99	1.77	1.94	3.82	1.85	2.32	3.14	0.80	2.17	3.68	1.48
12	Condiments and spices	2.25	1.65	-0.57	1.13	3.93	2.77	0.72	4.22	3.47	1.49	3.02	1.50
13	Remaining crops	1.49	2.98	1.46	2.23	6.26	3.94	2.98	2.24	-0.72	2.14	3.53	1.36
Non- foodgrains		0.81	2.21	1.39	0.75	3.98	3.21	1.73	2.36	0.62	1.08	2.69	0.62
All Crops		0.50	2.25	1.73	0.59	3.82	3.21	0.25	1.74	1.48	0.46	2.48	2.01

Source: As in Table 1.

During 1962-65 to 1980-83, the cropping pattern changes in regions other than the north-western regions were not that significant. In the eastern region, the share of area under rice declined and the share of area under wheat and oilseeds increased significantly. In the central region, the share of area under coarse cereals declined during 1962-65 to 1980-83, but the share of area under high value remaining crops increased from 7.7% in 1962-65 to 10.1% in 1980-83. The value share of "remaining crops" went up from 9.8% during 1962-65 to 12.7% during 1980-83. Despite some decline in the share of coarse cereals, it is noteworthy that nearly one-third to one half of the total GCA in the central states is under low value and low yield coarse cereals and pulses.

In the southern region, there was a substantial decline in the share of area under coarse cereals and foodgrains and some increase in the share of area under pulses, cotton, sugar cane, plantations and "remaining crops". As in many states in the central region, Andhra Pradesh and Karnataka in the southern region also had large shares of their area under coarse cereals and pulses. Although rice dominated the cropping pattern in Tamil Nadu, a sizeable proportion (22.4%) of its cropped area was under coarse cereals even by 1980-83.

share of area under coarse cereals in GCA declined rapidly from 23.9% during 1980-83 to 18.6% of during 1990-93. On the other hand, the crop area under oilseeds increased by about eight million hectares and the share of oilseeds in GCA increased from 10.4% in 1980-83 to 13.3% in 1990-93.

During 1980-83 to 1990-93, there was a decline in the share of coarse cereals in all regions. In the central and southern regions, the decline in the share of coarse cereals went to an increase in the share of oilseeds. In the north-western region, the share under coarse cereals declined but the main gainers were rice, wheat and remaining crops.

5.3 Post-Reform Period

The process of diversification in cropping pattern from foodgrains to non-foodgrains which began during 1980-83 to 1990, continued in 1990-93 to 2003-06 albeit at a slower rate and the share of foodgrains in GCA declined from 67.3% in 1990-93 to 63.7% by 2003-06.

The economic reforms initiated during the early 1990s were expected to hasten the process of crop diversification from low value foodgrains to high value non-foodgrain crops. However,

during the post-reform period, the yield growth rates of most of the important crops including wheat and rice, oilseeds, sugar cane decelerated considerably compared with the pre-reform period 1980-83 to 1990-93 (Table 6). Consequently, during the post-reform period, the pace of cropping pattern changes towards higher value crops slowed down as compared with the pre-reform period 1980-83 to 1990-93.

During 1990-93 to 2003-06, like during 1980-83 to 1990-93, the shift has occurred mainly from the area under coarse cereals and from some other crops like pulses. However, unlike the earlier period 1980-83 to 1990-93, when oil seeds were the main gainers, during 1990-93 to 2003-06, although share of oilseeds has also increased marginally, it is the remaining crops which are the biggest beneficiaries. Some other crops like cotton and sugar cane have also marginally increased their share in area during this period. But the share of pulses has declined.

Contrary to the all-India pattern, where share of area under foodgrains has declined sharply, in the north-western region, the share of area under foodgrains has marginally increased (Table 7).

In this region, area shifts away from pulses and coarse cereals gets diverted mainly to wheat and rice.

For example, in Punjab the share of area under foodgrains in total GCA increased from 75.4% in 1990-93 to 78.8% by 2003-06. Because of high yields combined with subsidised inputs and a remunerative price regime, wheat and rice are highly profitable crops in Punjab. Because of this, in Punjab, the share of area under rice increased from 27.3% in 1990-93 to 32.8% by 2003-06. Similarly, the share of wheat increased from 30.8% in 1962-65 to 43.2% by 2003-06.

The rapid increase in the share of rice in the total cropped area in Punjab occurred in spite of an ambitious programme of diversification of area away from paddy launched by the state government during the 1990s. The argument was that the extensive cultivation of highly water-intensive rice had led to depletion of underground water, deterioration in soil fertility and had a highly adverse impact on the ecological balance in the state. Despite the involvement of some of the important

private sector companies, this programme has been able to increase the share of area and value of output of remaining crops only marginally. The programme has failed to bring about any substantial changes in the cropping pattern in the state. Policy-makers need to analyse the main reasons for this failure.

Unlike the north-western region, there took place a steep decline in the area under foodgrains in both the eastern and central regions. In the eastern region, the share of area under foodgrains declined from 76.56% in 1990-93 to 72.3% in 2003-06 and in the central region from 64.0% to 57.9%. The share of area under foodgrains also registered a small decline in the southern region.

In the central region the decline in the share of coarse cereals and foodgrains was compensated by a substantial increase in the share of area under cotton, oilseeds and remaining crops. The most remarkable shift was in Gujarat where area under cotton increased from 10.0% during 1990-93 to as much as 16.2% by 2003-06 (Table 7).

In Tamil Nadu, the share of area under coarse cereals and pulses has gone down, while there is a big increase in the share of

Table 7: State and Regionwise Share of Various Crops in Total Gross Cropped Area (1962-65 to 2003-06) (%)

Region	Triennium	Rice	Wheat	Coarse Cereals	Pulses	All Food-grains	Oil Seeds	Fibres	Cotton	Sugar Cane	Plantation	Cardamom and Spices	Remaining Crops
Punjab	1962-65	5.3	30.8	11.4	16.8	64.3	4.3	10.0	9.8	2.3	0.0	0.5	18.6
	1980-83	18.9	44.1	7.2	4.4	74.6	3.3	10.4	10.3	1.4	0.0	0.2	10.3
	1990-93	27.3	43.4	3.2	1.6	75.4	2.3	9.1	9.1	1.4	0.0	0.0	11.8
	2003-06	32.8	43.2	2.3	0.5	78.8	1.1	6.3	6.3	1.2	0.0	0.1	12.5
North-Western	1962-65	15.4	20.1	23.3	21.1	79.8	12.3	2.5	2.2	4.6	0.0	0.2	0.6
	1980-83	19.0	33.9	16.1	10.8	79.7	10.7	2.9	2.8	4.7	0.0	0.1	1.8
	1990-93	20.9	35.2	11.8	8.9	76.9	6.3	3.0	2.9	5.2	0.0	0.1	8.4
	2003-06	23.0	37.3	9.6	7.2	77.1	4.6	2.5	2.5	5.6	0.1	0.2	9.8
Eastern	1962-65	57.0	2.6	6.7	14.2	80.5	3.0	3.8	0.1	0.9	0.9	0.3	10.6
	1980-83	55.7	7.1	7.2	11.9	81.9	5.5	3.2	0.0	0.8	1.0	0.6	7.0
	1990-93	54.9	7.3	4.5	9.8	76.5	6.3	2.8	0.0	0.7	1.0	0.8	11.9
	2003-06	54.3	8.0	3.7	6.2	72.3	4.5	2.8	0.1	2.2	1.3	1.0	16.1
Gujarat	1962-65	5.4	4.1	32.7	5.0	47.2	23.0	17.2	17.2	0.3	0.0	0.2	12.2
	1980-83	4.5	6.2	26.2	6.0	42.8	23.7	14.2	14.1	0.8	0.0	0.1	18.4
	1990-93	5.3	5.4	20.7	8.5	39.9	26.4	10.0	10.0	1.1	0.0	0.2	22.4
	2003-06	6.0	7.1	14.7	6.9	34.8	26.7	16.2	16.2	1.7	0.0	0.7	19.9
Central	1962-65	10.0	9.1	36.1	15.8	70.9	11.4	9.0	8.8	0.4	0.0	0.6	7.7
	1980-83	9.9	9.9	33.5	16.6	70.0	11.2	7.5	7.4	0.6	0.0	0.6	10.1
	1990-93	9.9	9.3	28.4	16.4	64.0	17.6	6.4	6.3	0.8	0.0	0.6	10.6
	2003-06	9.5	9.6	22.3	16.4	57.9	20.7	7.1	7.0	0.8	0.0	0.8	12.7
Kerala	1962-65	32.6	0.0	0.5	1.8	34.9	1.1	0.3	0.3	0.4	8.7	6.0	48.6
	1980-83	27.7	0.0	0.2	1.1	29.0	0.9	0.2	0.2	0.3	11.9	6.2	51.5
	1990-93	18.0	0.0	0.3	0.8	19.1	0.8	0.3	0.3	0.2	17.7	8.1	53.7
	2003-06	9.7	0.0	0.1	0.1	9.9	0.1	0.1	0.1	0.1	20.4	9.6	59.6
Tamil Nadu	1962-65	36.6	0.0	28.4	5.6	70.6	14.9	5.6	5.5	1.0	0.7	1.6	5.6
	1980-83	33.9	0.0	22.4	9.4	65.8	16.5	3.4	3.4	2.9	1.3	2.2	7.9
	1990-93	29.8	0.0	15.9	11.6	57.3	18.6	3.7	3.7	3.3	1.3	1.7	14.0
	2003-06	37.1	0.0	14.8	9.9	61.8	12.6	2.2	2.2	4.5	1.7	2.1	15.0
Southern	1962-65	23.9	1.0	35.2	9.2	69.4	11.7	5.9	5.5	0.8	1.0	2.0	9.2
	1980-83	23.6	1.0	28.4	10.8	63.9	13.2	5.4	5.0	1.6	1.7	2.6	11.7
	1990-93	21.9	0.6	20.1	11.7	54.4	20.7	4.8	4.5	2.0	2.2	2.5	13.4
	2003-06	21.2	0.8	18.5	13.5	53.9	18.4	4.9	4.7	2.1	2.9	2.6	15.2
All India	1962-65	22.8	8.6	28.0	15.3	74.7	9.8	6.1	5.1	1.5	0.4	0.6	6.9
	1980-83	22.8	13.0	23.9	13.2	73.0	10.4	5.3	4.6	1.8	0.5	0.9	8.2
	1990-93	23.0	13.0	18.6	14.4	68.9	13.3	4.7	4.1	2.0	0.6	0.9	9.6
	2003-06	22.4	13.9	15.5	12.0	63.8	13.8	4.9	4.4	2.1	0.8	1.0	13.6

Source: As in Table 1.

Table 8: State and Regionwise Share of Various Crops in Total Value of Output (1962-65 to 2003-05) (%)

Region	Triennium	Rice	Wheat	Coarse Cereals	Pulses	All Food-grains	Oil Seeds	Fibres	Cotton	Sugar Cane	Plantation	Cardamom and Spices	Remaining Crops
Punjab	1962-65	4.8	24.1	5.8	14.8	49.4	5.6	17.2	17.1	5.9	0.0	2.0	19.9
	1980-83	24.9	42.5	3.4	1.7	72.4	2.2	10.0	10.0	3.6	0.0	0.5	11.2
	1990-93	29.4	39.9	1.4	0.6	71.3	1.9	11.7	11.7	2.8	0.0	0.2	12.3
	2003-06	35.5	38.4	1.1	0.2	75.2	0.7	8.6	8.6	1.9	0.0	0.5	12.9
North-Western	1962-65	12.8	15.3	11.0	23.1	62.2	11.0	4.8	4.6	18.1	0.0	0.7	3.1
	1980-83	19.4	34.4	6.4	8.5	68.7	6.9	4.2	4.2	14.4	0.0	0.5	5.4
	1990-93	21.6	33.5	4.6	5.5	65.1	5.2	4.9	4.9	13.4	0.0	0.2	11.1
	2003-06	23.3	34.2	3.7	3.7	64.8	3.9	4.1	4.1	12.7	0.1	0.9	13.5
Eastern	1962-65	55.8	1.3	3.1	11.1	71.3	2.4	4.2	0.1	3.6	3.9	1.6	13.1
	1980-83	48.4	6.7	3.2	8.5	66.7	5.9	3.6	0.0	3.0	5.2	2.4	13.2
	1990-93	49.4	6.2	2.3	5.6	63.5	5.9	3.0	0.0	2.3	4.3	2.7	18.3
	2003-06	49.5	5.2	2.2	2.9	59.7	3.7	3.2	0.1	1.2	4.4	3.5	24.4
Central	1962-65	13.0	7.4	19.3	15.5	55.1	17.1	11.2	11.1	3.9	0.0	2.8	9.8
	1980-83	11.9	11.5	16.8	14.3	54.5	16.1	8.7	8.6	6.2	0.0	1.8	12.7
	1990-93	10.8	11.3	13.8	12.5	48.3	23.1	6.7	6.7	6.0	0.0	1.8	14.1
	2003-06	8.7	9.9	9.4	10.3	38.3	27.9	10.0	10.0	3.7	0.0	2.7	17.4
Karnataka	1962-65	19.4	0.9	20.9	6.6	47.9	15.8	6.8	6.7	7.6	3.2	3.8	14.9
	1980-83	17.5	1.1	17.7	6.7	43.0	12.1	5.2	5.2	10.7	5.9	3.6	19.5
	1990-93	15.5	0.6	15.0	5.1	36.2	19.3	5.4	5.4	12.4	5.9	3.1	17.6
	2003-06	19.6	0.6	16.9	6.5	43.7	14.8	3.2	3.2	7.9	7.7	4.4	18.3
Kerala	1962-65	17.1	0.0	0.1	0.4	17.7	0.7	0.2	0.2	0.7	5.4	4.2	71.2
	1980-83	15.9	0.0	0.0	0.4	16.3	0.4	0.1	0.1	0.7	11.2	5.4	66.0
	1990-93	10.7	0.0	0.0	0.3	11.0	0.2	0.2	0.2	0.5	16.7	6.1	65.2
	2003-06	7.2	0.0	0.0	0.1	7.3	0.1	0.1	0.1	0.3	36.3	12.1	43.8
Southern	1962-65	29.5	0.2	11.6	3.2	44.5	14.4	3.5	3.3	5.7	2.2	6.3	23.4
	1980-83	29.4	0.3	9.5	3.6	42.8	11.6	3.6	3.5	8.4	4.0	5.8	23.7
	1990-93	26.0	0.1	6.4	3.4	36.0	16.0	4.0	3.9	7.9	4.5	6.1	25.5
	2003-06	25.3	0.2	7.8	4.5	37.8	11.5	4.4	4.3	7.2	7.0	11.7	20.3
All-India	1962-65	26.7	6.0	11.9	13.0	57.6	11.8	6.2	5.2	7.7	1.4	3.0	12.4
	1980-83	25.0	14.2	9.5	8.7	57.4	10.4	5.1	4.5	8.5	1.9	2.7	14.0
	1990-93	24.8	14.1	7.0	6.8	52.7	12.3	4.8	4.3	8.0	1.9	2.7	17.6
	2003-06	23.5	14.1	6.1	5.8	49.6	13.2	5.9	5.4	6.6	2.3	3.7	18.8

Total value of output obtained by inflating the value output of 44 crops to the total GCA.
Source : As in Table 1.

area under rice and the share of foodgrains in total cropped area has gone up (Table 7).

Kerala has a unique cropping pattern, where only 9.9% of the gross cropped area is devoted to foodgrains as against a national average of 63.8%. About 90% of Kerala's area is under high value plantation crops like condiments and spices and remaining crops. Because of the preponderance of high value crops in the state, Kerala along with Punjab has the highest levels of crop productivity in the country (Table 7).

To sum up, in India as a whole, during 1980-83 to 1990-93, there was a big diversion of area under coarse cereals towards oilseeds. Oilseed cultivation got a boost due to favourable prices and the programmes of the Technology Mission on Oil Seeds launched in 1986. Consequently, the area under oil seeds increased rapidly and the share of oilseeds in GCA increased from 10.4% during 1980-83 to 13.3% during 1990-93.

The post-reform period is characterised by a setback to the process of diversification of area from coarse cereals to oil seeds. At the all-India level the share of area under oilseeds increased only marginally from 13.3% in 1990-93 to 13.8% in 2003-06 as compared with an increase from 10.4% during 1980-83 to 13.4% during 1990-93. During 1990-93 to 2003-06, it is only the states

in the central region that have registered a notable increase in their share of area under oilseeds.

The slowdown in diversification towards oilseeds and in oilseeds production comes at a time when the demand for edible oils is increasing very rapidly consequent to rapid rise in per capita incomes in the country. This has resulted in increasing India's dependence on imported edible oils.

But oilseeds in India are unable to compete internationally. Although individual oilseeds like rapeseeds and mustard and groundnut used to have a captive domestic market, this is fast giving way to imported Palmolive oil which is much cheaper. The reduction in custom duties on both refined and crude edible oils in 2008 has tended to cushion the prices in the Indian market, much to the detriment of the interests of oilseeds producers in the central states.

Edible oil import is a typical case where policymakers have to face the problem of a trade-off between better prices for

the producers and low prices for the consumers.

5.4 Relative Crop Shares in Value of Output⁵

Major changes in area allocation to different crops are also reflected in changes in the share of various crops in the total value of output during 1962-65 to 2003-06. As expected, the degree of shifts in value of output is much higher than those for area shifts for high value crops and vice versa for low value crops.

During the earlier period 1962-65 to 1980-83, at the all-India level, the share of foodgrains in the total value of output had remained almost constant at about 57%. However, during 1980-83 to 1990-93, along with a decline in the share of area under foodgrains to GCA from 73.0% to 68.9%, the share of foodgrains in the total value of output declined from 57.4% in 1980-83 to 52.7% in 1990-93. There was also a substantial decline in the share of coarse cereals and pulses in the total value of output.

On the other hand, during 1980-83 to 1990-93, the share of oil seeds in the total value of output increased from 10.4% to 12.3% while that of remaining crops increased from 14% in 1980-83 to 17.6% in 1990-93, and that of condiments and spices, plantation and fibre crops remained almost constant.

5.5 Post-Reform Period

The pattern of declining share of area under, and the value of output of foodgrains in, total GCA and the total value of output continued during the period 1990-93 to 2003-06 also. Thus, while the share of area under foodgrains to total GCA declined from 73.0% during 1990-93 to 68.9% during 2003-06, the share of foodgrains in total value of output declined from 52.7% to 49.6% (Table 8, p 42).

At the all-India level, there was only a marginal increase in the share of oilseeds in total value of output from 12.3% during 1990-93 to 13.2% during 2003-06. It is only in the central region that the share of oilseeds in total value of output has substantially increased during the post-reform period 1990-93 to 2003-06 compared with the earlier period. In the rest of the three regions, the share of oilseeds in the value of output has declined.

Again during this period, there was an increase in the share of fibre crops in the total value of output and some increase in the share of plantation crops, cardamom and spices and remaining crops, but there was a decline in the share of sugar cane in total value of output (Table 8).

Kerala registered a spectacular increase in its share of value of output of plantation crops in total value of output from 16.7% in 1990-93 to 36.3% during 2003-06 (Table 8). As condiments and spices are important export crops, trade liberalisation has created a favourable market situation that induced farmers to increase the area and production of these crops. On the other hand, unrestricted imports of cheap spices (black pepper) from Sri Lanka and some east Asian countries have posed some problems for the cultivators.

Punjab and Karnataka also registered a substantial increase in their share of foodgrains to total value of output during this period. In both these states, the shift to foodgrains has mainly occurred from oil seeds, cotton and sugar cane. Interestingly, as in other states, the share in the total value of remaining crops has also increased in these states during this period (Table 8).

To sum up, there was a significant change in cropping patterns during 1990-93 to 2003-06, both in terms of area allocation and share in total value of output. The most important change was a significant decline in the share of area under coarse cereals and an increase in the share of area under higher value crops brought about because of changes in relative prices and productivity. During 1980-83 to 1990-93, shifts occurred mainly towards oilseeds, and to some extent, towards remaining crops. But during the post-reform period 1990-93 to 2003-06, whereas the diversification of area as well as value of output towards plantation and condiments and spices, and towards remaining crops have continued, the diversification towards oilseeds has slowed down considerably.

However, there is a diversification of area as well as of value of output towards plantation and condiments and spices, and towards remaining crops (that includes other fruit and vegetables). But in the north-western region, despite an ambitious programme of diversification away from rice and foodgrains, the share of rice and total foodgrains in total cropped area has actually increased and the share of foodgrains in total value of output has remained constant. In short, economic reforms and trade liberalisation have failed to hasten the process of diversification in agriculture.

But, despite this slowdown at the all-India level, most of the states in the central region registered an increase in their share of area under as well as value of output of oilseeds as well as cotton. On the face of it, diversification away from coarse cereals to high value oilseeds, cotton and remaining crops should be a desirable development. However, in dryland agriculture, this shift also exposes the cultivators to much greater weather-borne risks. These risks are further exacerbated because of increased vulnerability to world commodity price volatility following trade liberalisation. These risks pose a serious problem for the livelihood of cotton and oilseed farmers.

6 Summary and Conclusion

A state-level analysis of levels and growth of agricultural output during 1962-65 to 2003-06 has brought out the outstanding characteristics of agricultural development in India during the post-green revolution period beginning in the mid-1960s. To begin with, the new technology was instrumental in raising the yield and output levels of wheat and was confined to irrigated states in the north-western region of India. This resulted in raising crop yields and promoting growth of agricultural output in most of the north-western states. The rapid growth of output in these states also resulted in raising agricultural worker productivity in these states. However, the spread of new technology remained confined to irrigated states only.

The new technology matured during the period 1980-83 to 1990-93 when it spread widely to more areas and encompassed more crops. The result was a notable increase in the levels and growth rates of yields and output as well as in agricultural worker productivity in most states and regions of India during 1980-83 to 1990-93.

Thus during 1980-83 to 1990-93, the crop output recorded an unprecedented annual growth rate of 3.40% compared with a growth rate of 2.24% during 1962-65 to 1980-83. Yet another important improvement during 1980-83 to 1990-93 was significant changes in the cropping pattern with a visible increase in crop diversification away from coarse cereals towards more valuable oilseeds crops in the rainfed states of central India, and towards rice and wheat in the north-western and eastern states.

But the post-reform period 1990-93 to 2003-06 is characterised by a serious retrogression both in the matter of levels and growth rates of yield and output in most states and regions and a slowdown in diversification towards oilseeds.

There are different reasons for slowdown of growth of yield and output in different regions. However, the decline in public investment in irrigation and water management, and in scientific research has adversely affected the profitability of farmers in all parts of India.

In the north-western region, it is an excessive use of inputs and a decreasing input use efficiency that has eroded profitability as well as adversely affecting its resource base like water table and soil quality. The decline in public investment in irrigation, water management and flood control has specially affected the resource-poor eastern region.

Although there took place a slowdown in diversification towards oilseeds at the all-India level, the states in the central

region have diversified in favour of cotton and oilseeds as also towards remaining crops, despite weather-induced uncertainties. Although this has helped in raising the output and income levels of resource-poor farmers in these regions, it has also exposed them to much greater weather-borne and price fluctuation risks. These risks are further exacerbated because of increased vulnerability to world commodity price volatility following trade liberalisation. These risks pose a serious problem for the livelihoods of cotton and oilseed farmers driving some of them to utter desperation leading to suicides.

The Indian economy has registered a visible acceleration in its gross domestic product growth rate as well as of per capita income since the initiation of economic reforms in 1991. It should be a matter of great concern for the policymakers that in this optimistic scenario, the agricultural sector should face a deceleration its growth rates of aggregate yield and output and the process of agricultural diversification should slow down. A more serious matter is that agricultural workers who constitute 58% of the total workforce should be facing deceleration in their productivity and income levels as well as distress during the post-reform period.

It is beyond the scope of this article to undertake a comprehensive analysis of the main reasons for the failure of economic

liberalisation to improve the state of agriculture in India. But, it is hoped that the state and regionwise analysis of agricultural growth during the pre- and post-liberalisation period undertaken above would provide a backdrop to scholars and policymakers to undertake an in-depth analysis of the reasons for slowdown in agriculture in the post-reform period.

NOTES

- 1 See, for example, Bhalla (2004); Chand (2002).
- 2 In this study, the statistics for cottonseed have been subsumed under cotton (*kapas*). Hence, the total numbers of crops covered in terms of Economic and Statistical Advisor's (ESA) list are 44.
- 3 MoAC (various issues).
- 4 It may be noted that the discussion in this section is based on the share of area under different crops in the GCA of each state and not in area under 44 crops. The difference between area under 44 crops and the GCA is covered under the head "remaining crops" (Row 13, Table 6).
- 5 Total value output here means the total value of output of the GCA. Total value output = (value output of 44 crops/area under 44 crops)* GCA.

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