
UTILIZATION OF AGRICULTURE INPUTS AND ITS OUTCOME IN INDIAN AGRICULTURE

Article Particulars

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Abstract

The agriculture sector occupies a significant position in the Indian economy as it provides livelihood and employment to more than 54 per cent of the population and contributes around 13.9 per cent to the Gross Domestic Product (TERI Year Book 2015/16). The agriculture and allied sector continues to be pivotal to the sustainable growth and development of the Indian economy. Not only does it meet the food and nutritional requirements of 1.3 billion Indians, it contributes significantly to production, employment and demand generation through various backward and forward linkages. Moreover, the role of the agricultural sector in alleviating poverty and in ensuring the sustainable development of the economy is well established (State of Indian Agriculture 2015-16).

Keywords: *Gross Domestic Product, Indian economy, agricultural sector, Crop protection chemicals, Seeds, Farm Mechanization*

Introduction

The backbone of any agricultural revolution is access of farmers to modern agricultural inputs. These agricultural inputs range from improved seeds, fertilizers and crop protection chemicals to machinery, irrigation and knowledge. Seeds are critical to successful crop production and inevitably, farm productivity and profitability. Fertilizer supplies nutrients to the soil that are essential for growth. Increased use of fertilizer and improved seeds are partially credited with the large increases in agricultural productivity growth in Asia during the Green Revolution in the 1960s.

Irrigation is also essential for growth as it enables off-season farming, provides the potential for multiple harvests per year, and brings additional land under cultivation. Crop protection chemicals (pesticides, herbicides, insecticides and fungicides) control weed species, harmful insects and plant diseases that afflict crops. Finally, technical knowledge and machinery enhance human labor effectiveness and increase farm productivity (Sahel 2014). Against this background, this study focuses on the agricultural inputs usage for agricultural production in India and the performance of agriculture sector in India during the time period of 1990-91 to 2016-17.

Agricultural Inputs

Agriculture is mostly made up of cultivation practices by giving the subsequent inputs viz., Seeds, Electricity Power, Mechanization, Fertilizers, and Pesticides etc.

Seeds

Seed is considered the basic input for enhancing agricultural production and productivity. Efficiency of all other agricultural inputs, such as fertilizers, pesticides and irrigation, etc., as well as the impact of agro-climatic conditions, is largely determined by the quality of the seed used. The estimated contribution of seeds in the productivity is considered to be 20- 25 per cent. Therefore, ensuring the availability of quality seeds for enabling farmers to achieve higher agricultural production is a strategic requirement (State of Indian Agriculture 2015-16).

Electrical Power

Now-a-days electricity has become a very important source of power on farms in various states of the country. It is steadily becoming more and more available with the increase of various river valley projects and thermal stations. On an average about 1/10th of the total electrical power generated in India, is consumed for the farm work. The largest use of electric power in the rural areas is for irrigation and domestic water supply. Besides this, the use of electric power in dairy industry, cold storage, fruit processing and cattle feed grinding has tremendously increased.

Chemical Fertilizer

Chemical fertilizers are the immediate source of nutrients in soils. It provides a vital input for the growth of agriculture and is an inevitable factor that has to be reckoned with the attainment of self-sufficiency goal in production of food grains. Apart from the primary nutrients ('N', 'P', and 'K'), the secondary and micro-nutrients are also required for plant growth. Calcium, Magnesium and Sulphur are termed as secondary nutrients and deficiencies in supply of these nutrients reduce the efficiency of primary nutrients by restricting the yield to a lower level. Hence, to obtain optimum results, crops have to be supplied with secondary nutrients in addition to primary nutrients. Micro-nutrients are a group of nutrients which are essential for plant growth in minute quantities. Intensive cropping depletes all nutrients, including micro-nutrients, from the soil. Therefore,

selective use of micro-nutrients is necessary for increasing agricultural production (State of Indian Agriculture 2015-16).

Pesticides

Plant protection strategies and activities have become pertinent in ensuring environment friendly and sustainable agriculture. Plant protection strategies encompass activities aimed at minimizing crop losses due to pests through integrated pest management, plant quarantine, regulation of pesticides, locust warning and control besides training and capacity building in plant protection (State of Indian Agriculture 2015-16).

Farm Mechanization

Farm mechanization not only provides optimal utilization of resources, e.g., land, labour, water but helps farmers to save valuable time and also reduces drudgery. This judicious use of time, labour and resources facilitates sustainable intensification (multi cropping) and timely planting of crops, leading to an increase in productivity (State of Indian Agriculture 2015-16). The present study analyses the agriculture inputs usage in food grains production in India as a whole.

Significance of the Study

Agriculture sector in India is considered to be the backbone of its economy. Agriculture is source of livelihood for more than 70 per cent of Indians in the rural areas of India (Department of Agriculture & Cooperation & Statistics, 2014). Similarly, agriculture sector in India is also the largest employer contributing 49 per cent of the total workforce. Apart from employment, agriculture also plays an important role in food security. According to (NSSO, 2013) an average Indian still spends more than half of the income in food security. However the growth rate of the agriculture sector in India has been fluctuating. The growth rate of the agriculture in India mainly depends on the inputs as majority of the cultivated area in India such as seeds, electricity, machinery, fertilizer and pesticides etc., (IndraGiri 2016). Therefore this study assumes greater significance in the current agriculture scenario in the Indian economy.

Research Problems

Agriculture production depends on several factors. These include the availability and quality of agricultural inputs such as seeds, machines, electricity, fertilizer and pesticides among others. The agriculture sector in India is facing many problems and this study specifically focuses on issues related to inputs for agricultural sector in India. Some of the major problems associated with the agricultural inputs are lack of adequate availability of inputs (especially seeds, machines, electricity, fertilizer and pesticides) at the right price and the right time, climate change (with longer drought periods and more frequent storms), degraded condition of many agricultural soils and

also lack of availability of financial products specifically for farm inputs investment (FAO 2016).

Objective of the Study

This study on agriculture inputs use in Indian agriculture and its performance focuses on the following objectives:

- To study about the use of inputs in agriculture in India.
- To study the growth of food grains production in terms of area, production and productivity in India during 1990-91 to 2016-17.
- To suggest suitable policy measures to improve the conditions of agriculture inputs use in Indian agriculture sector.

Methodology

The present study is based on the secondary sources of information, mainly taken from the Agriculture Statistical at a Glance - 2016 and ICAR (Indian Agricultural Statistics Research Institute) - Agricultural Research Data Book 2017. The paper covers the secular study period from 1990-91 to 2016-2017. As far as the statistical tool for analysis is concerned, the researchers have used annual growth rate and percentage to find out the growth performance of selected agriculture inputs and overall performance of agriculture sector in India. Further, the researchers have also planned to use simple statistical tools in appropriate manner for analysis.

Data Analysis and Result's Discussions

Seed

Seed is a living being which is vital and basic input for attaining sustained growth in agricultural production in different agro-climatic conditions (Apurva.S).

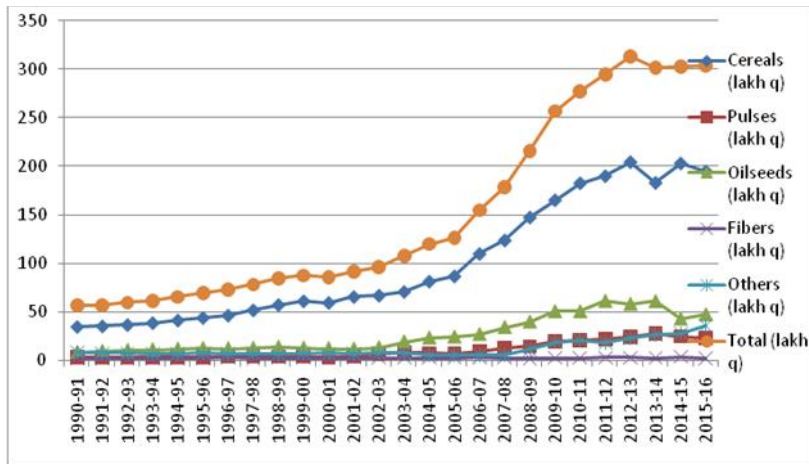
Table 1 Distribution of Certified/Quality Seeds and Its Growth of Total Seeds of India during 1990-91 to 2015-16

S.No	Year	Cereals (lakh q)	Pulses (lakh q)	Oilseeds (lakh q)	Fibers (lakh q)	Others (lakh q)	Total (lakh q)	Growth Rate of Total Seeds (%)
1	1990-91	34.7	3.41	8.59	2.16	8.24	57.1	---
2	1991-92	35.35	3.29	9.66	2.03	7.17	57.5	0.70
3	1992-93	36.72	3.4	10.75	2.09	7.37	60.33	4.92
4	1993-94	38.74	3.62	11.38	2.01	6.45	62.2	3.10
5	1994-95	41.35	3.6	12.01	2.2	6.7	65.86	5.88
6	1995-96	44.03	3.58	12.64	2.58	7.09	69.92	6.16
7	1996-97	46.43	4.19	12.53	3.18	6.94	73.27	4.79
8	1997-98	51.78	3.89	12.87	2.21	7.04	78.79	7.53
9	1998-99	57.27	4.06	13.98	2.92	6.89	84.97	7.84
10	1999-00	61.14	3.87	12.98	2.93	7.06	87.98	3.54
11	2000-01	59.47	3.85	12.54	2.91	7.5	86.27	-1.94
12	2001-02	65.56	4.69	12.1	2.89	6.56	91.8	6.41
13	2002-03	66.97	6.6	13.36	2.74	7.37	97.04	5.71
14	2003-04	70.82	8.17	19.39	2.78	7.24	108.4	11.71

15	2004-05	81.41	7.4	23.42	2.76	5.27	120.26	10.94
16	2005-06	86.73	7.37	24.35	2.89	5.41	126.75	5.40
17	2006-07	109.87	9.63	27	3.05	5.46	155.01	22.30
18	2007-08	123.8	12.57	34.33	2.63	5.72	179.05	15.51
19	2008-09	147.43	14.48	39.92	2.58	11.4	215.81	20.53
20	2009-10	165.15	19.69	50.71	2.65	18.91	257.11	19.14
21	2010-11	182.62	20.83	50.61	2.64	20.63	277.34	7.87
22	2011-12	189.96	22.26	61.49	3.09	18.32	294.85	6.31
23	2012-13	204.37	24.51	58.41	2.95	23.2	313.44	6.30
24	2013-14	183.03	27.8	61.09	2.87	26.6	301.39	3.84
25	2014-15	203.03	24.77	43.03	3.86	28.26	303.12	0.57
26	2015-16	194.95	22.71	47.44	2.49	36.45	304.04	0.30
	CAGR	7.15	7.88	7.07	0.57	6.13	6.92	---

Source: ICAR- Indian Agricultural Statistics Research Institute- Agricultural Research Data Book 2017

Fig.1 Distribution of Certified/Quality Seeds and Its Growth of Total Seeds of India



Cereals

It is evident from the table that there has been considerable increase in usage of certified/quality seeds of cereals during the study period. In 1990-91, 34.7 lakh q cereals was used and it increased to 194.95 lakh q in 2015-16 with CAGR of 7.15 per cent. Throughout the study period, the usage of cereals has increased over the respective previous years except during 2000-01, 2013-14 and 2015-16.

Pulses

Unlike cereals, there has been wide fluctuation in usage of pulses especially during the first decade of the study i.e., 1990-91 to 2000-01. From 2001-02 to remaining years of the study period, there has been positive growth in the study period except during 2004-05, 2005-06 and 2014-15, 2015-16. The usage of pulses which was 3.41 lakh q in 1990-91 increased to 22.71 lakh q in 2015-16 with 7.88 per cent CAGR which is highest CAGR among the seeds studied in this paper.

Oilseeds

Oilseeds has registered positive growth during the initial years from 1990-91 to 1995-96 and after growth dipping in 1996-97, it increased in next two years and from 1999-00 to 2001-02 for three years the growth was negative. Then the growth was positive from 2002-03 to 2009-10 and it was fluctuating thereafter. Overall, there has been 7.07 per cent of CAGR in Oilseeds during study period.

Fiber

The usage of Fibers which was 2.16 lakh q in 1990-91 has increased to only 2.49 lakh q in 2015-16 with CAGR of mere 0.57 per cent. Others which constitute all other seeds increased from 8.24 lakh q in 1990-91 to 36.45 lakh q in 2015-16 with CAGR of 6.13 per cent during the study period. Overall, in total all the seeds increased from 57.1 lakh q in 1990-91 to 304.04 lakh q in 2015-16 with CAGR of 6.92 per cent during the study period. In total seeds there has been positive growth in all years except during 2000-01 and 2013-14.

Mechanization

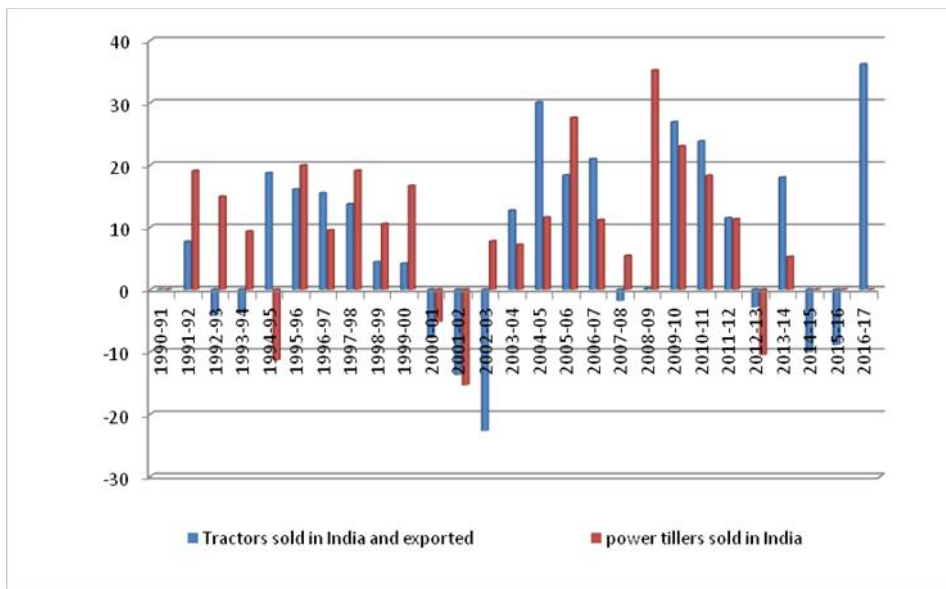
**Table 2 Agricultural Engineering Inputs Status
(Farm Mechanization) in India From 1990-91 to 20016-17**

S.No	Year	Tractors Sold in India (Numbers)	Power Tillers Sold in India(Numbers)
1	1990-91	-	-
2	1991-92	7.68	19.06
3	1992-93	-4.15	14.920
4	1993-94	-3.77	9.33
5	1994-95	18.69	-11.35
6	1995-96	16.06	19.92
7	1996-97	15.47	9.50
8	1997-98	13.69	19.09
9	1998-99	4.40	10.53
10	1999-00	4.16	16.65
11	2000-01	-7.77	-5.16
12	2001-02	-13.68	-15.32
13	2002-03	-22.65	7.74
14	2003-04	12.68	7.19
15	2004-05	30.05	11.59
16	2005-06	18.34	27.58
17	2006-07	20.96	11.15
18	2007-08	-1.79	5.421

19	2008-09	0.14	35.18
20	2009-10	26.89	23.01
21	2010-11	23.79	18.29
22	2011-12	11.47	11.31
23	2012-13	-2.79	-10.47
24	2013-14	17.97	5.25
25	2014-15	-10.04	NA
26	2015-16	-8.86	NA
27	2016-17	36.17	NA

Source: ICAR- Indian Agricultural Statistics Research Institute- Agricultural Research Data Book 2017

Fig.2 Farm Mechainization



Source: Based on Table 2

Tractors

From Table 2 and Figure 2, it can be understood that there has been significant growth in usage of tractors in India during the study period. Especially from 1994-95 to 1999-2000, even though the growth rate has been decreasing, it has remained positive. Then during 2000-01 to 2002-03 the growth rate has been negative. Overall in study period, the growth rate has been worst hit in 2002-03 with -22.65 per cent. Then from 2003-04 to 2011-12, the growth rate was positive except in 2007-08 with minor negative growth of -1.79. Recently, after negative growth in two years in 2014-15 and 2015-16, the growth rate has increased to whopping 36.17 per cent in 2016-17.

Power Tillers

Compared to growth in usage of tractors, the growth in power tillers has not been much impressive. But unlike growth rate of tractors, the power tillers have maintained positive growth in most of the years and also has registered decent level growth rate during the study period. The growth rate of power tillers have been positive from 1991-92 to 1999-2000, except in 1994-95, during which the growth rate was -11.35 per cent. Then in 2000-01, it was -5.16 and in 2001-02 the growth rate reduced to as much as -15.32 per cent. Then after, the power tillers have registered positive growth till 2011-12 and in 2012-13 the growth rate was -10.47 per cent but in 2013-14, the growth rate increased to 5.25 per cent.

Electricity

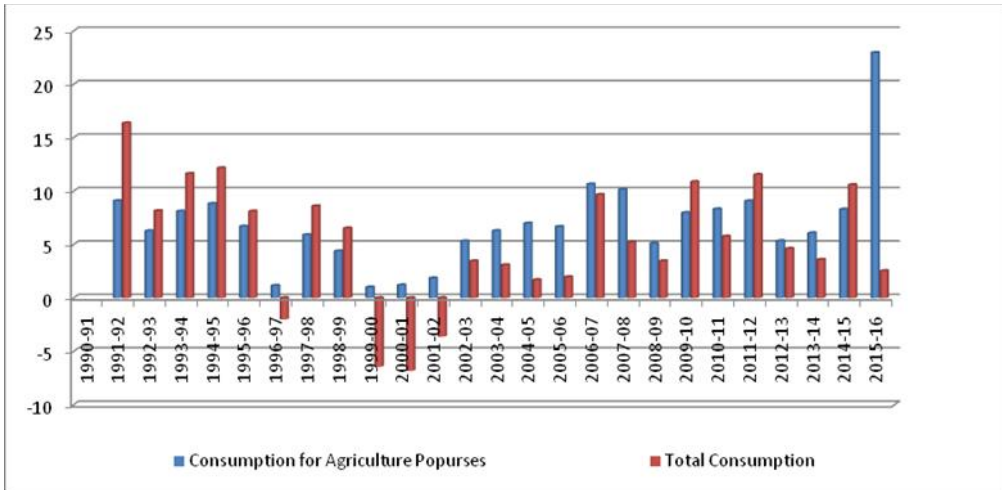
Table 3 Annual Growth Rate of Electricity Consumption for Agriculture Purpose in India during 1990-91 to 2015-16

S.No	Year	Annual Growth Rate of Consumption for Agriculture Purposes	Annual Growth Rate of Total Consumption
1	1990-91	-	-
2	1991-92	9.08	16.36
3	1992-93	6.27	8.14
4	1993-94	8.10	11.63
5	1994-95	8.82	12.167
6	1995-96	6.70	8.10
7	1996-97	1.14	-1.99
8	1997-98	5.90	8.59
9	1998-99	4.37	6.52
10	1999-00	1.00	-6.44
11	2000-01	1.20	-6.82
12	2001-02	1.85	-3.60
13	2002-03	5.31	3.44
14	2003-04	6.28	3.08
15	2004-05	6.98	1.68
16	2005-06	6.6	1.96
17	2006-07	10.64	9.66
18	2007-08	10.14	5.20
19	2008-09	5.09	3.44
20	2009-10	7.97	10.87
21	2010-11	8.31	5.76
22	2011-12	9.07	11.53

23	2012-13	5.33	4.61
24	2013-14	6.07	3.58
25	2014-15	8.29	10.58
26	2015-16	22.95	2.52

Source: ICAR- Indian Agricultural Statistics Research Institute- Agricultural Research Data Book 2017

Fig.3 Growth Rate of use of Electricity for Agriculture Purpose



Source: Based on Table 3

The above table and figure shows the growth rate of consumption of electricity for agricultural purposes and total electricity consumption. The consumption of electricity for agricultural purposes has registered positive growth throughout the study period even when there has been negative growth in total consumption of electricity. The growth rate of electricity for agriculture was lowest during 1999-00 with 1.00 per cent and it was highest during 2015-16 with 22.95 per cent growth. This shows the increased usage of electricity for agricultural purposes especially in recent years.

Fertilizers

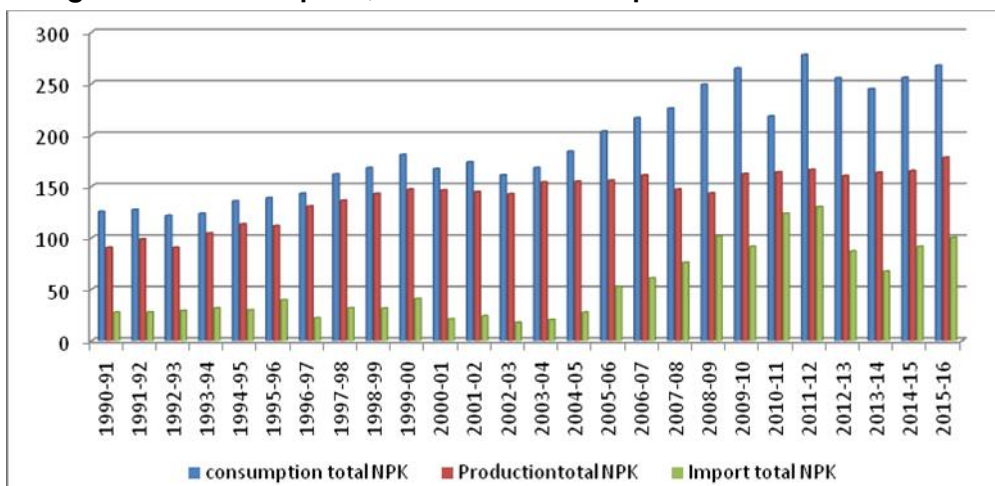
Table 4 Total Consumption, Production and Import of Fertilizers (NPK) in India during 1990-91 to 2015-16

S.No	Year	Total Consumption of NPK(Kg/ha)	Total Production of NPK(Kg/ha)	Total Import of NPK(Kg/ha)
1	1990-91	125.46	90.45	27.58
2	1991-92	127.28	98.63	27.69
3	1992-93	121.53	90.47	29.08
4	1993-94	123.66	104.38	31.67
5	1994-95	135.64	113.35	29.65

6	1995-96	138.77	111.55	39.55
7	1996-97	143.08	130.62	22.06
8	1997-98	161.88	136.24	31.74
9	1998-99	167.98	142.89	31.45
10	1999-00	180.69	147.04	40.75
11	2000-01	167.02	146.32	20.91
12	2001-02	173.6	144.68	23.99
13	2002-03	160.94	142.66	17.57
14	2003-04	167.99	154.04	20.18
15	2004-05	183.98	154.76	27.52
16	2005-06	203.41	155.76	52.53
17	2006-07	216.51	160.94	60.8
18	2007-08	225.7	147.06	75.83
19	2008-09	249.09	143.34	101.51
20	2009-10	264.86	162.21	91.47
21	2010-11	218.22	163.8	123.63
22	2011-12	277.9	166.27	130.02
23	2012-13	255.36	160.24	86.98
24	2013-14	244.82	163.38	67.31
25	2014-15	255.76	165.15	91.35
26	2015-16	267.53	178.1	100.09
	CAGR	3.08%	2.75%	5.29%

Source: Agricultural Statistics at a glance 2016

Fig.4 Total Consumption, Production and Import of Fertilizers in India



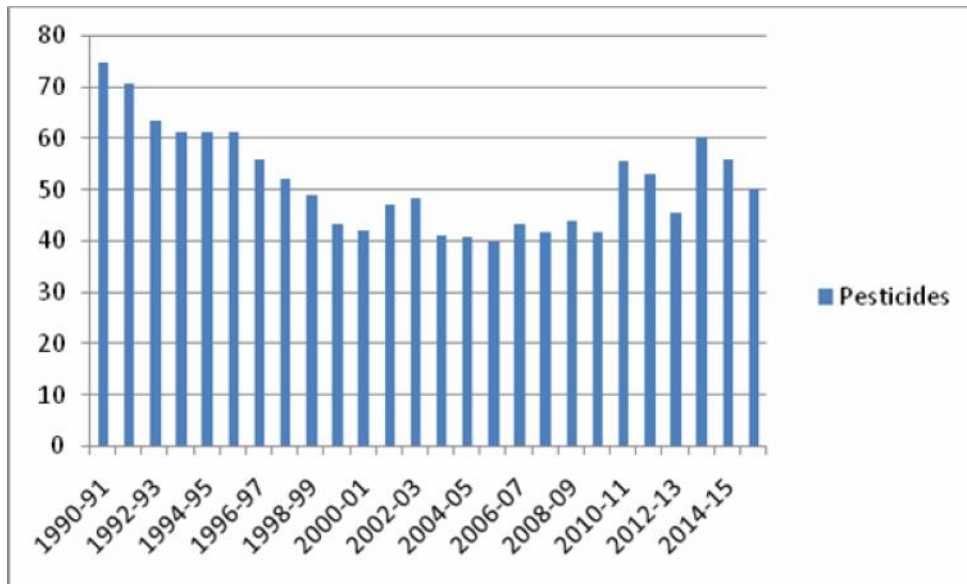
Source: Based on Table 4

The above table and figure 4 shows the total consumption, production and imports of fertilizer in India during 1990-91 to 2015-16. During the entire study period, the consumption of fertilizer was more than its production and therefore the gap between demand and supply was compensated through import of fertilizer. There has been negative growth in consumption in six years during the study period i.e., 1992-93, 2000-01, 2002-03, 2010-11, 2012-13 and 2013-14. During 26 years of study period, production and imports of fertilizer has registered negative growth in eight years. Overall, the CAGR has been 3.08 per cent, 2.75 per cent and 5.29 per cent for consumption, production and import respectively.

Table 5 Consumption of Pesticides (Technical Grade) and its Annual Growth Rate in India during 1990-91 to 2015-16

S.No	Year	Pesticides (Technical Grade)(in tonnes)	Growth Rate (%)
1	1990-91	75.00	-
2	1991-92	70.79	-5.61
3	1992-93	63.65	-10.09
4	1993-94	61.36	-3.60
5	1994-95	61.36	0.00
6	1995-96	61.26	-0.16
7	1996-97	56.11	-8.41
8	1997-98	52.24	-6.90
9	1998-99	49.16	-5.90
10	1999-00	43.34	-11.84
11	2000-01	42.02	-3.05
12	2001-02	47.02	11.90
13	2002-03	48.35	2.83
14	2003-04	41.02	-15.16
15	2004-05	40.67	-0.85
16	2005-06	39.77	-2.21
17	2006-07	43.41	9.15
18	2007-08	41.64	-4.08
19	2008-09	43.86	5.33
20	2009-10	41.82	-4.65
21	2010-11	55.54	32.81
22	2011-12	52.98	-4.61
23	2012-13	45.62	-13.89
24	2013-14	60.28	32.14
25	2014-15	56.12	-6.90
26	2015-16	50.41	-10.17

Source: ICAR- Indian Agricultural Statistics Research Institute- Agricultural Research Data Book 2017

Fig.5 Growth Rate of Pesticides

Source: Based on Table 5

The Table 5 and Figure 5 show the consumption of pesticides in Indian Agriculture Sector during 1990-91 to 2015-16. The consumption of pesticides shows negative growth continuously for ten years from 1990-91 to 2000-01. The pesticides consumption was 75 tonnes in 1990-91 and it reduced to 42.02 tonnes in 2000-01. Then the consumption increased to 47.02 tonnes in 2001-02 and 48.35 tonnes in 2002-03. Thereafter there has been wide fluctuation in consumption of pesticides with positive and negative growth following each other. Overall, the consumption of pesticide during the study period reduced from 75 tonnes in 1990-91 to 50.41 tonnes in 2015-16.

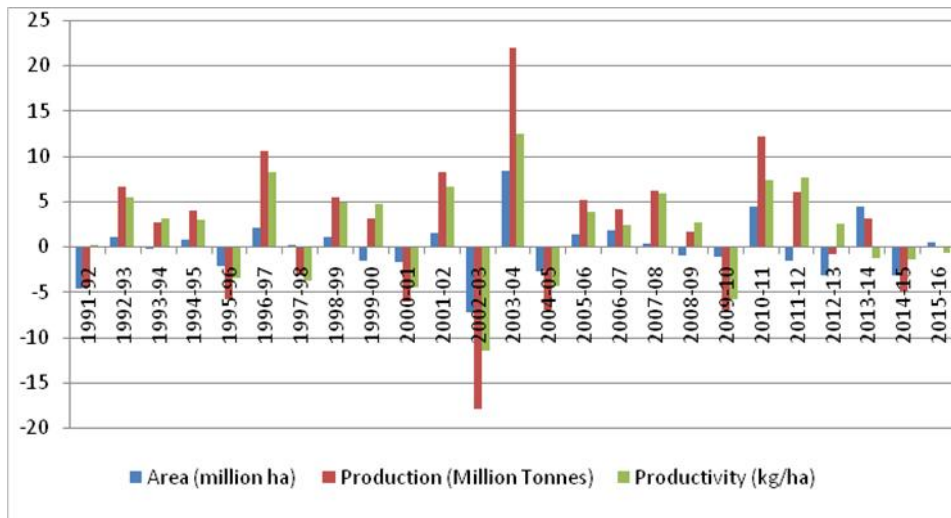
Table 6 Growth Rate of Area, Production and Productivity of Total Food Grains in India (1990-1991 to 2015-16)

S.No	Year	Area (%)	Production (%)	Productivity (%)
1	1991-92	-4.67	-4.54	0.145
2	1992-93	1.05	6.59	5.427
3	1993-94	-0.32	2.66	3.020
4	1994-95	0.77	3.93	2.998
5	1995-96	-2.18	-5.79	-3.558
6	1996-97	2.12	10.54	8.249
7	1997-98	0.22	-3.16	-3.841
8	1998-99	1.06	5.43	4.832
9	1999-00	-1.64	3.04	4.733
10	2000-01	-1.67	-6.19	-4.577

11	2001-02	1.42	8.15	6.642
12	2002-03	-7.25	-17.89	-11.476
13	2003-04	8.41	21.98	12.508
14	2004-05	-2.73	-6.96	-4.343
15	2005-06	1.27	5.16	3.814
16	2006-07	1.73	4.16	2.391
17	2007-08	0.29	6.21	5.923
18	2008-09	-0.99	1.60	2.634
19	2009-10	-1.22	-6.98	-5.815
20	2010-11	4.40	12.09	7.341
21	2011-12	-1.52	6.05	7.668
22	2012-13	-3.25	-0.83	2.454
23	2013-14	4.42	3.08	-1.315
24	2014-15	-3.15	-4.91	-1.475
25	2015-16	0.48	0.08	-0.676

Source: Handbook of Statistics on the Indian Economy- Reserve Bank of India 2015-16

Fig.6 Growth Rate of Total Food grains



Source: Based on Table 6

Area

The Table 6 and Figure 6 show the growth rate of variables of area under cultivation, production and productivity of food grains in India during the post economic reform periods. The growth rate of area under cultivation of food grains starts with a negative growth of -4.67 Million Hectare in 1991-92. Thereafter there has been minor fluctuation till 2001-02 which ranges between -2.18 to 2.12 per cent. Then in

2002-03 the growth rate fell rapidly to -7.25 per cent but in 2003-04 it increased to 8.41 per cent growth rate. In 2004-05 the growth rate reduced to -2.73 per cent and then there was positive and negative growth one after the other year till 2015-16.

Production

The changes in growth rate of production of food grains were much higher than the area under cultivation. The growth rate of production starts with negative growth of -4.54 per cent and this might be due to decrease in area under cultivation which also registered negative growth of -4.54 per cent in 1991-92. It is also important to note that throughout the study period, whenever there was negative growth rate in production of food grains, the area under cultivation also has witnessed negative growth rate. During the study period, the growth rate was lowest in 2002-03 with -17.89 per cent and the highest growth rate was in the next year 2003-04 with 21.98 per cent.

Productivity

The growth rate of productivity was positive in the initial years of study period from 1991-92 to 1994-95 and then there has been fluctuations in growth rate of productivity. Similar to area under cultivation and production, the growth rate of productivity was lowest in 2002-03 with -11.476 per cent and was highest in 2003-04 with 12.508 per cent. In 2004-05, there was -4.343 per cent of negative growth rate and from 2005-06 to 2012-13 there was considerable positive growth in productivity except in 2009-10 which registered negative growth. Recently, the last three years of study period i.e., 2013-14 to 2015-16 has registered negative growth in productivity mainly due to drought and lack of sufficient rain fall.

Conclusion

The present study has discussed the input use in agriculture sector at the national level. The major findings of the present study are agriculture inputs such as certificate/quality seeds, farm mechanization, electricity, fertilizer and pesticides consumption in Indian agriculture has increased year by year due to improved use of modern technology. Besides basic inputs of high productivity, land preparation, irrigation, fertile land and pest control in agriculture, the sector also requires adequate and quality inputs which include seeds, electricity, farm equipment, fertilizer pesticides, agriculture finance support and highly professional extension services. The study suggests that based on the findings, the timely availability of agriculture inputs like adequate irrigation facilities, short period and new variety of seeds, financial support, knowledge of mechanization, enough electricity voltage and timely availability of relevant chemical fertilizer, pesticides etc., will help in the development of input use in Indian agriculture and thereby agriculture sector as a whole and the economy as well.

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