

2 Indian agriculture after the Green Revolution

An overview

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1 Introduction

After independence in 1947, Indian agriculture experienced two phases – the successful Green Revolution, which made the nation food grain self-sufficient during 1968–1978, and more significantly, the agrarian crisis after economic liberalization. On the eve of independence, the country was suffering from food shortages, particularly due to poor productivity. The Green Revolution initiated in India in 1964–65 aimed mainly at achieving self-sufficiency in food grains. Initially, the success of the Green Revolution was observed most noticeably in the highly irrigated areas of India, especially in Punjab and Haryana in the northwestern region. The success of the Green Revolution was made possible by the introduction of high-yielding varieties of seeds, increased use of chemical fertilizers, irrigation and other modern farming methods. This crop revolution¹ spread to other regions of the country over time and resulted in a spectacular growth of major cereals like wheat and rice at the expense of coarse grain and pulse crops during the late 1960s and early 1970s (Gulati and Kelley, 1999). However, Indian agriculture faced several problems starting from 1980s in the form of degradation of natural and environmental resources like soil and water, rising cost of cultivation and declining profitability, dwindling of farm productivity and so on. The extreme manifestation of the crisis was a spate of farmers' suicides (Bezbaruah, 2014). Neo-liberal economic reforms which India initiated in 1991 and the new environment after the establishment of the World Trade Organization (WTO) in 1994 brought both new challenges and opportunities for the agriculture sector. While adjusting to such changing circumstances, Indian agriculture has experienced changes in many dimensions.

This chapter gives an overview of the performance of the agriculture sector in India after the Green Revolution. The chapter is organized into eight sections. Section 2 describes the growth performance of the agriculture sector in comparison to the overall economic growth of the country. A discussion on variations in agricultural growth across regions and states is also presented in this section. Section 3 deals with compositional changes within agriculture which have occurred over time. Changes in cropping patterns and the extent of crop diversification

across regions are discussed in section 4. The changes in investment in the agriculture sector over time are described in section 5. Section 6 discusses the cost of cultivation and income from farming. Section 7 analyzes the trend in terms of trade between the agriculture and non-agriculture sectors since the 1950s. The conclusion is in the last section.

2 Growth trends in Indian agriculture

2.1 The trend in overall growth of GDP and agricultural GDP

The Indian economy was growing at around 2 per cent annually immediately after partition. However, after 1950 with the adoption of economic planning, the growth rate of the Indian economy has risen significantly, as shown in Figure 2.1. India’s average annual real GDP growth rate was 6.52 per cent during the post-liberalization period (1991–92 to 2013–14), compared to 4.06 per cent during the pre-liberalization time (1951–52 to 1990–91). During the early phase of the Green Revolution (1967–68 to 1980–81), the average annual growth rate of real GDP was 3.9 per cent, which increased to 5.4 per cent during the period of wider dissemination of the modern agricultural technology (1981–82 to 1990–91). It further rose to 5.7 per cent during the first decade of economic reforms and reached 7.7 per cent during the second decade of reforms. The period 2011–2014 showed a decline in the growth rate compared to previous sub-periods.

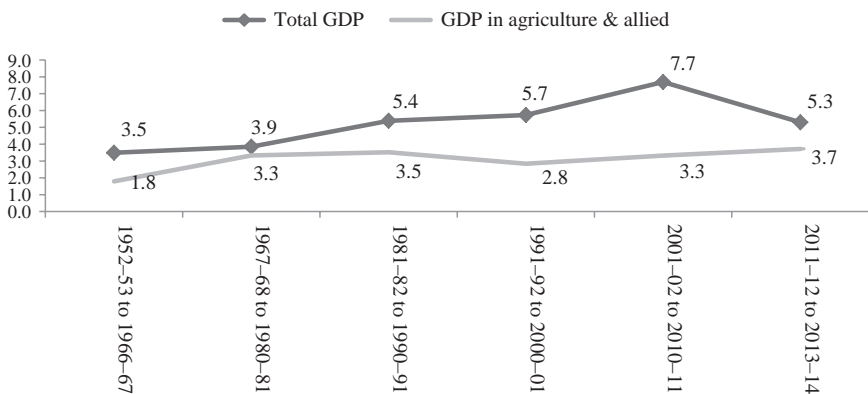


Figure 2.1 Annual growth rate of India’s GDP and GDP from agriculture and allied sectors during 1952–53 to 2013–14 (in %)

Notes: (i) GDP data at factor cost at constant prices of 2004–05. (ii) Growth rate is average of annual growth rates in each sub-period.

Sources: Compiled from the CSO database, October 31, 2014, and Planning Commission, Govt. of India (Databook for PC: 22 December 2014, pp. 10–11).

While the overall growth of the Indian economy has been remarkable, all the sectors did not grow impressively. The growth rate of agriculture was lower than the overall growth rate in every sub-period, as shown in Figure 2.1. Agricultural GDP growth did increase from around 2 per cent in the 1950s to 3.33 per cent during the Green Revolution period (1967–68 to 1980–81) and to an even higher level (3.52 per cent) during the later sub-period. However, since the beginning of economic reforms until 2010–11, the growth rate of agricultural GDP slowed down. The recent sub-period, 2011–2014, showed marginal revival as compared to previous sub-periods, but the rate is still lower than the overall GDP growth rate.

As a consequence of slower growth in agriculture compared to the economy as a whole, the share of agriculture in the country's total GDP has been declining sharply in the post-reform period. At current prices, the share of agriculture and allied sectors in overall GDP was 51.81 per cent in 1950–51 (compared to 14.16 per cent for industry and 33.25 per cent for the services sector). It declined to 29 per cent in 1991–92, and then further to 22 per cent in 2000–01. At 2011–12 prices, composition shares of agriculture and allied sectors, industry and services were 16.11 per cent, 31.37 per cent, and 52.52 per cent, respectively, for the year 2014–15. The fall in the contribution of the agriculture sector to the total GDP of the country would not be a problem had the proportion of people engaged in this sector also declined.² In fact, the decline in the share of workforce engaged in the agriculture sector (cultivators and agricultural labourers) has been much slower than the decline in the sector's contribution to the country's total GDP over time. For example, from 1980–81 to 2010–11, the share of the agricultural sector in the overall GDP declined by 17 percentage points (from 35.39 per cent in 1980–81 to 18.21 per cent in 2010–11); however, the share of the workforce engaged in agriculture as a part of the total main workforce declined by only 13.7 percentage points (from 68.1 per cent in 1981 to 54.6 per cent in 2011). This implies that the average labour productivity in agriculture has remained at a low level, and other sectors of the economy have not been able to absorb labour from agriculture. As per the countrywide "Situation Assessment Survey of Agricultural Households" conducted by the National Sample Survey Office (NSSO) for the 2012–13 crop year, about 58 per cent of rural households in India were engaged in farming activity, which, in turn, contributed only about 60 per cent to their average total monthly incomes (Damodaran, 2014).

2.2 Agricultural growth across regions and states

Agricultural growth performance has varied across different regions of the country over time due to differences in agro-climatic conditions, levels of adoption of modern technology, procurement policies and market conditions. BIRTHAL et al. (2013) analyzed the performance of the crop sector across four regions of the country for the period 1980–2010. They found that while the western and southern regions performed consistently well throughout the period of study, the northern and eastern regions did well during the 1980s and 1990s but poorly during 2000–01 and 2009–10. In the northern region, the annual compound growth rate of the real value of crop output increased from 3 per cent in the

1980s to 3.5 per cent in the 1990s, but then fell to only 1.8 per cent during 2009–10. The corresponding figures for the eastern region are 3.7 per cent in the 1980s, 3.3 per cent in the 1990s and 1.8 per cent during 2000–01 and 2009–10. On the other hand, the annual compound growth rate in real value of crop output in the western region increased from 2.6 per cent in 1980s to 4.4 per cent in 1990s and then further to 5.7 per cent in the subsequent decade, and the corresponding growth rate has been slightly above 3 per cent in the southern region throughout the period of the study. The study further shows that while growth in crop output in the rice-wheat dominated regions, particularly in the northern region, has been technology led, the western and the southern regions depended more on crop diversification as a growth strategy. Price effect also played an important role in the northern and eastern regions.

Sawant and Achuthan (1995) examined the growth trend of agricultural GDP for 15 major states. They found that all states (except Andhra Pradesh, Maharashtra and Gujarat) exhibited an acceleration of agricultural GSDP from period I (1968–69 to 1981–82) to period II (1981–82 to 1990–91). In terms of food grain production, three southern states (Andhra Pradesh, Karnataka and Kerala) and two western states (Gujarat and Maharashtra) recorded a deceleration in growth rate of food grain production from period I to period II. For the post-reform period, Mathur et al. (2006) estimated the growth rate of the value of food grain production instead of quantity of production at 1993–94 prices. They found that many states performed well, but states like Madhya Pradesh, Tamil Nadu, Gujarat, Karnataka and Maharashtra recorded negative growth during the study period. Chand and Parappurathu (2012) compared the growth rate of agricultural net state domestic product from 1999–2000 to 2008–09 at 2004–05 prices. They found that Gujarat made remarkable progress in the 10-year period, particularly after 2002–03. Other states that registered more than 4 per cent growth rates are Chhattisgarh, Andhra Pradesh, Maharashtra, Rajasthan and Madhya Pradesh. States like Gujarat, Maharashtra and Andhra Pradesh, which recorded a deceleration in food grain output and in the share of agriculture in net state domestic product, performed really well, particularly after 2003–04.

An important feature of the post-2000 growth pattern in the agricultural sector is that the growth of production has been faster in moderately and even in relatively low-irrigated states such as Madhya Pradesh, Bihar, Odisha, Andhra Pradesh, Maharashtra, Gujarat and Assam than in the highly irrigated states of Punjab, Uttar Pradesh and West Bengal. As a result, there has been a regional diversification of total agricultural production in the country (Bezbaruah, 2014 and 12th Five Year Plan document, vol. 2, Government of India, 2013).

3 Compositional change in agriculture

3.1 Performance of the constituting sub-sectors of agriculture

Broadly, the agriculture sector includes sub-sectors of crops, livestock, forestry and fisheries. In Indian agriculture sector, crops have dominated in terms of the

income share as compared to other sub-sectors. However, the share of crops in agricultural income has been declining over the period, particularly after 1990-91 (Figure 2.2). On the other hand, the combined share of incomes from livestock, forestry and fisheries has been increasing. For example, the share of income from crops in total income from the agriculture sector was 75 per cent during the triennium ending (TE) 1990-91 but declined to 65 per cent during the TE 2002-03. On the other hand, the share of income from livestock increased from 17 per cent to 25 per cent, an increase of 8 percentage points during the same period. Such a change in composition has implications for patterns of resource requirements in future growth. These sub-sectors are complementary to each other; the growth of one may help the other and vice versa. For example, growth in the livestock sector may require less land and irrigation directly per unit of GDP contribution as compared to conventional crops. But, growth in the livestock sector will require the cultivation of more fodder crops.

Livestock and fishing also recorded higher growth rates over time since the Green Revolution period as compared to all crops in terms of value of output (Table 2.1). For example, the values of output of livestock and fishing increased from 3.3 per cent and 3.1 per cent during the Green Revolution to 4.8 per cent and 3.6 per cent respectively during the 11th plan period. The value of all crops together grew from 3 per cent to 3.4 per cent during the same period. Within all crops, the output value of horticulture crops has been growing at a faster rate than non-horticulture crops after the liberalization period.

3.2 Changes within the crop sector: food grains vs. non-food grain

Crops can be classified broadly into food grains (like rice, maize, bajra and other cereal crops, and pulses) and non-food grains (like oil seeds, fibre crops of cotton

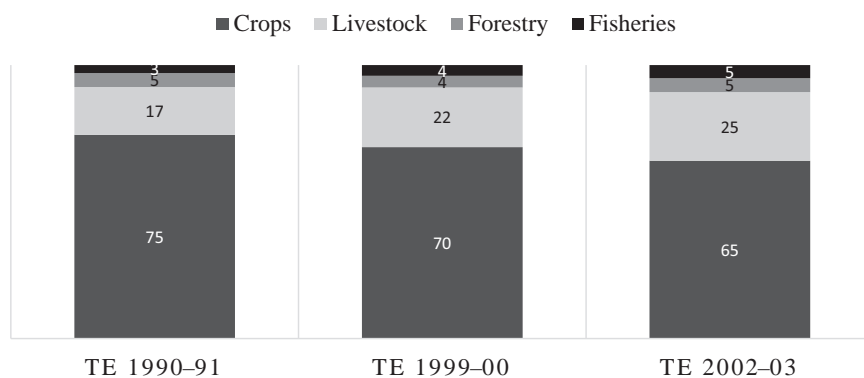


Figure 2.2 Shares of different sub-sectors in total income from agriculture in India (at current prices)

Source: Compiled from Singh et al. (2006)

Table 2.1 Growth of values of outputs of different sub-sectors within agriculture in India (at 2004–05 prices)

<i>Sub-sectors</i>	<i>Pre-Green Revolution</i>	<i>Green Revolution</i>	<i>Wider coverage</i>	<i>Early Liberalization</i>	<i>9th Plan</i>	<i>10th Plan</i>	<i>11th Plan</i>
	1951–52 to 1967–68	1968–69 to 1980–81	1981–82 to 1990–91	1991–92 to 2001–02	1997–98 to 2001–02	2002–03 to 2006–07	2007–08 to 2011–12
Non-horticulture crops	3.2	2.7	3.0	2.1	1.7	2.1	2.8
Horticulture crops	2.6	4.2	3.1	5.7	3.8	2.6	4.7
All Crops	3.0	3.0	3.0	3.1	2.3	2.1	3.4
Livestock	1.0	3.3	4.8	4.0	3.6	3.6	4.8
Fishing	4.7	3.1	5.7	7.1	2.7	3.3	3.6
Forestry	1.7	-0.2	0.3	0.3	2.7	1.3	2.3

Note: Growth rates are averages of annual growth rates in respective periods

Source: Compiled from the 12th Five Year Plan (2012–17), Economic Sectors, vol. 2. Planning Commission, Government of India, 2013.

and jute, plantation crops of tea and rubber, etc.). Several studies have examined the growth of the crop sector in India. Sawant and Achuthan (1995) found that growth in production of non-food grains (2.41 per cent) was marginally higher than that of food grains (2.21 per cent) during 1967–68 to 1981–82. Further, the output growth in non-food grain (4.30 per cent) was higher than that of food grain (2.92 per cent) during the second phase of the Green Revolution period (i.e., 1981–82 to 1991–92). Mathur et al. (2006) estimated that the growth rate of the real value of food grains was negative at –3 per cent during the 1990s and –5 per cent during 1999 to 2002–03. Deokar and Shetty (2014) also estimated that during the post-reform period of 1995–96 to 2004–05, the production of total food grain grew at a low rate of 0.92 per cent and area under food grains production experienced a negative growth rate (–0.24 per cent). Balakrishnan (2000) found that growth rates of both food grains and non-food grains came down from 3.54 per cent and 4.84 per cent, respectively, during the 1980s to 1.66 per cent and 2.36 per cent, respectively, during the 1990s. Studies (Bhalla and Singh, 2009; Vaidyanathan, 2010) attributed the slowdown in the 1990s and early 2000s to a number of factors, such as technology fatigue, low public investment in research and developmental activities, gradual breakdown of extension networks and so on.

Since 2004–05 onwards, however, the growth rate of food grain production experienced a slight acceleration. During the eight-year period from 2004–05 to 2013–14, the growth rate of total food grain output was 3.43 per cent, which was mainly contributed by yield growth. The revival in food grain production from 2005–06 onwards is due to the high growth in low-irrigation areas rather than in high-irrigation and high-productivity areas (Deokar and Shetty, 2014). The recovery after 2004–05 onwards is also attributed to new initiatives by the government in the form of Rashtriya Krishi Vikas Yojana (2007), National Food Security Mission (2007) and a special emphasis on certified seed production.

It may be mentioned in this context that the importance of various sources of growth in the crop sector has changed over time. Improvement in yield was the main source of growth in the crop sector in the 1980s. In the 1990s, the importance of yield fell, and diversification towards high-value crops became as important a source of growth as yield. Price also became an important source of growth. In the subsequent decade, notwithstanding a marginal decline in its contribution to the growth of crop output, diversification continued to be an important source. The contribution of yield, however, improved. Interestingly, area expansion also appeared to be an important source of growth in the crop output in this period (Birthal et al., 2013).

4 Changes in cropping pattern and crop diversification

The term ‘cropping pattern’ is generally defined as the share of various crops in the gross cropped area of a region at a particular point of time, usually one year. Table 2.2 shows the cropping pattern of India for the triennium ending (TE) average figures of areas under various crops during 1960–2013.

Table 2.2 Cropping pattern in India during 1960–2013 (% of gross cropped area)

<i>Crop/Groups</i>	<i>TE 1960–61</i>	<i>TE 1970–71</i>	<i>TE 1980–81</i>	<i>TE 1990–91</i>	<i>TE 2000–01</i>	<i>TE 2007–08</i>	<i>TE 2012–13</i>
Rice	22.33	23.02	23.18	23.00	23.82	22.57	21.99
Wheat	8.50	10.42	12.98	13.04	14.28	14.18	15.69
Coarse cereals	26.35	28.48	25.25	20.48	16.17	15.14	13.00
Total cereals	61.10	61.93	60.41	56.53	54.27	51.88	50.62
Total pulses	15.60	13.50	13.23	12.94	11.49	11.93	11.30
Total food grains	76.70	75.54	73.67	69.47	65.32	63.52	61.91
Total oil seeds	8.30	9.85	10.11	12.51	12.96	13.93	14.97
Groundnut	3.30	4.42	4.14	4.64	3.68	3.20	2.71
Cotton	4.30	4.70	4.27	4.08	4.70	4.68	6.11
Jute	0.40	0.42	0.51	0.39	0.45	0.41	0.40
Total fibres	5.10	5.41	5.08	4.64	5.27	5.18	6.58
Sugarcane	1.30	1.62	1.62	1.90	2.23	2.47	2.80
Tobacco	0.30	0.27	0.25	0.22	0.21	0.19	0.22
Condiments/Spices	0.90	1.04	1.23	1.32	1.52	1.55	1.70
Potatoes	–	0.31	0.43	0.51	0.69	0.76	0.85
Onions	–	–	0.14	0.17	0.24	0.36	0.28
Total fruits	2.12	2.24	2.77	3.57	4.35	5.10	5.05
Fodder crops	4.11	4.15	4.50	4.59	4.55	4.26	4.73
Total non-food grains	19.19	19.39	20.13	23.60	25.44	26.41	28.41
Gross cropped area	100	100	100	100	100	100	100

Notes: Figures are calculated by taking triennium ending (TE) average and gross cropped area.

Source: Compiled from Singh et al. (2006) and Ministry of Agriculture and Farmers Welfare, and Directorate of Economics and Statistics, Government of India (<http://data.gov.in>)

The cropping pattern in the post-Green Revolution period in India witnessed two significant changes. First, the cropping pattern changed in favour of non-food grains at the cost of food grain crops. The acreage share of non-food grains has been continuously increasing, from about 19 per cent of gross cropped area (GCA) during the 1960s to about 28 per cent during TE 2012–13. But total food grain has been witnessing a declining share of acreage over the years, from about 77 per cent of the GCA during the pre-Green Revolution period to about 62 per cent in the recent period. Second, rice, the dominant crop in India, has had almost constant acreage share at around 22 per cent of GCA. But, high-value non-food grain crops like oil seeds, spices and fruits showed increasing acreage shares, particularly in the period after 1990–91. The increase in area shares of non-food grains came mainly from the decline in area shares of coarse cereals and total pulses.

Demand side factors played an important role in the observed changes in crop mix. The change in the production mix is consistent with the change in the consumption basket. The per person consumption of food grains fell from 179 kg/year in 1983 to 141 kg/year in 2009–10. During the same period, the per capita consumption of fruits and vegetables increased from 51 kg/year to 62 kg/year. The consumption of edible oils also increased significantly during this time. Supply-side factors such as improvements in roads, modes of transportation, communication, and electricity complemented the demand-driven growth in the horticultural crops sector (Birthal et al., 2013).

Among food grains, wheat is the only crop which showed a consistently increasing area share over the years, from 10.42 per cent in TE 1970–71 to about 13 per cent in 1990–91 and further to about 16 per cent in 2012–13. The increase in area under wheat can be attributed to (i) area expansion in the 1990s in states like Madhya Pradesh, which is not traditionally a wheat growing state, (ii) assured procurement through a public distribution system and (iii) increase in the minimum support price (Birthal et al., 2013).

Among non-food grains, the increase in acreage share has been more noticeable in total oil seeds than in other crop groups, like total fibres, total fruits, total fodder and vegetables. The increase in the acreage share of oil seeds is due to the conscious efforts of the government to increase their production by providing favourable incentive and protection structures. The government of India launched the Technology Mission on Oilseeds in 1986 to increase the production of oilseeds. In 2004, another programme, the Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize, was introduced in order to increase production further. At the same time, the area shares under total fruits increased consistently, from around 2 per cent in TE 1970–71 to 5 per cent in TE 2012–13. Both domestic and export demand contributed to the increase in area under fruits.

The regional variations in the cropping patterns in India are shown in Table 2.3. As evident from Table 2.3, the acreage share of non-food grains has increased over the years in all the regions. The cropping pattern is still dominated by cereals and food grains throughout the country. Given this broad national trend, the experiences in different parts of the country show some variations in

Table 2.3 Changes in cropping patterns across India: regional variations (1968–2005)

<i>Region</i>	<i>Year</i>	<i>Cereals</i>	<i>Pulses</i>	<i>Food grains</i>	<i>Oil seeds</i>	<i>Fibres</i>	<i>Condiments and Spices</i>	<i>Others</i>	<i>Non-food grains</i>
Eastern	1968	78.72	12.59	91.30	3.23	2.51	0.34	2.61	8.70
	1980	75.05	12.83	87.89	5.07	3.73	0.71	2.60	12.11
	1990	73.98	11.95	85.83	7.33	2.95	0.88	3.01	14.17
	2000	79.65	6.90	86.55	5.38	3.84	0.85	3.38	13.45
	2005	79.01	7.07	86.08	5.54	3.60	1.06	3.72	13.92
Northern	1968	68.26	15.19	83.46	4.94	7.31	0.26	4.02	16.54
	1980	72.37	10.75	83.12	5.26	9.13	0.22	2.27	16.88
	1990	74.87	7.45	82.32	5.09	10.07	0.08	2.44	17.68
	2000	83.12	1.76	84.87	4.03	8.22	0.05	2.82	15.13
	2005	80.41	1.73	82.14	6.33	8.85	0.14	2.55	17.86
Western	1968	59.98	9.72	74.64	12.03	11.94	0.53	0.86	25.36
	1980	58.14	11.02	73.64	13.13	11.20	0.73	1.30	26.36
	1990	52.17	12.88	69.42	18.94	9.12	0.78	1.75	30.58
	2000	50.07	15.47	65.54	18.75	12.35	0.78	2.58	34.46
	2005	44.93	15.99	60.92	24.94	11.03	0.66	2.45	39.08
Central	1968	63.82	18.29	82.10	12.41	1.92	0.13	3.44	17.90
	1980	66.07	15.94	82.00	12.36	1.55	0.27	3.82	18.00
	1990	63.59	16.82	80.41	12.88	1.38	0.38	4.94	19.59
	2000	60.15	15.13	75.28	16.85	1.26	0.47	6.13	24.72
	2005	58.18	16.86	75.03	16.15	1.52	0.60	6.70	24.97
South	1968	66.16	9.58	75.77	13.11	6.08	1.65	3.39	24.23
	1980	60.31	12.54	72.85	14.21	6.23	2.93	3.78	27.15
	1990	50.95	13.93	64.88	22.75	5.41	2.82	4.14	35.12
	2000	50.08	15.87	65.96	18.60	6.29	3.45	5.71	34.04
	2005	48.76	14.89	63.65	22.50	5.70	2.83	5.32	36.35

Source: Calculated from state-level data compiled by the Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

the rates and patterns of crop composition changes. The eastern and northern regions still have around four-fifths of their total cropped area under cereals. In fact, there has been a 12 per cent increase in the acreage share of cereals in the northern zone, from around 68 per cent in 1968 to 80 per cent in 2005. This region comprises the two major beneficiaries of the Green Revolution, namely Punjab and Haryana. Likewise, the share of cereals in the eastern zone decreased from around 79 per cent in 1968 to 74 per cent in 1990 before rising to 79.65 per cent in 2000 and eventually falling slightly to 79.01 per cent in 2005. In the rest of the regions there has been a significant shift in the cropping patterns from cereals to non-cereals.

The changes in the cropping pattern in a particular region over time may lead to either concentration around a few crops or diversification across a larger number of crops, depending on the nature of such changes. The two major sources of growth in agriculture, area expansion and productivity growth, which served well in the past, are now plagued with some limitations. Therefore, a third alternative which may prove to be very useful in this context, at least in the short run, is to move towards diversification, particularly into high-value crops (Mandal, 2011). Moreover, Indian agriculture is characterized by risk and uncertainty, as more than two-thirds of the cultivable land is dependent on monsoon rains (Gopalappa, 1996). The farmers are often the victims of natural and market-induced risk. A diversified cropping pattern can be a useful strategy for the farmers to cope with the risk and uncertainty associated with agriculture (Shiyani and Pandya, 1998; Kumar et al., 2002). In fact, as held by Mandal (2014), farmers on

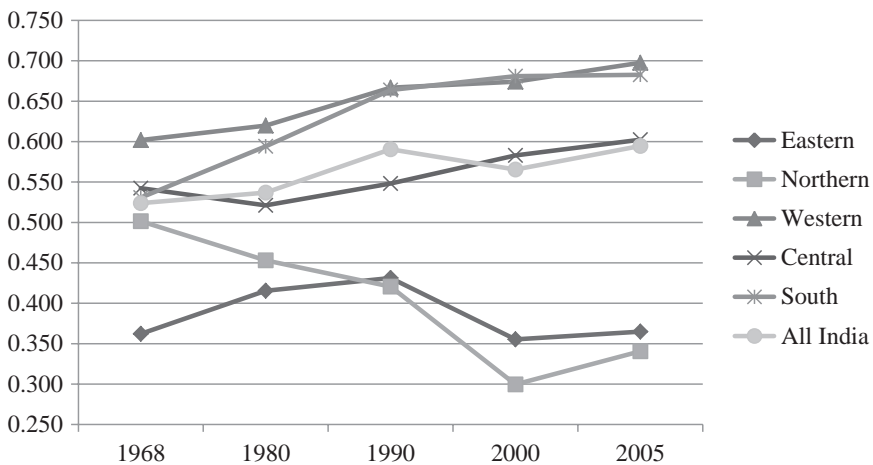


Figure 2.3 Cropping pattern diversification in India: regional variations

Note: Herfindahl index has been used. The index is computed as the sum of the squares of acreage shares of different crops in the total cropped area. The Herfindahl index is, in fact, a measure of concentration. Hence it is transformed into a diversification index by subtracting it from 1.

Source: Table 2.3.

many occasions try to cope with price and production risks in their own capacities by making adjustments in the cropping patterns across crops as well as seasons, especially when they do not have any other ex-ante coping mechanisms, like crop insurance and contract farming.

The broad cropping patterns, along with changes in and across the country (as shown in Table 2.3), have been summarized in an index of crop diversification. Figure 2.3 shows the dynamics of cropping pattern diversification in India along with its regional patterns. It is interesting to note that the northern region, which includes Punjab and Haryana, the major beneficiaries of Green Revolution, has experienced a sharp increase in concentration in their cropping pattern towards cereals (see Table 2.3). The eastern zone diversified its cropping pattern until 1990 and thereafter has concentrated towards cereals. This concentration may be attributable to the government policy of intensifying application of Green Revolution technology in the eastern region to enhance production of rice. In sharp contrast, all other regions and India as a whole have diversified their cropping pattern away from cereals toward high-value commodities.

5 Trends in agricultural investment

Investment is a key driver of growth in any sector or in the whole economy. The fixed capital formation in agriculture is considered to be more effective in enhancing agricultural output than subsidies because investment has a longer term and sustained impact on agricultural growth rate while subsidies are effective only in the short run (Mathur et al., 2006). The gross capital formation (GCF) broadly includes spending on land improvements (like fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, canals, railways, private residential dwellings, and commercial and industrial buildings.³

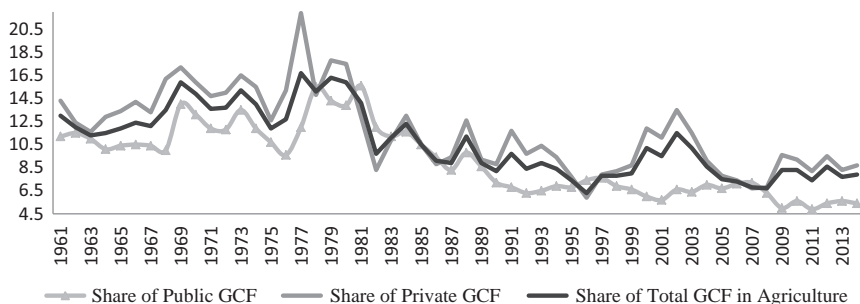


Figure 2.4 Gross capital formation (GCF) in agriculture (both public and private) as a percentage of total GCF in the Indian economy

Sources: Compiled from Ministry of Agriculture and Farmers Welfare, and Directorate of Economics and Statistics, Government of India (<https://data.gov.in>)

Figure 2.4 shows the trend of GCF in agriculture as a percentage of total GCF in the economy at current prices. Two important trends can be observed in the GCF in Indian agriculture: (i) an increasing trend in the share during the Green Revolution period and up to 1980, and (ii) a declining trend in share after 1980.

On the average, GCF in agriculture was about 13 per cent of total GCF in the Indian economy during the 1960s. While the share of private GCF was 14 per cent, that of public GCF was 11 per cent. During the 1970s, the GCF in agriculture (public and private) as a percentage of total GCF increased to 14.5 per cent, with private investment (16 per cent) having a larger contribution than public investment (12.4 per cent). During the 1980s, the share of overall GCF in agriculture declined to 11.2 per cent of total GCF in the economy. The decline was marked in the share of both private and public investment. Thereafter, it persistently declined in the 1990s as well as in the 2000s to 8 per cent. Although the share of both components declined, it was more noticeable in public GCF than in private GCF in recent years.

Many studies have analyzed the trend of investment in Indian agriculture.⁴ Shetty (1990) examined the trend in public and private investment from 1960–61 to 1987–88 at 1980–81 prices as well as at current prices. The growth of the GCF at 1980–81 prices during the decade 1960–61 to 1970–71 was 5.2 per cent. It rose to 5.3 per cent during 1970–71 to 1980–81. But over the seven-year period from 1980–81 to 1987–88, it declined at a rate of –1.5 per cent. Singh (2014) estimated that during 1980–81 to 1989–90 the growth rate of public GCF at 1994–95 prices was negative (–4.18 per cent), while private GCF grew at a positive rate of 2.23 per cent per annum. In the subsequent decade public GCF declined (–1.85 per cent) and private GCF grew at a positive rate of 1.52 per cent. During the next decade, 2000–01 to 2009–10, total investment went up and private investment grew at a higher rate (11.55 per cent) than public investment (7.56 per cent). Thus, the hypothesis of the crowding-in effect of public investment in agriculture in India was quite apparent.⁵ The deceleration of public investment in the 1980s was mainly due to large resources flowing in terms of subsidies for various inputs rather than actual investment (Singh, 2014).

Figure 2.5 shows the trend in GCF in agriculture as a percentage of agricultural GDP. Notwithstanding some fluctuations, the overall GCF in agriculture as a percentage of agricultural GDP has shown an increasing trend over the years (Figure 2.5). Between 1961 and 1976, the share of public GCF in agricultural GDP was a little above 2 per cent and increased to about 4–5 per cent during 1977–1988. Thereafter, however, it fell to slightly above 2 per cent throughout the period from 1989 to 2004. Though public GCF grew after 2005, it increased only by a percentage point until 2010. In 2014, public GCF as a percentage of agricultural GDP was only 5.40 per cent. Private investment as a percentage of GDP from agriculture stagnated at around 5–6 per cent during the 1980s and the 1990s. But after 2000 private investment as a percentage of agricultural GDP experienced a substantial jump, and the gap between private and public investments has been widening since then. Many studies

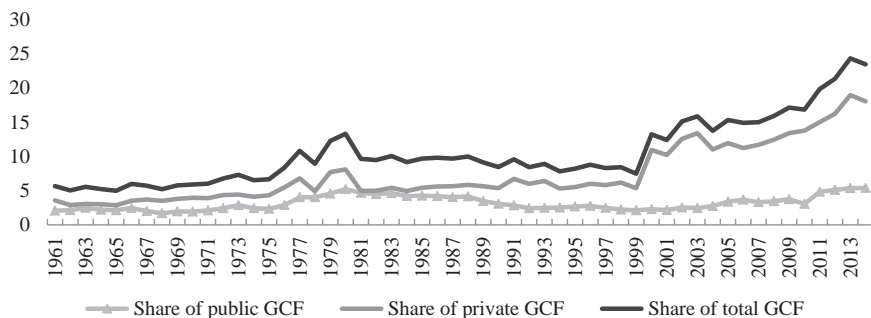


Figure 2.5 Gross capital formation (GCF) in agriculture (both public and private) as a percentage of agricultural GDP in India

Sources: Compiled from Ministry of Agriculture and Farmers Welfare, and Directorate of Economics and Statistics, Government of India (<https://data.gov.in>)

attribute this gap to the adoption of neo-liberal economic reforms in India which emphasized the reduction and/or withdrawal of input subsidies, reduction in public employment leading to the decline of extension services and privatization/marketization of economic activities (Patnaik, 2006; Vaidyanathan, 2006; Srinivasalu, 2015; Siddiqui, 2015).

6 Cost of cultivation and farm income

One of the important reasons behind the recent agrarian crisis in India, as argued by researchers, is the rising costs of cultivation and a declining net returns from many crops. Empirical studies on the topic include Sen and Bhatia (2004), Raghavan (2008), Dev and Rao (2010), and Narayanamoorthy (2013, 2017). Crop-specific and time-series studies show that the overall costs of cultivation, in terms of both per unit of land and output, has been rising because of the rise in input costs due to reduction/withdrawal of input subsidies after the liberalization policy. Raghavan (2008) examined the cost of cultivation of wheat in five major states of India – Haryana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh. He found that costs increased moderately during the 1970s and further picked up in 1980s before recording dramatic increases in the 1990s and in the first half of the 2000s. He found that the major drivers of increase in costs of cultivation are costs on inputs like fertilizer, irrigation, machine, labour and seeds.

Narayanamoorthy (2013) showed that cost C2 and cost C3 items,⁶ on an average, have increased from 1975–76 to 2006–07 (post-Green Revolution period) for six crops – rice, wheat, gram, groundnut, sugarcane and cotton. In the case of paddy, the cost C2 was Rs 2193 per ha in 1975–76 and increased to Rs 10,258 per ha in 1991–92, which is a 368 per cent increase in cost. Then, in subsequent years, it rose to even higher levels, such as Rs 17,980 per ha in 1995–96,

Rs 27,043 per ha in 2001–02 and Rs 30,492 per ha in 2006–07. The cost C3 followed an almost identical pattern. At the same time, profitability of many crops has been declining because of several reasons, such as failure of the increase in the minimum support price (MSP) to keep pace with the rise in the cost of cultivation, insignificant increases in value of output due to market failure, poor infrastructure, low productivity and so on. It can be observed from Narayanamoorthy (2013) that in many years net returns for many crops were negative. Paddy, the dominant crop in India, witnessed negative profit in all years from 1975–76 to 2006–07 when cost C3 is considered, and the negative return has been rising at a faster rate since 1985–86. Cotton farmers faced huge losses in 2001–02 and 2006–07. Wheat is the only crop that can earn good net returns even though this crop also experienced negative profit in some years during the 1970s and 1980s. Wheat farmers were able to reap profits in four out of seven time points, and net returns were very high during 2001–02 and 2006–07. Overall good returns of wheat in the post-reform period occurred because of a steep increase in MSP announced by the government (Dev and Rao, 2010). Using Agricultural Costs and Prices Commission (CACPC) data, Narayanamoorthy (2017) updated the same analysis for the above-mentioned six crops. Except for sugarcane, profits in relation to cost A2 were found to be very low in the triennium ending 2003–04 and in 2013–14 in both high and low productivity states. In fact, in relation to cost C2, profits were negative for paddy and groundnut and very low for the other crops considered except sugarcane.

Narayanamoorthy (2017) examined various issues related to farm income in India using both the Cost of Cultivation Survey (CCS) data from 1971–72 to 2013–14 and the Situation Assessment Survey (SAS) data for the periods 2002–03 and 2012–13. He observed that the income realized by the farmers from various crop cultivation has been very low over the years, and the year-on-year fluctuation was very high. According to SAS data at the national level, the average annual income from crop cultivation increased from Rs. 3645 in 2002–03 to Rs. 5502 in 2012–13 (at constant prices of 1986–87) per farmer household. The increase in income from crop cultivation was not very significant as compared to the income realized through the farming of animals. This implies that the farmers who are relying purely on cultivation not only earned less income but their growth of income was also lower than those who did animal husbandry. The study further found that the annual income from cultivation per farmer household varied substantially across the states in India. During 2012–13, it varied from Rs. 19,396 per household in Punjab to Rs. 1748 in West Bengal. Besides substantial variations in farm income among states, many predominantly paddy-cultivating states had much lower income than the national average.

Contrary to what usually is believed, estimates by Narayanamoorthy (2017) show that the average incomes from cultivation for the ‘States Having Above National Level Irrigation’ (SHANLI) are not substantially different from those of the ‘States Having Below National Level Irrigation’ (SHBNLI) during 2002–03 and 2012–13. During 2012–13, the average annual income from cultivation for states in the SHANLI category was Rs. 7796 per household, whereas it was

Rs. 5641 per household for states in the SHBNLI category, a difference of only about Rs. 2155. In fact, a good number of states belonging to SHBNLI category were able to earn higher income from cultivation than a few states under SHANLI category. The reason for this has been explained in Narayanamoorthy (2017, p. 55): ‘Although the gross income from the crops cultivated under irrigated condition is higher because of higher productivity, increased cost of cultivation might have counterbalanced the net returns from crops cultivation’.

7 Terms of trade

The domestic terms of trade is an index which helps to understand how people engaged in one sector have fared vis-à-vis another sector. This section discusses the movement in the index of terms of trade between agriculture and non-agriculture sectors in India since 1950. Usually two variants of terms of trade are used when analyzing the terms of trade between agriculture and non-agriculture sectors: barter terms of trade (BoT) and income terms of trade (IoT). The net BoT is the ratio of the index of prices received by the agriculture sector to the index of prices paid by the sector in its transactions with the non-agriculture sector. Dividing the agricultural GDP deflator by the same for the non-agriculture sector, the gross BoT is obtained. An increase in the BoT implies that a given quantity can be bought by the agriculture sector from the non-agriculture sector by selling a lesser amount to the later. However, if the relative price of agricultural commodities increases, the amount of commodities sold by the sector may fall, and the aggregate command over non-agricultural commodities may essentially decline. In order to capture these dynamics, the IoT has been developed. It is the net BoT weighted by the index of marketed surplus at constant prices.

The movement in the terms of trade between the agriculture and non-agriculture sectors may affect the welfare of the people engaged in these sectors through many channels. For example, favourable terms of trade to agriculture may in fact have an adverse effect, at least in the short run, on the rural poor. Since money wages do not increase immediately, a rise in agricultural prices means a fall in real wages. The rural poor being the net purchasers of cereals, a fall in real wages leads to less consumption. By contrast, Misra (2004) shows that a favourable terms of trade to agriculture while raising private investment in agriculture can increase aggregate crop output as well as productivity per hectare of net sown area.

The starting point of the discussion on terms of trade between agriculture and non-agriculture sectors in Indian context is the work by Thamarajakshi, which she has updated from time to time. Thamarajakshi (1990) computed the terms of trade for the period 1961–62 to 1987–88. She divided the entire period into two sub-periods, 1961–62 to 1973–74 and 1974–75 to 1987–88. She found that though the annual compound growth rates of BoT in both periods were positive, the rate was lower in the second period. Her estimation, however, showed that the agriculture sector gained more than it lost during both sub-periods. Kahlon and Tyagi (1980) criticized Thamarajakshi on many counts. However, the estimation of index of terms of trade by them revealed a similar trend to that of Thamarajakshi.

Raghavan (2004) presents the growth rate of BoT using estimates based on GDP deflators and those provided by the Commission for Agricultural Costs and Price (CACP) for four sub-periods spanning from 1950–51 to 2000–01. Both series have been found to have behaved in a similar manner for all the sub-periods. The compound growth rate of BoT was negative during the first sub-period, 1950–51 to 1963–64, which is attributed to a deliberate attempt to keep the terms of trade unfavourable to agriculture to serve the policy of industrialization. Further, substantial imports of food grains under PL-480 during that period also contributed towards preventing agricultural prices from rising. During 1963–64 to 1973–74, the BoT was favourable to agriculture for the following reasons: severe droughts in 1965 and 1966, which pushed the price of agricultural commodities up; subsidies provided to farmers on several inputs, which enabled them to make yield-improving investments, and no tax on agricultural income (Raghavan, 2004). In the subsequent period, 1973–74 to 1990–91, the growth rate of BoT was negative. There is, however, no unanimous explanation as to why the BoT became unfavourable to agriculture during this time. In the last sub-period (1990–91 to 2000–01), though the growth rate of BoT was positive, Raghavan (2004) estimated that the BoT based on CACP was 91.7 during this period, implying it was against the agriculture sector. During this period, private capital formation decelerated, and costs of production increased due to withdrawal of subsidies. Further, this period witnessed persistent price crashes and income losses, pushing farmers to commit suicide. The conditions have not changed much in recent time, and BoT tends to be against agriculture in most of the years during 2004–05 to 2014–15, as shown in Figure 2.6.

It is clear from Figure 2.6 that the terms of trade between the agriculture and non-agriculture sectors, and between farmers and non-farmers, have remained unfavourable to agriculture and farmers for most of the years from 2004–05 to 2014–15. In fact, during 2004–05 to 2007–08, the index of BoT was substantially

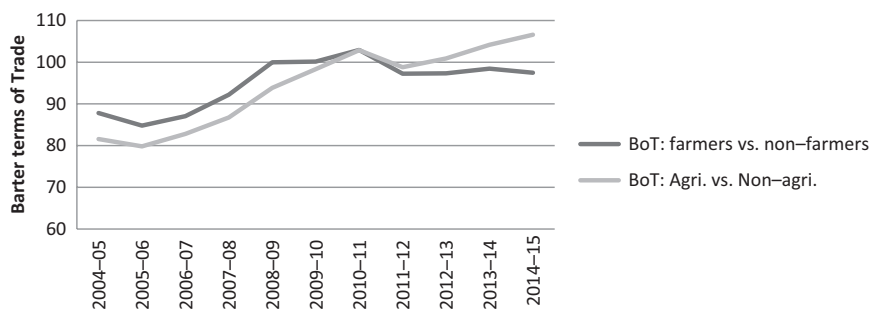


Figure 2.6 Barter terms of trade between agriculture vs. non-agriculture sectors and farmers vs. non-farmers during 2004–05 to 2014–15 in India

Source: Authors' construction based on data provided by Directorate of Economics and Statistics, Department of Agriculture, Cooperation & Farmers Welfare

unfavourable to the agriculture sector and the farmers. In other words, the agriculture sector and the farmers have lost more than what the sector and the people engaged therein have gained. Only in the last three years of the time period considered was BoT slightly in favour of agriculture. On the other hand, the BoT was marginally in favour of the farmers only in one year (2010–11) of one decade considered in Figure 2.6.

8 Concluding remarks

This chapter provides an overview of the performance of Indian agriculture since the introduction of Green Revolution. Over the years, the sector has undergone many changes. Within the sector, the combined income share from livestock, fisheries and forestry has been increasing, whereas that from conventional crops has been declining. Cropping patterns in the country have been changing in favour of non-food grain at the cost of food grain crops. Initially, Green Revolution technology was concentrated in highly irrigated regions like Punjab and Haryana. But the post-2000 growth pattern in the sector showed that growth of production has been faster first in the medium irrigation states of Madhya Pradesh, Bihar, Odisha and Andhra Pradesh, and later on even in the relatively low irrigation states of Maharashtra and Assam, than in the high irrigation states of Punjab, Uttar Pradesh and West Bengal.

One of the remarkable achievements of the Green Revolution technology was that it made India a food-grain self-sufficient nation. By the mid-1990s, India had a huge stock of food grains, which has been maintained since then. But, the sector suffered several problems from the mid-1990s onwards. While the contribution of the sector to overall GDP came down rapidly and substantially, the proportion of the workforce engaged in the sector did not decline as fast. Meanwhile, the growth of food grain production slowed down after 1991. Other challenges faced by the sector are rising costs of cultivation and poor rates of return from crops, declining investment and unfavourable terms of trade in recent years. As a result, the sector has been in a crisis since the early 1990s, the extreme manifestation of which is a series of farmer suicides in many states. Chapter 10 discusses the agrarian crisis and farmer suicides in detail.

While all problems associated with the agrarian crisis cannot be solved in a short span of time, they can be addressed or at least minimized with proper policies in the long run. A comprehensive set of policy interventions to overcome the agrarian crisis are discussed in the concluding chapter of the book.

Notes

- 1 In Indian agriculture, the terms Green Revolution and Yellow Revolution are used to denote mainly the successes achieved in the production of food grain and oil seeds, respectively. Initially a net importer, India became self-sufficient and turned into a net exporter of oil seeds during the early 1990s, thanks to the setting up of the Technology Mission on Oilseeds in 1986 (Rai, 1999). Another term, White Revolution, is used to denote the success in milk production due to Operation

- Flood – the world’s largest agricultural dairy development programme. This programme transformed India from a milk-deficient nation to the world’s largest milk producer, with about 17 per cent of global output in 2010–11 (www.drkurien.com and *The Hindustan Times*, 2011).
- 2 In the United States, the proportion of employment in agriculture is very low and has been declining over time (4.4 per cent in 1970, 2.7 per cent in 1990, 1.6 per cent in 2011). In the world, the agriculture sector contributes merely 3 per cent of the global GDP; while, more than 25 per cent of the GDP is derived from agriculture in many least-developed countries (FAO Statistical Yearbook, 2014).
 - 3 www.economicshelp.org (accessed in March 2017)
 - 4 See, for instance, Shetty (1990), Alag (1994), Mishra and Chand (1995), Mishra (1996), Dhawan and Yadav (1997), Chand (2000), Gulati and Bathla (2001), Mathur et al. (2006), Chand and Parappurathu (2012) and Singh (2014).
 - 5 Studies like Shetty (1990), Mallik (1993) and Dhawan and Yadav (1997) concluded that there is a crowding in effect of public investment in Indian agriculture, while studies like Mishra and Chand (1995) refuted the complementary hypothesis both conceptually and factually.
 - 6 The Commission for Agricultural Cost and Prices (CACPC) uses different cost concepts, like cost A1, cost A2, cost B1, cost B2, cost C1 and cost C2. Cost C1 and cost C2 are used for measuring profitability of crop cultivation because cost C2 covers actual expenses in cash and kind incurred in production by the owner, rent paid for leased-in land, imputed value of family labour and the interest on value of own capital assets (excluding land). Cost C3 includes all the components of cost C2 and adds 10 per cent in account of managerial functions performed by the farmer. For details, see Sen and Bhatia (2004) and Narayanamoorthy (2013, 2017).

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