

Trend and performance of Indian agriculture in post-independence era: an analysis of determinants

Lekharani Gohain*

¹Research Scholar, Department of Economics and Politics, Visva Bharati University, West Bengal 731235, India
lekha_go@hotmail.com

Abstract

Objective: India was a heavily agriculture-dominant economy during the period of independence and experienced a long path of developmental processes till now. A number of factors of production lend a hand to escalate the situation of the sector since then. Therefore, this study focuses on the growth trend of agricultural production since independence and elaborates the effects of some of the important determinants implicit to the growth of the sector.

Methods: The present study is based on secondary data to showcase the trend and pattern of some important determinants of Indian agriculture during the time span 1950-2013. The study takes into account six major tradable crops. To delineate the trend distinctively formula for percentage change is calculated from original data compiled from sources like Agricultural Statistics at a Glance, Department of Agriculture and Cooperation, Ministry of Agriculture etc. and rendered by charts and line diagrams.

Findings: In our present study, data show that since independence, production and yield per hectare of selected crops have been increasing at a decreasing rate. The agricultural growth rate is not satisfactory as it was at the time of independence. Factors affecting agricultural growth are analysed over the decades and found that till mid-sixties area expansion was the major driver of growth but after then productivity began to be the major driver of growth accompanied by better irrigation systems, fertiliser usage, credit facilities etc.

Application: It is found that area expansion and irrigation are highly correlated with yield per hectare.

Keywords: Trend and pattern of Indian agriculture, Post-independence, Determinants of agricultural growth.

1. Introduction

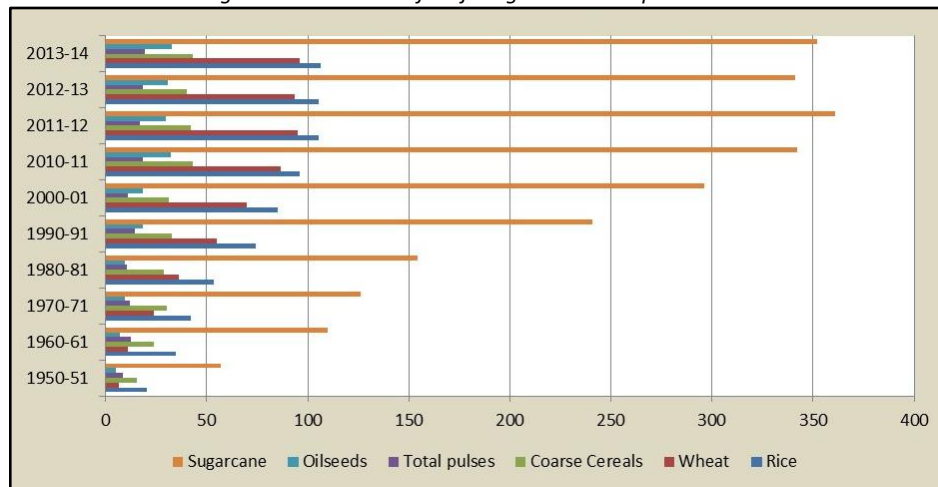
Agriculture sector in developing countries performs focal role in their development process and is considered as an important driver of macroeconomic activities and also an essential element of the strategy to make growth more inclusive. Compared to the other sectors India's agriculture sector is the broadest and more than half of its total work force is engaged in this sector. It provides not only food to its masses but also generates employment, creates savings, contributes to the manufacturing sector etc. At the time of independence, Indian economy was backward and largely based on agriculture. Almost one third of the total population were directly engaged in agriculture and agriculture related activities. Today, after 70 years since independence when the economy experienced many technological changes, still 54.6% of total population are engaged in the sector. The share of agriculture to the country's total GDP declined from 50% in 1950 to 17.32% in 2016-17 [1]. Besides, the growth in all other sectors of the economy depends upon the growth in agriculture sector and hence it continues to be the dominant sector of the economy. From the earlier literatures available on Indian agriculture, it is found that in the period of fifties and sixties the main source of growth was expansion of area [2-4]. But gradually the source of growth switched from area expansion to increased productivity. In due course of time, the Government of India introduced a number of schemes to enhance agriculture production. Land reforms, new agricultural strategy (1966-67), investment in agricultural research and extension, investment in major and or minor irrigation systems, provision of credits, development in infrastructure, use of chemical fertilisers and pesticides are some of the initiatives taken by Indian government that indeed contributed a lot to the sector [5].

But in spite of all these efforts and progresses, almost all sub-sectors of Indian agriculture, except forestry, experienced adverse outcome of production during post-WTO period [3]. Within crop sector, all crops except sugar showed declining trend between initial years of reforms and post-WTO period. Initially the deceleration was very small and then turned sharp after 2001-02. This deceleration was very high in the case of Cereals, Coarse Cereals, Pulses, Oilseeds, and Drugs & Narcotics. The growth rate turned even negative in case of pulses. During the first five-year plan, India’s net sown area was 266 million acres which was 43% to total land. The total cultivated area was 324 million acres (excluding mountains, deserts and inaccessible forests). The first three plans concentrated on growth with some institutional changes including abolition of intermediaries in agriculture like Zamindars and Jagirdars and came up with some reforms like land reform, tenancy reform etc. In the mid-sixties, a new technology in the form of high yielding varieties (HYVs) was introduced for cereals. Initially, people were reluctant to adopt this new technology as some risk factors were associated to it, but later it has experienced positive growth in productivity when espoused [6]. Apart from HYV technology, public investment in agriculture particularly in irrigation was stepped up significantly [7] [8]. In the post-liberalisation period when the economy further opened up to the world market, brought about modern farming technologies and innovations. Cooperative farming, which implies pooling of land and joint management, was developed in the second plan so that over a period of 10 years or so a substantial proportion of agricultural lands are cultivated on cooperative lines.

2. Data source and Methodology

This study is based on secondary time series data collected from Agricultural Statistics at a Glance (2014, 2015), Economic Survey of India, Reserve Bank of India, directorate of Economics and Statistics etc. The time span of the study is from 1950 to 2013. To pose the main issue, six major crops out of total agricultural commodities are taken under this study; they are rice, wheat, sugar, coarse cereals, pulses and oilseeds. The reason behind choosing these particular crops is that these are major consumables as well as major tradable of the nation. Simple charts and line or bar diagrams are used to distinctively depict the trend and pattern. Also, to see the degree of association between production and or yield and other factors correlation coefficients are calculated.

Figure 1. Production of major agricultural crops since 1950-51

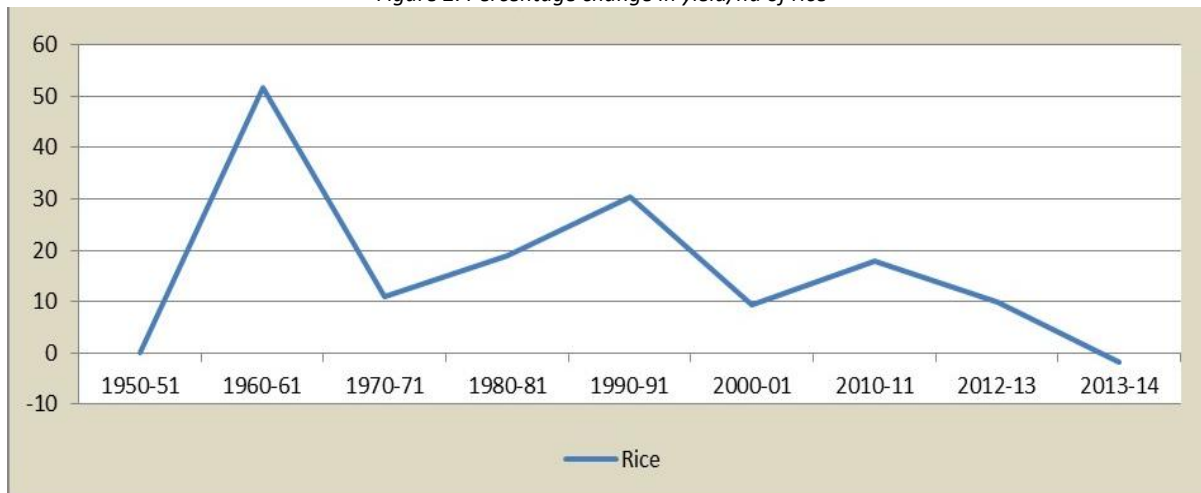


Source: Agricultural Statistics at a Glance 2015

3. Growth trend of production and productivity

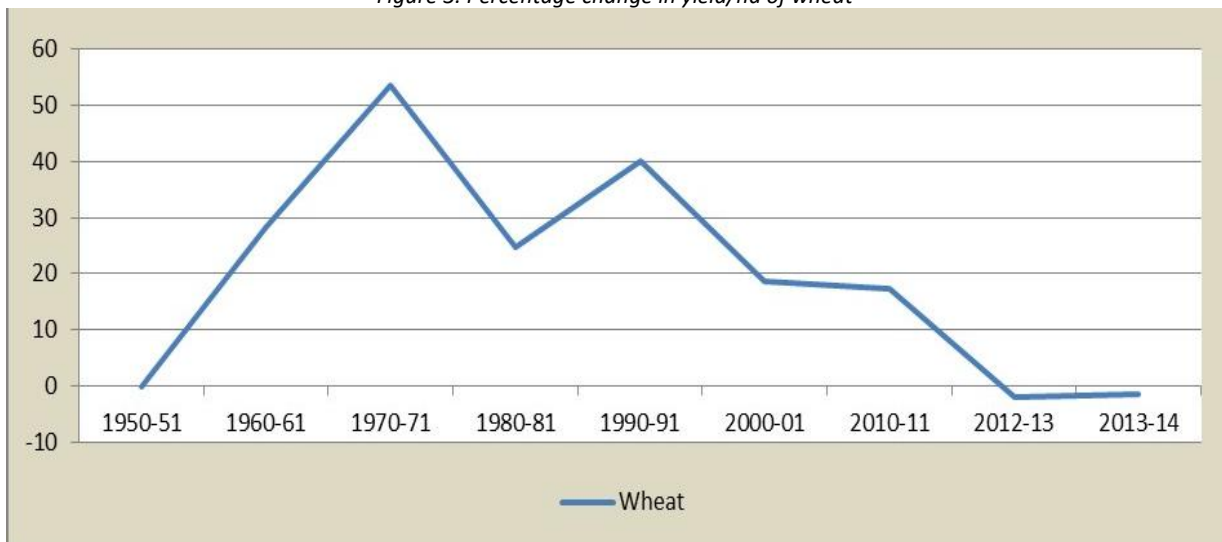
India produces crowds of primary commodities like varieties of rice, wheat, pulses, cereals, oilseeds; commercial crops like sugarcane, cotton, jute, tea, coffee; horticulture products like fruits and vegetables, spices and many more others. Considering the time period since 1950-51 i.e., since independence, India has been able to build up impressive growth in production and productivity of some major crops.

Figure 2. Percentage change in yield/ha of rice



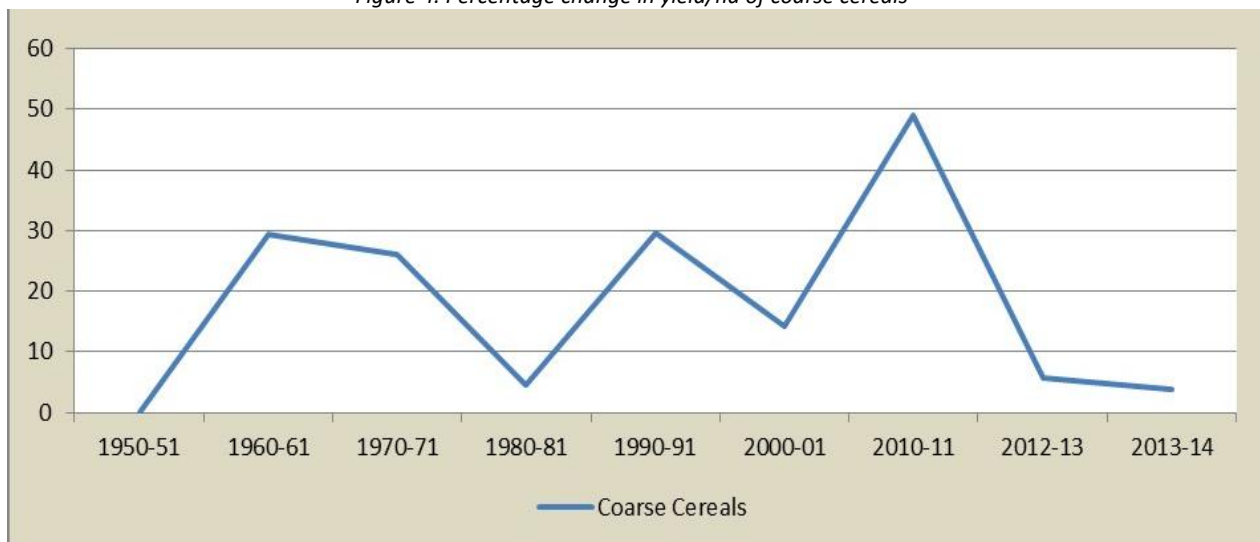
Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

Figure 3. Percentage change in yield/ha of wheat



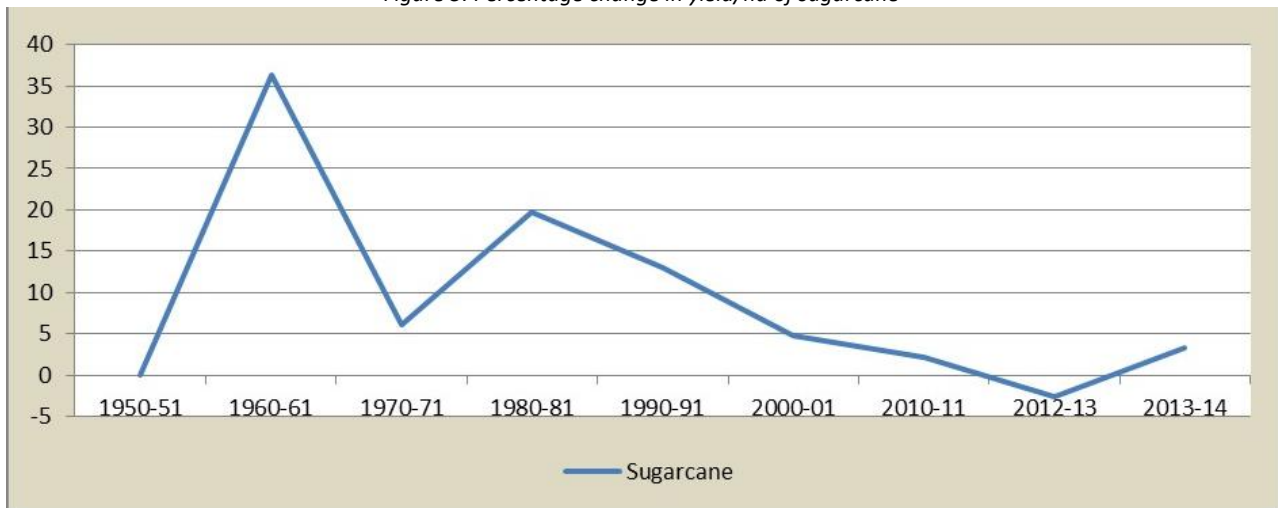
Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

Figure 4. Percentage change in yield/ha of coarse cereals



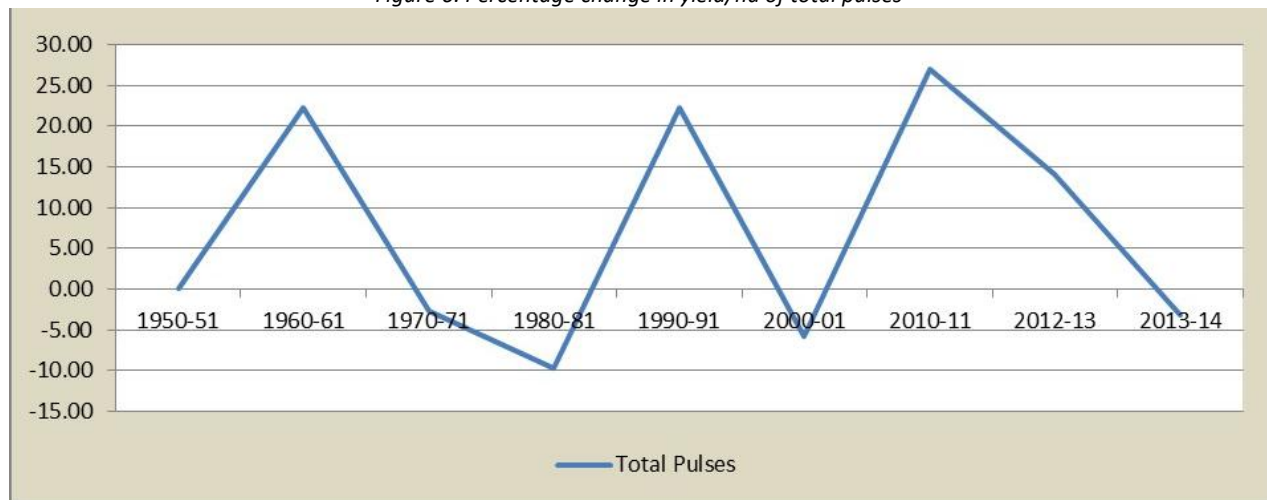
Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

Figure 5. Percentage change in yield/ha of sugarcane



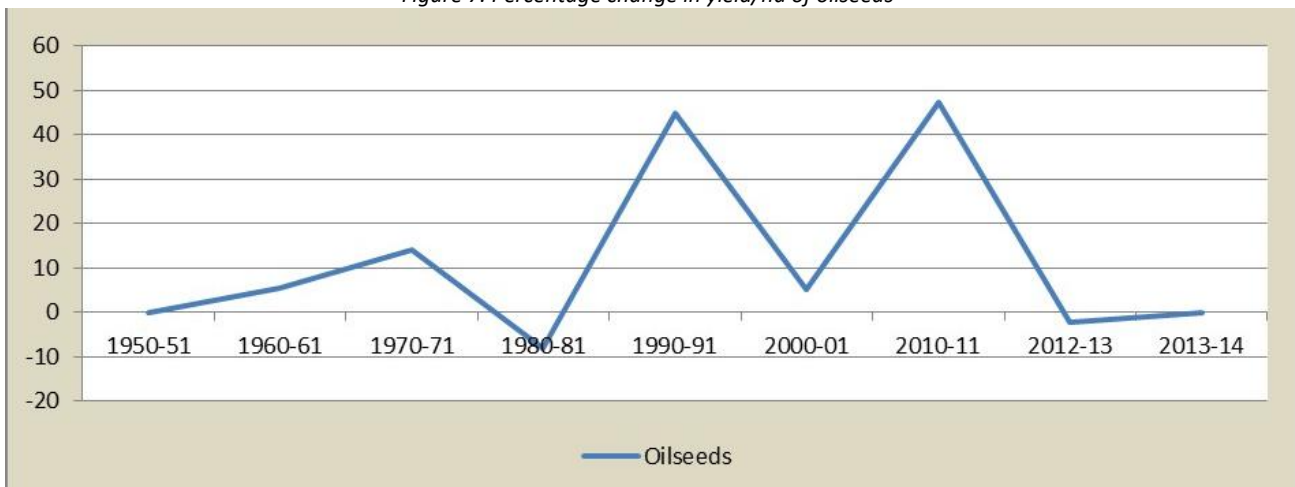
Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

Figure 6. Percentage change in yield/ha of total pulses



Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

Figure 7. Percentage change in yield/ha of oilseeds



Source: Calculations based on yield per hectare data compiled from Agricultural Statistics at a Glance 2015

India’s production of rice and wheat has been increasing significantly over the years. In 1950-51, India’s total production of rice was 20.58 million tonnes while it is 106.65 million tonnes in 2013-14. Accordingly, wheat production of India rises from 6.46 million tonnes in 1950-51 to 95.85 million tonnes in 2013-14. Rice, being the main staple food of India, has been showing a positive trend in its production over the years since independence (Figure 1). The same is the case for wheat which is the next core staple food of India.

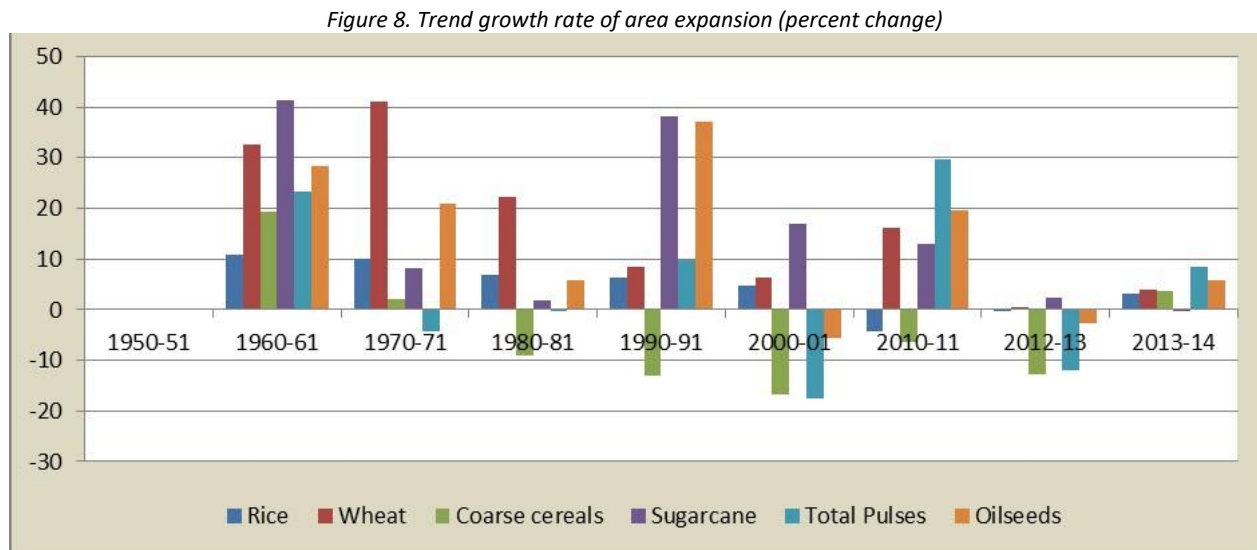
Despite high subsidies and slow pace of domestic consumption wheat production could not meet its expected targets. One of its reasons could be pointed towards low level of yields. The production of coarse cereals has not shown satisfactory growth since independence. Similarly, the growth in production of pulses and oilseeds are not satisfactory. Contrary to this, sugarcane, which is a commercial crop, is growing at a faster rate than all other crops. The same is the case for yield of these six crops shown in the following Figures 2-7.

4. Major drivers of agricultural growth

1. Area under cultivation

One of the important drivers of production of agriculture is area under cultivation. Acceleration of agriculture is possible when production increases followed by an increase in productivity and area expansion. In 1950-51, 97.32 million hectares of total land was under cultivation. Within a decade, it increased up to 115.58 million hectares and achieved immense growth in production and productivity as well. After that, it goes on increasing in the similar trend but bit less than the initial periods.

If we check the growth pattern of area under cultivation in each decade, it could be seen that the rate of growth of area expansion is positive for wheat, oilseeds and sugar; more or less stagnant for rice and pulses; and negative for coarse cereals (Figure 8). But still the production of food-grains goes on increasing. It is nothing but the achievement of satisfactory growth in yields which was only 522 kg/hectare in 1950-51 and now in 2013-14 stood at 2129 kg/hectare.



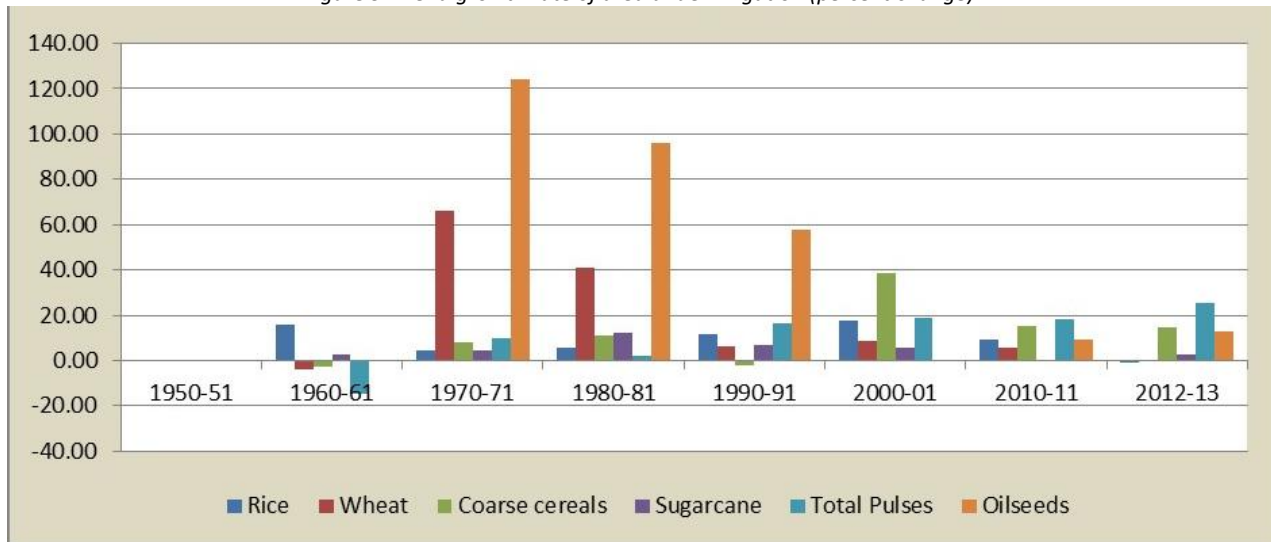
Source: Calculations based on area under cultivation data compiled from *Agricultural Statistics at a Glance 2015*

1.1. Area under irrigation

During the time of independence, Indian farmers relied too much on nature and had to wait for rainfall to plough or sow the land. This traditional way of cultivation has been replaced by advanced irrigation facilities, though differences are there in availability of proper irrigation from region to region. For example, according to 2011-12 data taken from Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Punjab (98.7%), Haryana (88.9%), Uttar Pradesh (76.1%) are some of highly irrigated states whereas Assam (4.6%), Jharkhand (7.0%), Maharashtra (16.4%) etc. avail very low level of irrigation facilities.

However, efforts have been made to cover more area under irrigation as a whole. In 1950-51, total area under food-grains irrigation was 18.1%. The figure increased almost two-fold to 35.1% in 1990-91 and in 2012-13 it rose to 51.2%. To analyse the trend in production, area expansion and yield along with irrigation coverage, the data has been re-arranged in a 10-years gap fashion. Then, it is easily observable that food-grains production of India has been going on increasing in every successive decade since 1950-51 followed by an increase in yield per hectare and area under irrigation. Notably, here it is distinctly seen that during 1950s and 1960s expansion of area remained the major driver to gear up food-grains production and yield than irrigation facilities.

Figure 9. Trend growth rate of area under irrigation (percent change)



Source: Calculations based on area under irrigation data compiled from Agricultural Statistics at a Glance 2015

But after 1970s the growth of area expansion became negative and more passive than growth in irrigation due to bulky public investments on irrigation facilities and fertilisers (Figure 9). From 1950-51, area under cultivation of rice was continuously going on increasing till 2001-02.

The rate of increase of area was highest in the decades of 1950s and 1960s, although some fluctuations are there afterwards. Production of rice grew tremendously due to better implementation of irrigation facilities along with increasing yield. Irrigation on rice covers 58.6% in 2010-11, while it was just 31.7% in 1950-51. Similarly, area under cultivation of wheat has increased in every subsequent decade while coarse cereals have experienced a negative area expansion since 1970s. At the same time, area for oilseeds and pulses confronts some moderate fluctuations over the years while in the case of sugarcane it has only marginally increased. In case of production, growth trend of wheat is sharp positive than that of rice, sugarcane and oilseeds. Coarse cereals and pulses production shows some marginal increments only. Similarly, yield per hectare growth rate for wheat, rice and total pulses are in line with their production trend. On the other hand, yield growth rate for coarse cereals and oilseeds are positive with some jerks over the decades, while yield growth rate for sugarcane and pulses show almost a stagnant trend with some marginal increments (Figure 2-7). It is observable that except for coarse cereals, growth trend of area under cultivation of all other crops are positive. Rate of irrigation providence is very high in case of oilseeds cultivation while it is lower but positive for all other crops. Correlation coefficient between both yield and area, and yield and irrigation are highly positive (0.996 and 0.994 respectively).

1.2. Fertiliser use

Fertiliser is one of the major inputs in terms of agricultural production and productivity growth. In terms of zone-wise consumption, Western zone of the country consumes maximum fertilisers than the rest and North-Eastern zone consumes the least amount of fertilisers. Nitrogenous (N), Phosphatic (P) and Potassic (K) are the key type of chemical fertilisers that are used in production process. Both consumption and production of fertilisers were very high till 2010-11 and then a gradual fall is observed afterwards.

From Table 1, it is seen that during 1990-91, import of fertilisers (N+P+K) was only 27.58 lakh tonnes. The figure rose to 130.02 lakh tonnes in 2011-12 and then started to fall continuously. It is, however, very interesting to point out that production, consumption and import of fertilisers altogether has decreased almost since the same time period, *i.e.* 2010-11 onwards. This is most likely due to environmental concern to reduce soil degradation and increased demand for organic food items.

Table 1. Consumption, production and import of fertilisers (Lakh Tonnes)

Year	Consumption				Production			Imports			
	N	P	K	Total	N	P	Total	N	P	K	Total
1981-82	40.69	13.22	6.73	60.64	31.44	9.49	40.93	10.54	3.43	6.44	20.41
1990-91	79.97	32.21	13.28	125.46	69.93	20.52	90.45	4.14	10.16	13.28	27.58
2000-01	109.20	42.15	15.67	167.02	109.61	37.43	147.04	1.54	3.96	15.41	20.91
2010-11	165.58	80.50	35.14	281.22	221.56	42.22	263.78	45.64	37.38	38.81	121.83
2011-12	173.00	79.14	25.76	277.90	122.59	41.01	163.60	52.40	44.27	33.35	130.02
2012-13	180.36	59.55	18.13	258.04	121.94	35.41	157.35	46.90	27.78	12.30	86.98
2013-14	165.25	54.58	19.76	239.59	123.78	37.14	160.92	38.08	15.90	13.33	67.31

Source: Department of Fertilisers

1.3. Certified/Quality Seeds

During the initiation of Green Revolution in 1960s, use of High Yielding Variety (HYV) seeds were introduced to enhance production and yield of crops. In the light of new economic reform these HYV seeds were opened up for various crops which were earlier limited for some particular cereals only. Use of these HYV seeds increases production and yield of respective crops. In Table 2, distribution of these quality seeds for wheat, paddy and oilseeds are given which clearly shows increments over the years.

Table 2. Crop-wise distribution of certified/quality seeds (Lakh qncls)

Year	Wheat	Paddy	Oilseeds (total of nine)
2000-01	27.04	24.41	12.54
2001-02	32.59	25.58	12.10
2002-03	33.00	25.79	13.36
2003-04	35.97	26.51	19.39
2004-05	41.31	30.98	23.42
2005-06	44.21	32.41	24.35
2006-07	54.55	43.51	27.00
2007-08	63.25	48.93	34.33
2008-09	74.83	58.18	39.92
2009-10	90.66	60.95	50.71
2010-11	97.83	69.95	50.61
2011-12	97.61	74.41	61.49
2012-13	116.47	72.14	58.41
2013-14	93.75	72.45	61.09

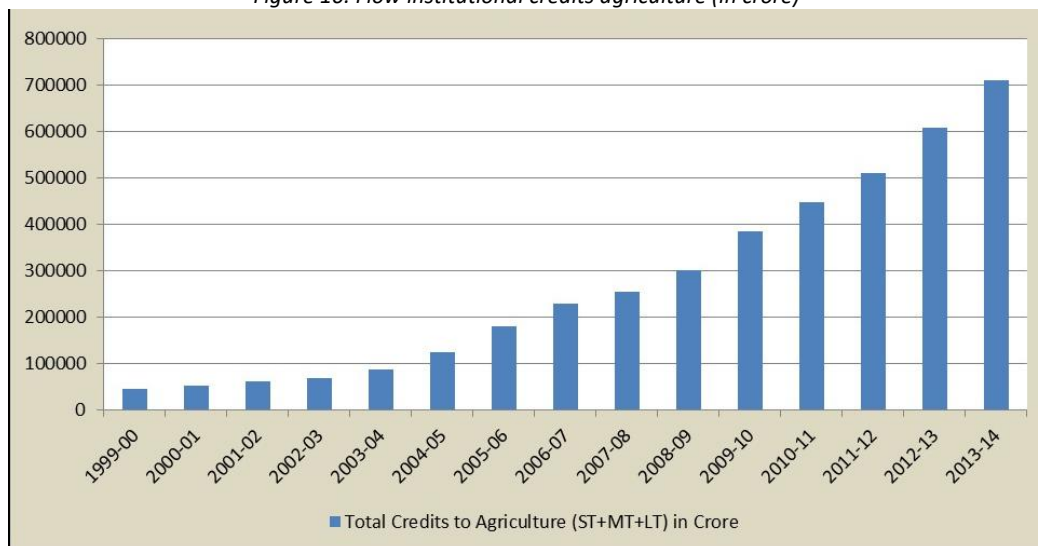
Source: Department of Agriculture and Co-operation, Seeds Division

1.4. Institutional credit

Credit is one of the pivotal inputs for agricultural development. It does not only capitalise farmers but also appreciates them to undertake new investments and/or to adopt new technologies to raise volume of production. Flow of credit to agriculture comes both in the form of institutional and non-institutional which was 7.30% and 92.70% respectively in 1951, while the figure reversed to 66.80% to 33.20% in 2011. A large number of formal institutional agencies like Co-operative Banks, Regional Rural Banks (RRBs), Non-Banking Financial Institutions (NBFIs), and Self-Help Groups (SHGs) etc. are involved to provide the short, medium and long term agricultural credits to farmers.

The flow of institutional credits (Co-operative Banks + RRBs + Commercial Banks + Other agencies) to agriculture sector since 1990-91 is shown in the following Figure 10. It is clear from the figure that farmers are now able to meet their short term and long term needs in terms of agriculture production to adopt new inputs and or technologies as credits continue to increase over the years. The figures are cumulative of short term, medium term and long term credits.

Figure 10. Flow institutional credits agriculture (in crore)



Source: Agricultural Statistics at a Glance, 2015

Notes: ST= Short term, MT= Medium Term, LT= Long Term

1.5. Electricity use

Another key input in agriculture is use of electricity for agricultural purposes. Electricity is consumed in various stages of production. For irrigation requirements there is a growing demand for electrical energy. Considering decade-wise power consumption in agricultural purposes, the figure slipped to 20.48% in 2010-11 from 26.76% in 2000-01 (Table 3). Contrary to this, coverage under irrigation has increased in these two decades. It is because the year 2010 was a good monsoon year with heavy rainfall during all the seasons.

Table 3 Consumption of electricity for agricultural purposes

Year	Consumption for Agricultural purposes (GWh)	% share of consumption of electricity to total consumption
1982-83	17817	18.64
1990-91	50321	26.44
2000-01	84729	26.76
2010-11	126377	20.48

Source: Central Electricity Authority, New Delhi

5. Conclusion

At the time of independence, Indian economy was backward and largely dependent on agriculture. In the first five-year plan, the sector has been given more priority to enhance its production and productivity. In the mid-sixties, a new technology in the form of high yielding varieties (HYVs) was introduced for cereals. Apart from the new technology, public investment in agriculture particularly in irrigation was stepped up significantly. Rate of growth of consumption of fertilisers (NPK) is seen very high since the introduction of New Economic Reforms of 1991. Also, consumption of electricity for agricultural purposes has been increasing since 1980s, but percentage share of consumption of electricity to total consumption has been declining, sharply after 1990s.

Flow of total agricultural credits (Short term + Medium term + long term) has also been ever increasing since 1999-00. Notably, a positive relationship is observed between production and or productivity and factors of production. It is observable that except for coarse cereals, growth trend of area under cultivation of all other crops are positive. Rate of irrigation providence is very high in case of oilseeds cultivation while it is lower but positive for all other crops. Correlation coefficient between both yield and area, and yield and irrigation are highly positive (0.996 and 0.994 respectively). These altogether remain instrumental for India's agricultural growth. However, a serious matter of concern observed is that production of all the six crops has been increasing but at a decreasing rate. Excessive use of chemical fertilisers calls an emergence of organic farming system. In this context, role of public investments remain pivotal in accelerating irrigation facilities.

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