

# **Original Research Article**

## **Growth and instability of fertilizer consumption in Haryana**

### **Abstract**

The present study was undertaken with a view to assess the growth in fertilizer consumption and instability by using the fertilizer consumption data for the period 1990-91 to 2019-20 and analyses by exponential growth model. The periods of study were divided into four sub periods viz. Period-I (1990-91 to 1999-00), Period-II (2000-01 to 2009-10), Period-III (2010-11 to 2019-20) and Overall period (1990-91 to 2019-20) for the meaningful elucidation of results. NPK consumption in Haryana across four divisions, during period-I, period-II and period-III was found positive except for phosphorus in period-III. Among all the fertilizer, higher growth was noticed in potash and has highest variability as compared to other fertilizer nutrient. The variability in consumption of different nutrients (N, P and K) in Haryana has shown that during period-I, II, III and overall nitrogen consumption was more stable, while, potash consumption was highly unstable during all the period.

Key word – Fertilizer, consumption, Haryana, instability

### **Introduction**

Agriculture plays the most important role in Indian society and its economy as well. The significance of agriculture in India arises from the fact that the development of agriculture is an essential condition for the development of a rational economy (Mala, 2013). India made impressive gains in the field of agricultural production and harvested a record in food grains production of 230 million tonnes during 2007-2008. The introduction of the green revolution, modernization of agriculture, encouragement of research and extension in agriculture are some of the factors contributing to this growth (Kumar and Indira, 2017). The world's population is expected to grow by one billion people, reaching 9.6 billion by 2050 (United Nations, 2012). Indian Population will likely reach 1.67 billion by 2050 (United States, Census Bureau, 2014). Food grain demand in India is expected to exceed 335 million tonnes (MT) by 2025, according to reports (NITI Aayog, 2018). Today the most challenging task for the country is to maintain a balance between increasing population and agricultural production to feed the growing masses of the country (Chadha *et al.*, 2019). The role of chemical fertilizers for increased agricultural production, in particular in developing countries, is well established (Sharma and Thaker, 2011). The requirement of fertilizer has been the demand of time to increase food grain productivity (Pathak *et al.*, 2014).

Indian agriculture has made remarkable progress in the last few decades, especially after the introduction of the Green Revolution and the high yielding variety seeds, fertilizers, pesticides and expansion of irrigation facilities are responsible for the higher production and productivity in the country (Kumar and Akshu, 2017). Fertilizers in the broadest sense are products that improve

the levels of available plant nutrients and/or the chemical and physical properties of soil, thereby directly or indirectly enhancing plant growth, yield, and quality. Plants' nutrients supply from the chemical fertilizer is the key to increasing agriculture production by enhancing land productivity (Jaga and Patel, 2012). Chemical fertilizer was identified as one of the three most important factors, along with seed and irrigation, for raising agricultural production and sustaining food self-sufficiency in India (Chand, 2009).

With 27.30 million tonnes consumed in 2019, India is the world's second-largest fertiliser producer following China (Praveen et al., 2020). However, India's average fertiliser usage rate remains significantly lower than that of the majority of other countries. In 2019, nitrogen accounted for more than 64% of total fertiliser nutrient intake, while phosphorus and potash consumptions were 25.45 and 10.15 per cent, respectively. In Punjab, Haryana, Andhra Pradesh, and Tamil Nadu, fertiliser application per acre were comparatively higher, but in Rajasthan, Orissa, and Madhya Pradesh, it was quite low. In India, the average fertiliser use per hectare increased from 127.2 kg in 2008-09 to 137.40 kg in 2018-19. (Ministry of Chemicals and Fertilizers, 2018-19). The present level of three nutrient components that is nitrogen, potassium and phosphate seems to be not fully balanced. The imbalance is due to problems such as all the Nitrogen being used and lower use of Phosphates and Potash by the soil. Many states are taking measures to correct the imbalances. Keeping in view the above factors, the present study was undertaken to examine the growth performance and instability of fertilizer nutrient consumption in Haryana.

### **Methodology**

The secondary time series data for the period 1990-91 to 2019-20 was collected on the consumption of fertilizer nutrient in Haryana. To meet the objective of this study, secondary data was collected from Directorate of Economics and Statistics (Agricultural Statistics at a glance) and fertilizer Association of India (Fertilizer Statistics). The periods of study was divided into four sub periods viz. Period-1 (1990-91 to 1999-00), Period-II (2000-01 to 2009-10), Period-III (2010-11 to 2019-20) and Overall period (1990-91 to 2019-20) for the meaningful elucidation of results.

### **Analysis of data**

**Growth rate:** To calculate the compound growth rates (CGR) of production and consumption of fertilizer, the following linear trend equation has been used due to lower  $R^2$  value on the variables. The linear growth rate will be 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

Now, CGR per cent can be expressed as:

$$\text{CGR per cent} = (\text{Antilog } b - 1) \times 100$$

Where, b is the regression coefficient.

**Instability analysis:** To measure the variability in production and consumption of fertilizer the following formula has been used.

$$\text{CV}(\%) = \frac{SD}{\bar{x}}$$

## Result and discussion

### Trend in Fertilizer nutrient consumption in Haryana

The perusal of data in Table 1 showed that consumption of fertilizer was continuously increased from 586.29 thousand tonnes in 1990-91 to 1410.45 thousand tonnes in 2019-20 with an annual growth rate of 3.20 per cent. The compound annual growth rates (CGRs) showed positive trend in respect of nitrogen ( $\text{N}_2\text{O}$ ), phosphorus ( $\text{P}_2\text{O}_5$ ) and potash ( $\text{K}_2\text{O}$ ) consumption with growth rates of 3.09, 3.06 and 12.50 per cent, respectively for the overall period. The highest growth of consumption has been registered in potassic fertilizer. The results exhibited increasing trend in consumption of nitrogenous, phosphatic and potassic fertilizer. This may be due to the rapid expansion of irrigation, spread of HYV seeds, distribution of fertilizers to farmers at affordable prices, expansion of dealer's network, improvement in fertilizer availability and virtually no much change in farm gate fertilizer prices until recent years were the major reasons for the increase in fertilizer consumption (Bagal *et al.* 2018). The earlier studies by Vijay and Hrima (2018) also revealed similar findings. The results of CAGR in consumption of nitrogen fertilizer revealed that during period-I, period-II and III there was positive growth of nitrogen consumption in all the divisions. It might also be due to the higher priority given to nitrogenous fertilizer rather than phosphorous and potash fertilizers. These results are in conformity with Makadia and Patel (2014). During 2010-11 there is a negative growth rate in phosphatic fertilizer and considerable decline in fertilizer use. On other hand nitrogen and total fertilizer shows positive and slow growth *i.e.*, 0.35 and 0.68 percent due to rise in the price of fertilizer in India after implementation of Nutrient based subsidy scheme.

**Table1. Fertilizer consumption and Growth rate in Haryana:1990-2020**

(‘000 tonnes)

Year	Nitrogen ( $\text{N}_2\text{O}$ )	Phosphorus ( $\text{P}_2\text{O}_5$ )	Potash ( $\text{K}_2\text{O}$ )	Total Fertilizer
1990-1991	443.25	138.01	5.04	586.29
1995-1996	587.05	133.58	3.16	723.79
2000-2001	714.31	206.32	9.67	930.30

<b>2005-2006</b>	847.43	252.57	28.67	1128.67
<b>2010-2011</b>	974.05	335.95	47.63	1357.62
<b>2015-2016</b>	1037.10	290.59	19.70	1347.39
<b>2019-2020</b>	1049.07	317.00	42.21	1410.45
<b>Annual growth rate</b>				
<b>1990-91 to 2019-20</b>	3.09	3.06	12.50	3.20
<b>1990-91 to 1999-00</b>	5.19	3.59	4.46	4.82
<b>2000-01 to 2009-10</b>	3.76	4.13	18.65	4.14
<b>2010-11 to 2019-20</b>	0.95	-0.59	5.67	0.68

Table 2 presents the Standard Deviation and instability of fertilizer consumption in Haryana. The coefficient of variation (CV) of fertilizer was found 25.47, 29.17 and 86.06 per cent for Nitrogen, phosphorus and potash, respectively for the overall period. The instability of total fertilizer consumption was highest in period-I (14.56 %) and lowest in period-III (6.16 %) and for overall period the variability was 26.71 per cent. Instability of Nitrogen fertilizer consumption was declined across all the divisions from period-I to period-III. The high instability was noticed for phosphorus fertilizer consumption during period-I (17.73%). It was found that period-III recorded the lowest variability compared to the period-I and period-II across all the divisions. With respect to the variability in potash consumption period-II (66.75%) has witnessed high variability compared to period-I (42.83) and period-III (39.07). The growth and instability of NPK fertilizer consumption showed wide variation during period-I, with regard to variability during period-II across all the divisions which has decreased as compared to period-I. The consumption of NPK was not uniform in different periods. Hence, it is clear that instability showed a declining trend over the periods.

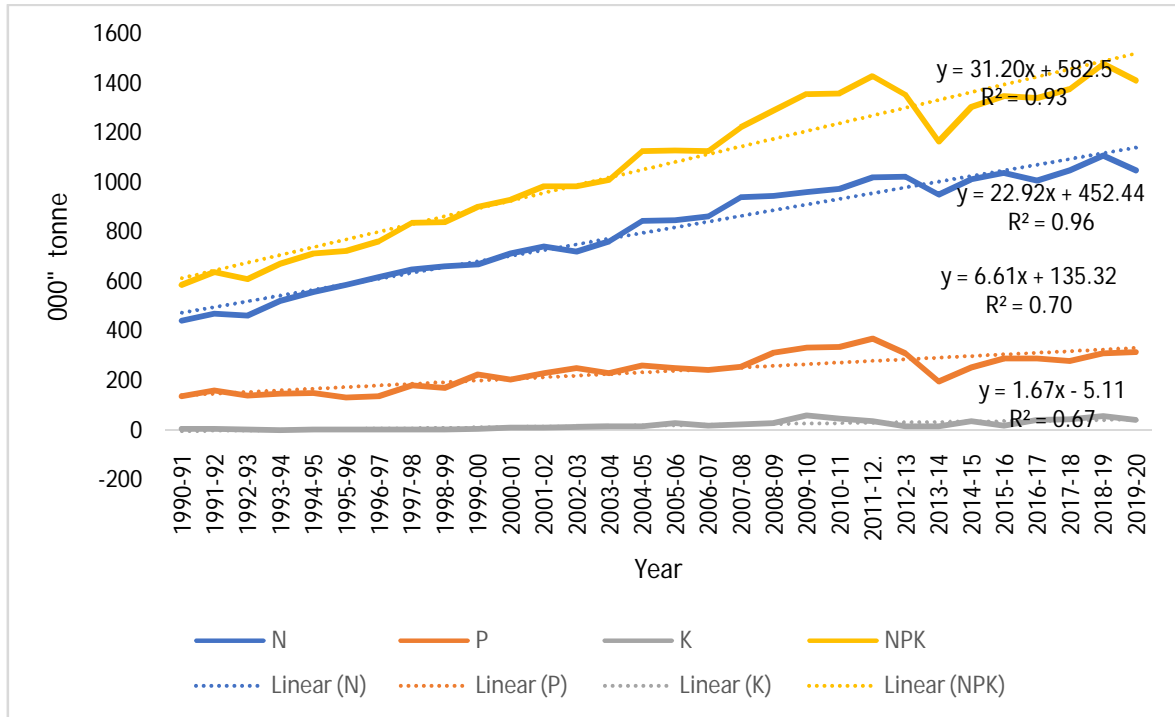
**Table2. Mean and instability of fertilizer nutrient consumption in Haryana**

Period		Nitrogen (N <sub>2</sub> O)	Phosphorus (P <sub>2</sub> O <sub>5</sub> )	Potash (K <sub>2</sub> O)	Total Fertilizer
<b>1990-91 to 2019-20</b>	Mean	807.49	237.84	20.74	1066.15
	SD	205.69	69.38	17.85	284.73
	CV (%)	25.47	29.17	86.06	26.71
<b>1990-91 to 1999-00</b>	Mean	564.96	159.25	3.49	727.70
	SD	86.22	28.24	1.49	105.98
	CV (%)	15.26	17.73	42.83	14.56
<b>2000-01 to 2009-10</b>	Mean	834.19	258.25	22.62	1115.05
	SD	95.51	38.20	15.10	141.23
	CV (%)	11.45	14.79	66.75	12.67
<b>2010-11 to 2019-20</b>	Mean	1023.32	296.03	36.12	1355.69
	SD	43.14	46.54	14.11	83.53
	CV (%)	4.22	15.72	39.07	6.16

CV: Coefficient of variation

The estimates of linear trend in the consumption of fertilizer in Haryana are shown in Fig.

1. The figure revealed that the value of regression coefficient 'b' associated with the time element in Haryana was positive for nitrogen (22.91), phosphorus (6.61), potash (1.67) and total fertilizer (31.20). The positive value of 'b' indicated that the shape of trend line is linear, which indicates that there was an increase in the consumption of fertilizer over the period study period.



**Fig. 1.** Fertilizer consumption in Haryana

### Fertilizer product consumption in Haryana

Urea is the highest consumed fertilizer product, followed by DAP and MOP in Haryana. Consumption of Urea increased at a growth rate of 3.45 per cent per annum during 1990-91 to 2019-20. The highest growth rate was found in MOP during all the periods under study. Consumption of MOP was increased with an annual growth rate of 14.71 per cent and DAP and SSP with an annual growth rate of 3.19 and 3.78 per cent during the overall study period. CAN Fertilizer is not being consumed in Haryana since 2014.

**Table3.** Fertilizer consumption in Haryana :1990-2020

(‘000 tonnes)

Year	Urea	DAP	MOP	SSP	CAN
1990-1991	850.04	279.46	7.52	52.86	6.18
1995-1996	1144.30	263.17	4.61	62.92	44.98
2000-2001	1410.60	480.50	14.60	43.30	14.00
2005-2006	1671.00	491.00	22.60	48.20	1.60
2010-2011	1911.70	733.40	46.70	68.80	0.30
2015-2016	1962.06	562.37	61.52	165.14	0.00
2019-2020	0.00	0.00	0.00	0.00	0.00

<b>Annual growth rate</b>					
<b>1990-91 to 2019-20</b>	3.45	3.19	14.71	3.78	-
<b>1990-91 to 1999-00</b>	5.30	3.54	8.08	3.47	14.68
<b>2000-01 to 2009-10</b>	3.83	4.73	19.88	-5.66	-27.36
<b>2010-11 to 2019-20</b>	1.41	-0.59	13.85	14.82	-

Table 4 presents the Standard Deviation and instability of fertilizer consumption in Haryana. The coefficient of variation (CV) of fertilizer was found 26.50, 29.86 and 91.48, 61.85 and 122.42 per cent for Urea, DAP, MOP, SSP and CAN, respectively for the overall period. Instability of urea consumption was declined across all the divisions from period-I (15.88%), period-II (13.58%) to period-III (4.79%). Instability in DAP consumption was 11.03, 15.70 and 17.37 per cent during period-I, period-II and period-III. The highest instability was noticed for CAN consumption during period-III (169.97%) With respect to the variability in MOP consumption period-II (66.75%) has witnessed high variability compared to period-I (42.83) and period-III (39.07). Instability in variability in SSP consumption was 30.79, 32.14 and 38.86 per cent, respectively during period-I, period-II and period-III.

**Table4. Mean and instability of fertilizer consumption in Haryana**

<b>Period</b>		<b>Urea</b>	<b>DAP</b>	<b>MOP</b>	<b>SSP</b>	<b>CAN</b>
<b>1990-91 to 2019-20</b>	Mean	1538.61	471.54	27.47	67.33	10.96
	SD	407.75	140.82	25.13	41.64	13.41
	CV (%)	26.50	29.86	91.48	61.85	122.42
<b>1990-91 to 1999-00</b>	Mean	1063.72	304.79	4.48	52.07	25.28
	SD	168.93	33.61	2.25	16.03	12.06
	CV (%)	15.88	11.03	50.22	30.79	47.69
<b>2000-01 to 2009-10</b>	Mean	1568.01	523.48	29.75	40.26	7.80
	SD	208.24	82.21	23.08	12.94	8.79
	CV (%)	13.28	15.70	77.57	32.14	112.77
<b>2010-11 to 2019-20</b>	Mean	1980.82	580.58	47.95	112.67	0.14
	SD	94.98	100.82	21.33	43.78	0.25
	CV (%)	4.79	17.37	44.48	38.86	169.97

## **Conclusion**

As other resources like land and water are under severe strain, fertiliser must play a significant role in the expansion of agricultural output in the future. This paper demonstrates that the growth trend in NPK consumption in Haryana across four divisions, during period-I, period-II and period-III was found positive except for phosphorus in period-III. Among all the fertilizer, higher growth was noticed in potash and has highest variability as compared to other fertilizer nutrient. The variability in consumption of different nutrients (N, P and K) in Haryana has shown that during period-I, II, III and overall nitrogen consumption was more stable, while, potash consumption was highly unstable during all the period.

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