

Research Paper

# Analysis of Growth Trends of Production and Consumption of Fertilizer Nutrients in India

Nitin Sharma<sup>1\*</sup>, R.S. Pannu<sup>2</sup>, D.P. Malik<sup>1</sup>, Veer Sain<sup>1</sup> and Ratika Kayastha<sup>3</sup>

<sup>1</sup>Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar, India

<sup>2</sup>Ex. Regional Director, CCS HAU Regional Research Station, Karnal, India

<sup>3</sup>MS Swaminathan School of Agriculture, Shoolini University, Solan, Himachal Pradesh, India

\*Corresponding author: nitingautam2720@gmail.com (ORCID ID: 0000-0002-2351-6398)

Received: 12-02-2022

Revised: 29-05-2022

Accepted: 09-06-2022

## ABSTRACT

The present study was carried out to determine the trend in production and consumption in India from 1990-91 to 2019-20. The study had been divided into three phases viz. I period (1990-91 to 1999-2000), II period (2000-01 to 2009-10) and III (2010-11 to 2019-20). The compound growth rates (CGRs) of production and consumption were estimated as for three phases as well as for the overall period. The consumption of fertilizer is continuously increased year by year. Only nitrogen fertilizer shows positive growth i.e., 0.35 per cent. The annual growth rate of consumption of Nitrogen, phosphatic and potassic fertilizer is 3.04, 3.77 and 4.09 per cent respectively between 1990-91 to 2018-19. The highest growth of consumption has been registered in potassic fertilizer. However, after 2010-11 there is a negative trend and considerable decline in fertilizer use. The growth rate falls to -0.21 per cent, with phosphatic fertilizer decline at -1.29 per cent and potassic fertilizer at -0.31 per cent.

## HIGHLIGHTS

- ① There is increasing trend in the consumption of total fertilizer nutrients.
- ② Annual growth rate of production is 2.02 which is very slow as compared to the consumption.
- ③ The annual growth rate of consumption of Nitrogen, phosphatic and potassic fertilizer is 3.04, 3.77 and 4.09 per cent, respectively between 1990-91 to 2018-19. The highest growth of consumption has been registered in potassic fertilizer.

**Keywords:** Fertilizer consumption, trend, gap analysis, production, fertilizer nutrient

Our population is increasing very fast, food is also needed in more quantity for more population, as a result, agricultural products will be in more demand. While on the other hand the land of agriculture is decreasing (Venugopal, 2004). Agricultural production can be increased either by bringing more area under cultivation or by increasing the productivity. In the Indian context, land is becoming a shrinking resource for agriculture due to the competitive demand for its use. However, increasing agricultural output almost depends completely on increasing land productivity.

Fertilizer is an important input in agricultural for enhancing the productivity of land (Pani *et al.*

2021). The use of the right amount of chemical fertilizer at the right time, as well as the cultivation of high yielding or improved seed varieties and efficient water management, resulted in a significant improvement in agricultural output (Prasad, 2009). In order to meet the country's food requirement, the government encouraged the use of chemical fertilizers in the early years of independence by subsidizing chemical fertilizers. There is a long-term

**How to cite this article:** Sharma, N. and Pannu, R.S., Malik, D.P., Sain, V. and Kayastha, R. (2022). Analysis of Growth Trends of Production and Consumption of Fertilizer Nutrients in India. *Econ. Aff.*, 67(03): 189-196.

**Source of Support:** None; **Conflict of Interest:** None



link between fertilizer usage and food grain yield. As a result, fertilizer usage grew more rapidly in the early years. Fertilization strategies that incorporate the application of macronutrients and micronutrients according to crop requirements might enhance fertilizer efficiency.

Variances in fertilizer usage between districts and states can be due to differences in basic agro-climatic conditions, unequal irrigation facility development, infrastructure development, fertilizer supply, and the availability or non-availability of appropriate production technologies. Irrigation and high yielding or improved seed varieties are the two most important elements that influence fertilizer consumption (Chadha and Meena, 2019). However, there are other factors also which affect the fertilizer consumption such as supply of fertilizer, availability of credit for input purchase and the relative prices of fertilizers are also influence the fertilizer consumption (Zhou *et al.* 2010), (Jadhav and Ramappa, 2021).

Given the importance of fertilizers in agriculture, the fundamental challenge for the future is not whether or not to raise fertilizer consumption, but rather how to accelerate fertilizer consumption growth while ensuring maximum efficiency in farm production. It is necessary to examine past experience in order to understand the opportunities for boosting fertilizer usage in the future. Thus, to check the past trend in consumption and production of fertilizer in India this study entitled "Trends in Production and consumption of fertilizer nutrients in India" was conducted.

## MATERIALS AND METHODS

The study utilizes the time series data of production and consumption of fertilizer nutrient in India for the period 1990-91 to 2019-20. Mainly secondary data is used to achieve the objective of current study. The whole period i.e., from 1990-91 to 2019-20 is divided into three sub periods viz. I period (1990-91 to 1999-2000), II period (2000-01 to 2009-10) and III (2010-11 to 2019-20). The data was collected from Indian fertilizer scenario 2018, Agricultural Statistics at a Glance 2020 and IndiaStat.com

The growth rate is helpful to examine the tendency of the variable to increase, decrease or stagnate over time. Regression coefficient (b) can be calculated from the linear growth rate. The linear growth rate was computed using the flowing formula:

$$Y = a + bt$$

Where,  $Y$  = production and consumption of fertilizer  
 $a$  = Intercept,  $b$  = regression coefficient,  $t$  = time period in year

The compound growth rates (CGRs) of production and consumption were estimated as follows:

$$CAGR = \text{Antilog} (b - 1) \times 100$$

Where,  $b$  is the regression coefficient.

## RESULTS AND DISCUSSION

### Fertilizer Production in India

The production of fertilizer nutrient for the period 1990-91 to 2019-20 is presented in Table 1. The production of nitrogen showed an increasing trend in which production increased from 6993 thousand tonnes to 13685 thousand tonnes, respectively from 1990-91 to 2019-20. Similarly, Phosphorous production also increased in same period from 2051 thousand tonnes to 4791 thousand tonnes.

The growth rate of fertilizer production in nutrients has been presented in table 1, which depict that the production of Nitrogen nutrient was continuously increasing from base year i.e., 1990-91 in 2019-20; the production has been boosted to 47.76 per cent from the base period. In the case of phosphorus 56.57 per cent increase has been observed in 2019-20 from 1990-91.

The Compound annual growth rate of nitrogen and phosphorus production from the period 1990-91 to 2019-20 in India has increased with an annual growth rate of 2.20 per cent and by 2.61 per cent, respectively.

### Total Fertilizer Consumption Trend in India

The consumption of fertilizer is continuously increasing year by year. Table 2 revealed that the total consumption of nutrients was 12546 tonnes in 1990-91 and it increased to 27375.20 tonnes in 2018-19 with the annual growth rate of 3.04 per cent. The annual growth rate of consumption of Nitrogen, phosphatic and potassic fertilizer is 3.04, 3.77 and 4.09 per cent respectively between 1990-91 to 2019-20. The highest growth of consumption has been registered in potassic fertilizer.

**Table 1:** Growth rate of fertilizer production in nutrient (Production- thousand tonnes)

Year	Nitrogen		Phosphorous	
	Fertilizer Production in nutrient	Percentage change over base period (1990-91)	Fertilizer Production in nutrient	Percentage change over base period (1990-91)
1990-1991	6993		2051	
1995-1996	8769	20.25	2594	20.93
2000-2001	10943	36.10	3734	45.07
2005-2006	11333	38.30	4203	51.20
2010-2011	12179	42.58	4371	53.08
2015-2016	13416	47.88	4394	53.32
2019-2020	13685	48.90	4791	57.19
<b>Annual growth rate</b>				
1990-91 to 2018-19	2.156		2.56	
1990-91 to 1999-00	5.38		5.36	
2000-01 to 2009-10	0.83		0.62	
2010-11 to 2019-20	1.46		2.08	

Source: Indiatat for India, (GOI), Department of Agriculture, Cooperation & Farmers Welfare.

**Table 2:** Growth rate of fertilizer consumption in India (Consumption- thousand tonnes)

Year	Nitrogen (N)	Phosphorus (P)	Potash (K)	Total Fertilizer
1990-1991	7997	3221	1328	12546
1995-1996	9823	2898	1156	13877
2000-2001	10920	4215	1568	16703
2005-2006	12723	5204	2413	20340
2010-2011	16558	8050	3514	28122
2015-2016	17372	6979	2402	26753
2019-2020	19100.5	7661.8	2607	29369.3
<b>Annual growth rate</b>				
1990-91 to 2019-20	3.02	3.71	3.92	3.27
1990-91 to 1999-00	4.682	4.330	2.804	4.409
2000-01 to 2009-10	4.792	6.419	10.287	5.818
2010-11 to 2019-20	0.35	-1.29	-0.31	-0.21

Source: Indiatat for India, (GOI), Department of fertilizer Department of Agriculture, Cooperation & Farmers Welfare.

However, after 2010-11 there is a negative trend and considerable decline in fertilizer use. The growth rate falls to -0.21 per cent, with phosphatic fertilizer decline at -1.29 per cent and potassic fertilizer at -0.31 per cent. Only nitrogen fertilizer shows positive growth i.e., 0.35 per cent.

### Trend in the consumption of fertilizer nutrient in India

The estimates of a linear trend in consumption of nitrogen, phosphorus and potash in India is shown in Fig 1-3. The fig revealed that the value of regression coefficient 'b' associated with time element in India was positive i.e., 377.48. The

positive value of 'b' indicated that the consumption of nitrogen had increased over the period 1990-91 to 2019-20. Therefore, the shape of the trend in consumption is linear upwards indicating that there was an increase in the consumption of nitrogen year by year.

The Fig. 2 revealed that the value of regression coefficient 'b' associated with time element in India was positive i.e., 176.61. The positive value of 'b' indicated that the consumption of nitrogen had increased over the period 1990-91 to 2019-20. Therefore, the shape of the trend in consumption is linear upwards.

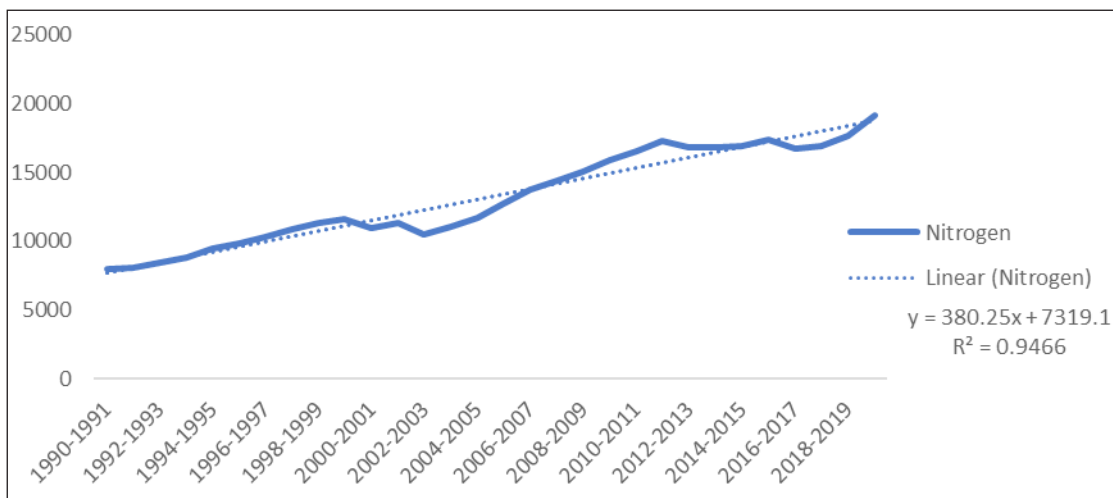


Fig. 1: Trend in nitrogen consumption in India (1990-2020)

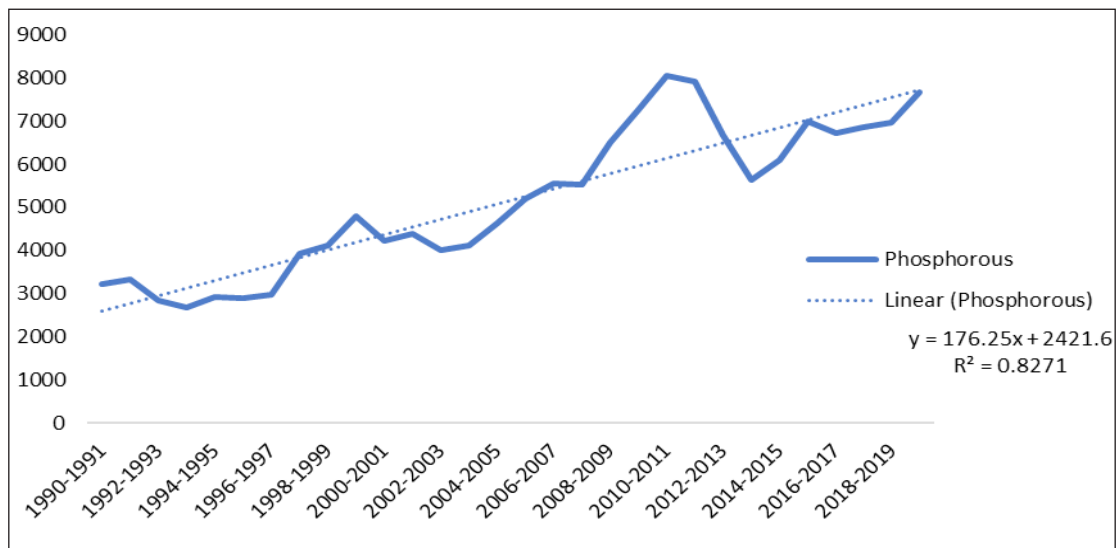


Fig. 2: Trend in phosphorus consumption in India

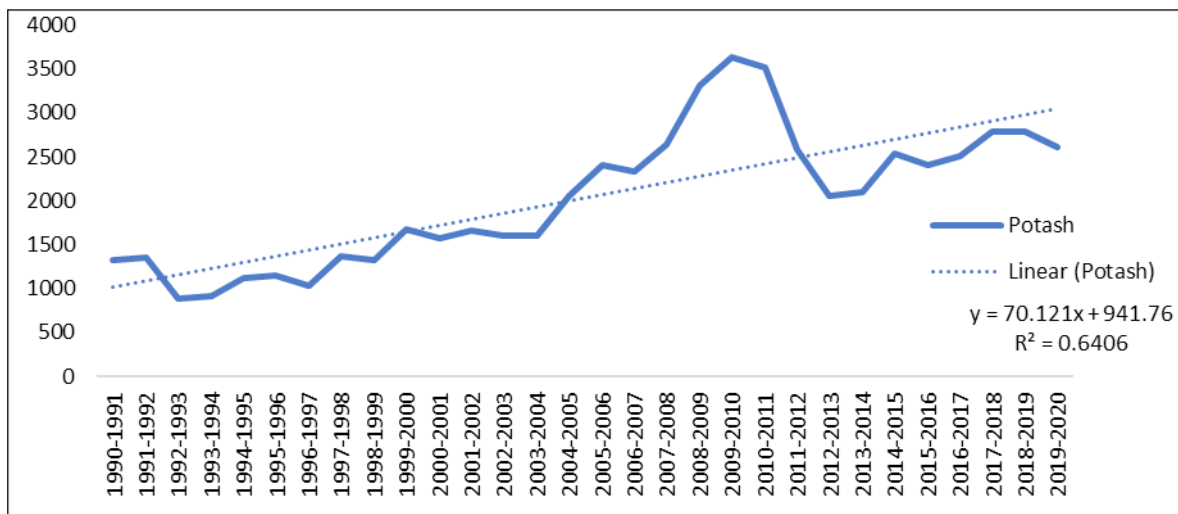


Fig. 3: Trend in potash consumption in India

Fig. 3 revealed that the value of regression coefficient 'b' associated with time element in India was positive i.e., 73.36. The positive value of 'b' indicated that the consumption of nitrogen had increased over the period 1990-91 to 2019-20. Therefore, the shape of the trend in consumption is linear upwards.

### Trend in the consumption of total NPK in India

In Fig. 4 trend of total fertilizer, consumption is presented which shows an increasing trend in the consumption of total nutrients. Total fertilizer nutrient consumption was around 12546 tonne in 1990-91 and 54.17 per cent consumption has

been increased in 2018-19 i.e. 27375.2 tonne with an annual growth rate of 3.04 per cent. The Fig. 4 revealed that the value of regression coefficient 'b' associated with time element in India was positive i.e., 627.45. The positive value of 'b' indicated that the consumption of nitrogen had increased over the period 1990-91 to 2019-20. Therefore, the shape of the trend in consumption is linear upwards.

### Gap analysis between production and consumption of fertilizer

As shown in Fig. 5 there is an increasing trend in both production and consumption of Nitrogen fertilizer but we can see that the gap between the

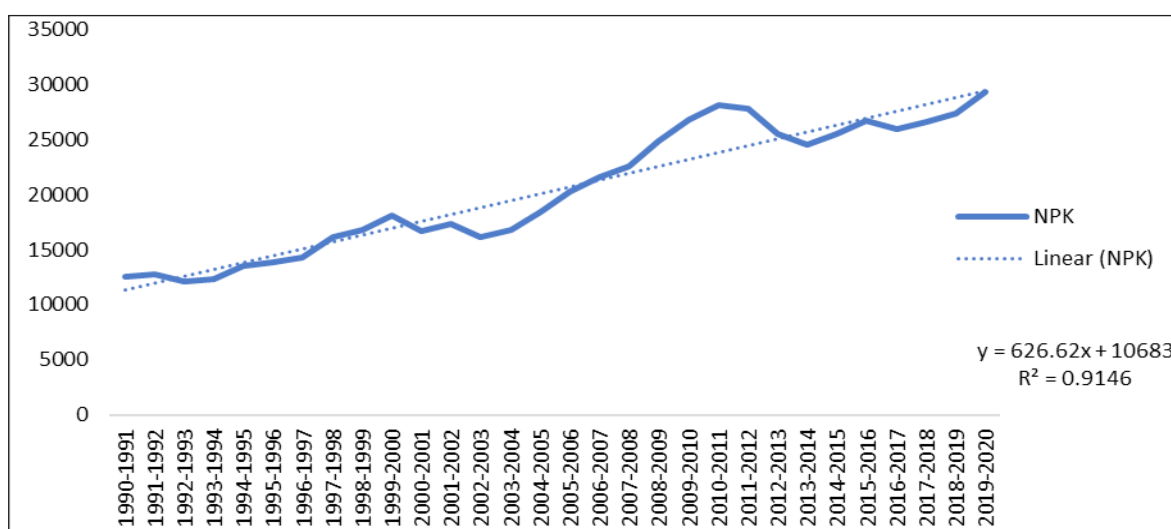


Fig. 4: Trend in total NPK consumption in India

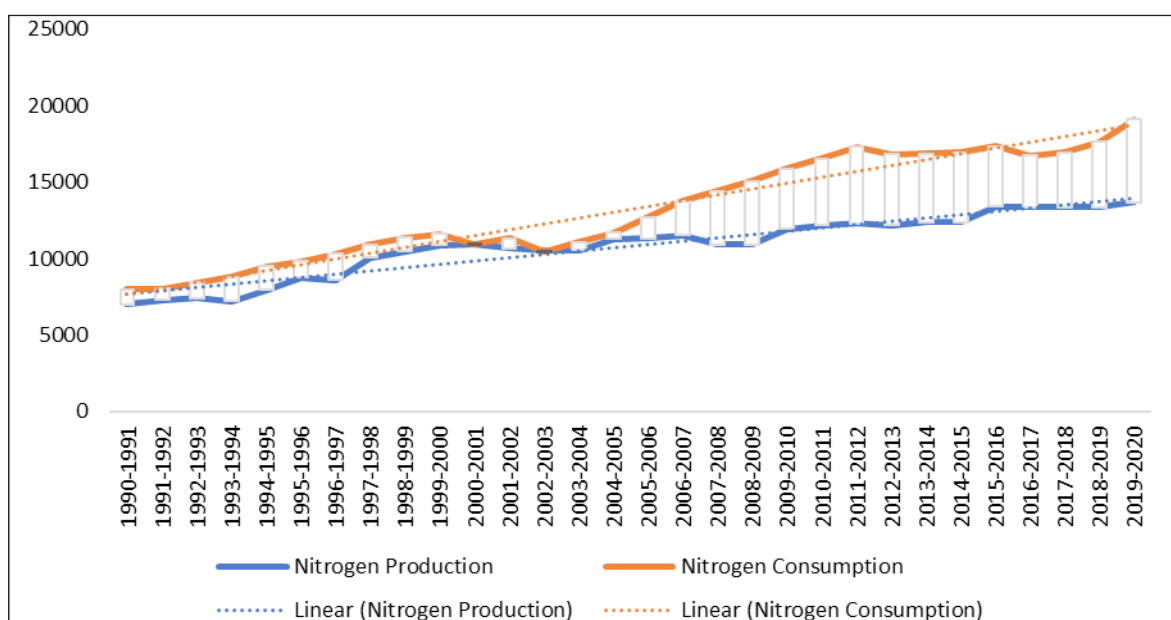


Fig. 5: Gap analysis of Production and consumption level of Nitrogen fertilizers

production and consumption is also increased. Only in 2000 and 2002 production meet to consumption level. As shown in the Fig. 5 there is too much fluctuation in the gap between consumption and production there is an increasing and decreasing trend in the gap. As we can see in table 1 and table 2 the annual growth rate of consumption of nitrogen is 3.04 per cent where the Annual growth rate of production is 2.02 which is slow as compared to the consumption this is the reason for the increasing gap between the consumption and production.

Consumption and production of Phosphatic fertilizer also follow the same pattern as followed in nitrogen fertilizer. In Fig. 6 we can see that in consumption and production there is an increasing trend and the

gap between production and consumption is also increasing. Production of phosphors is increased at the rate of 2.61 per cent per annum while consumption grew at the rate of 3.04 per cent per annum as shown in table 1 and 2.

### NPK consumption Ratio

NPK consumption ratio of India since 1990-91 has been presented in table 3 the ideal ratio for NPK is considered to be 4:2:1. Excepted from few years actual ratio never be closed to ideal in 1990-91 ratio was 6:2.4:1. In 2009-10 it was closer to the ideal one but after that, the consumption of nitrogen fertilizer is increased and the ratio is also disturbed.

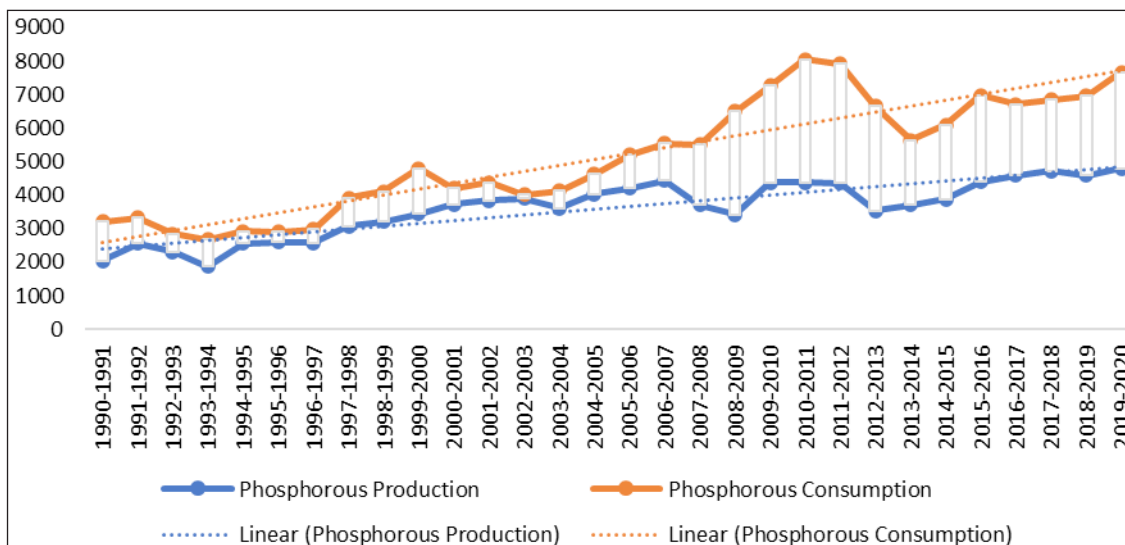


Fig. 6: Gap analysis of Production and consumption level of Phosphatic fertilizers (P)

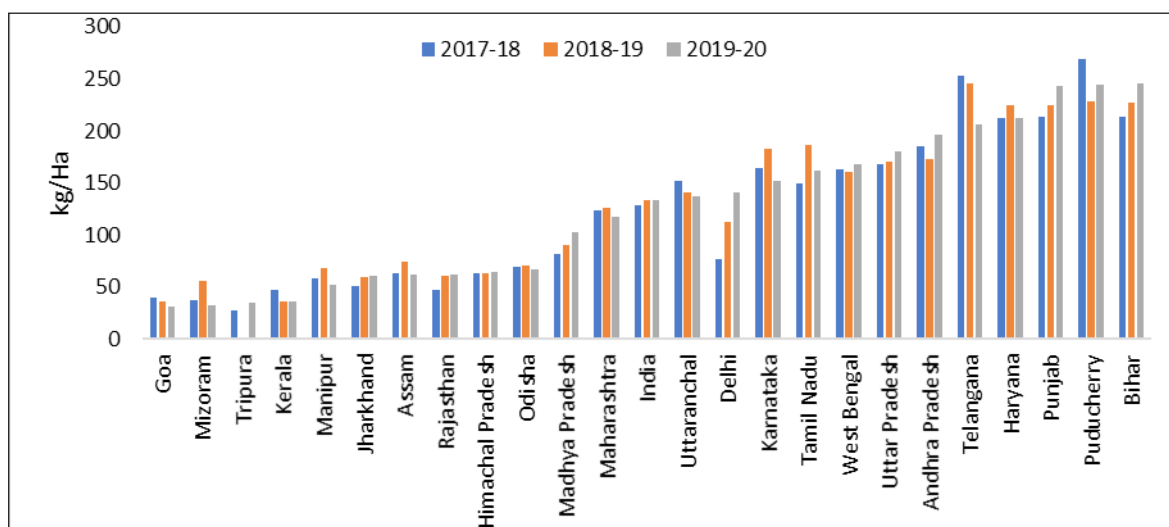


Fig. 7: State-wise consumption of fertilizer per hectare during 2017-20

**Table 3:** NPK consumption ratio

Year	N:P <sub>2</sub> O <sub>5</sub> :K <sub>2</sub> O		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1990-1991	6	2.4	1
1991-1992	5.9	2.4	1
1992-1993	9.5	3.2	1
1993-1994	9.7	2.9	1
1994-1995	8.5	2.6	1
1995-1996	8.5	2.5	1
1996-1997	10.0	2.9	1
1997-1998	7.9	2.9	1
1998-1999	8.5	3.1	1
1999-2000	6.9	2.9	1
2000-2001	7.0	2.7	1
2001-2002	6.8	2.6	1
2002-2003	6.5	2.5	1
2003-2004	6.9	2.6	1
2004-2005	5.7	2.2	1
2005-2006	5.3	2.2	1
2006-2007	5.9	2.4	1
2007-2008	5.5	2.1	1
2008-2009	4.6	2	1
2009-2010	4.3	2	1
2010-2011	4.7	2.3	1
2011-2012	6.7	3.1	1
2012-2013	8.2	3.2	1
2013-2014	8.0	2.7	1
2014-2015	6.7	2.4	1
2015-2016	7.2	2.9	1
2016-2017	6.7	2.7	1
2017-2018	6.1	2.5	1
2018-2019	6.3	2.5	1
2019-2020	7.3	2.9	1

## Intensity of fertilizer use

### Per Hectare consumption of fertilizer

Total fertilizer consumption is not a good indicator for analyzing fertilizer Trends it would be more appropriate to the exam in trends in fertilizer consumption per hectare of the gross cropped area.

The all-India average consumption of fertilizer per hectare also increased substantially over the years but was accompanied by wide inter-state variability. The all-India average consumption of fertilizers has increased from 69.84 kg per hectare in 1991-92 to 133.44 kg per hectare in 2019-20. There is, however, wide inter-state variability in consumption of fertilizers, with states like Punjab, Haryana and Andhra Pradesh having per hectare consumption of over 200 kg and other states, like Odisha, Kerala, Madhya Pradesh, Jharkhand, Chhattisgarh and Rajasthan, reporting less than 100 kg per hectare consumption. The consumption of nutrients per hectare of gross cropped area for the major state is presented in table 4.

The highest consumption of fertilizer per hectare was found in Bihar, followed by Pondicherry, Punjab and Haryana in 2019-20. If we talk about the last year 2018-19, Telangana had the highest consumption, followed by Bihar than Punjab and Haryana. In India, the consumption of fertilizers has increased year after year since last years. Puducherry is the

**Table 4:** Per Hectare consumption of fertilizer in major states of India

States/UTs	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Andaman and Nicobar Islands	53.5	50.6	40	28.2	29.1	—	34.6	20	16.1	0
Dadra & Nagar Haveli	53.3	45.9	40	57.6	67.9	56.1	73.1	31.7	13.9	0
Daman & Diu	152.5	23.3	56.7	26.2	—	41.1	41.2	35.9	38.6	0
Goa	46.1	46.5	33	53.5	46.9	49.1	144.6	39.1	36.5	31.21
Mizoram	45.5	12.3	15.2	27.7	—	18.2	22.9	36.8	55.9	31.97
Tripura	51.6	50.2	69.1	50.7	41.2	43	46.2	27.4	0	34.71
Kerala	106.2	113.2	106.9	62.5	40.6	43.8	35.1	47.6	36.4	36.49
Jammu and Kashmir	105.9	86.2	94.4	—	—	63.8	61.2	70.7	61.9	40.85
Manipur	27.9	21.9	35.1	31.8	44.4	41.6	34.7	58	68.3	51.9
Jharkhand	90.2	136.6	119.3	37.7	38.4	54.5	43.6	50.6	59.8	60.32
Assam	67.6	66	65.7	88.8	90.2	44.8	74.6	63.5	73.7	61.51
Rajasthan	60.6	55.3	56.1	45.9	54.5	61.6	51.9	47.4	60.8	62.28
Himachal Pradesh	59.1	54.1	50.3	51.3	54	57.1	61.4	63.2	63.3	64.24
Odisha	59.1	103.7	96.7	57.1	57.5	62.6	62.6	68.7	70.6	67.19
Madhya Pradesh	87.2	84	80.8	80.5	78.2	83.6	79.6	82	90.3	102.49
Chhattisgarh	101.1	105.2	105.7	86.5	92.1	100.1	102.6	86.8	86.3	111.26

Maharashtra	152.8	137.9	113	117.7	125.6	122.5	114.8	123.9	126	117.74
Gujarat	174.1	132.4	106.5	119.6	132.8	124.5	128	144.7	135.5	130.75
Uttaranchal	134.5	147	135.7	164.1	160	169.2	169.3	152.1	140.7	136.46
Delhi	9.1	14.9	24.5	33	82.3	57.5	76.5	77	112	140.97
Karnataka	164	193.7	130.3	153.7	176.2	175	166.7	164.5	183.2	152.21
Tamil Nadu	220.6	214.8	184.2	143.1	163.7	175.2	161	149.5	186.4	161.82
West Bengal	164.9	172.9	161.2	126.9	150.9	173.8	158.3	162.9	161.1	167.9
Uttar Pradesh	174.3	165	180.1	138.4	150.5	155.5	154.3	168.2	170.1	180.37
Andhra Pradesh	278.4	242.9	199.7	220.1	237.2	225.7	186.3	184.8	173.3	195.81
Telangana	—	—	—	213	231.4	268.9	252.6	253	245.3	206.52
Haryana	213.8	220.1	211.8	206.9	221.4	220.4	206.7	212.9	224.5	212.86
Punjab	242.7	242.6	250.6	219.4	227.5	248.6	232.6	213.8	224.5	243.06
Puducherry	918.1	798.9	607.3	637.7	284.7	262.2	289.2	268.9	227.9	244.77
Bihar	180.6	180.5	196.3	169.9	178.7	220.2	196.9	213	227.3	245.25
India	146.3	142.3	130.8	118.5	127.5	130.7	124.4	127.9	133.1	133.44

only union territory where fertilizer consumption has come down in the last few years.

## SUMMARY AND CONCLUSION

From the study, an increasing trend in production and consumption of fertilizer nutrient is observed. However, after 2010-11 there is a negative trend and considerable decline in fertilizer use. The growth rate falls to -0.21 per cent, with phosphatic fertilizer decline at -1.29 per cent and potassic fertilizer at -0.31 per cent. Only nitrogen fertilizer shows positive growth i.e., 0.35 per cent. Domestic production of fertilizer nutrient is unable to meet the consumption of nutrients. The gap between the production and consumption is also increased. Only in 2000 and 2002 production meet to consumption level.

The all-India average consumption of fertilizer per hectare also increased substantially over the years but was accompanied by wide inter-state variability. The all-India average consumption of fertilizers has increased from 69.84 kg per hectare in 1991-92 to 133.44 kg per hectare in 2019-20. The highest consumption of fertilizer per hectare was found in Bihar, followed by Pondicherry, Punjab and Haryana in 2019-20.

## REFERENCES

- Agricultural Statistics at a Glance. 2020. Directorate of Economics and Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, New Delhi.
- Chadha, D. and Meena, G.L. 2019. Factors Affecting Fertilizer Consumption in Rajasthan. *Econ. Aff.*, **64**(3): 547-551.
- FAI, *Fertilizer Statistics* 2015-16. 'The Fertilizer Association of India, New Delhi
- Indian Fertilizer Scenario. 2018. Economics and Statistics Wing, Department of Fertilizers, Ministry of Chemicals & Fertilizers, New Delhi.
- Jadhav, V. and Ramappa, K.B. 2021. Growth & Determinants of Fertilizer Consumption in India: Application of Demand and Supply Side Models. *Economic Affairs*, **66**(3): 01-07.
- Pani, S.K., Jena, D., Subudhi, R. and Rath, J.P. 2021. Nitrogen Fertilizer Use in Agriculture Among Marginal and Small Farmers in India: Review of Important Drivers. *Int. J. Modern Agri.*, **10**.
- Venugopal, P. and Venugopal, P. 2004. *State of the Indian Farmer: A Millenium Study: 8. Input Management*. Academic Foundation.
- Zhou, Y., Yang, H., Mosler, H.J. and Abbaspour, K.C. 2010. Factors affecting farmers' decisions on fertilizer use: A case study for the Chaobai watershed in Northern China. *Consilience*, (4): 80-102.