Journal of Agriculture and Ecology Research International

Volume 24, Issue 3, Page 1-6, 2023; Article no.JAERI.89815
ISSN: 2394-1073

Growth and Instability of Fertilizer Consumption in Haryana, India

Nitin Sharma [a*], R. S. Pannu [bφ], D. P. Malik [a], Neelam Kumari [a] and Veer Sain [a]

[a] Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar, India.
[b] Department of Agricultural Economics, MMDU, Mullana, Ambala, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAERI/2023/v24i3526

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/89815

Original Research Article

Received: 17/06/2022
Accepted: 28/08/2022
Published: 15/03/2023

ABSTRACT

The present study was undertaken 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 the exponential growth model. The periods of the study were 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. 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 fertilizers, higher growth was noticed in potash which has the highest variability as compared to other fertilizer nutrients. 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 periods.

Keywords: Fertilizer; consumption; instability; agricultural production.

[φ] Ex. Regional Director;
**Corresponding author: E-mail: nitingautam2720@gmail.com;*

1. 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 [1]. 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 [2]. The world's population is expected to grow by one billion people, reaching 9.6 billion by 2050 [3]. Indian Population will likely reach 1.67 billion by 2050 [4]. 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 [5]. Chemical fertilizers are a key element of modern technology and have played an important role in agriculture production growth. However, the demand-supply gap of fertilizers in India has increased in recent times due to dependency on imports [6]. The role of chemical fertilizers in increased agricultural production, in particular in developing countries, is well established [7]. The requirement of fertilizer has been the demand of time to increase food grain productivity [8].

Indian agriculture has made remarkable progress in the last few decades, especially after the introduction of the Green Revolution and the high-yielding variety of seeds, fertilizers, pesticides, and expansion of irrigation facilities are responsible for the higher production and productivity in the country [9]. 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 [10]. 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 fertilizer producer following China [11]. However, India's average fertilizer usage rate remains significantly lower than that of the majority of other countries. In 2019, nitrogen accounted for more than 64% of total fertilizer nutrient intake, while phosphorus and potash consumptions were 25.45 and 10.15 percent, respectively. In Punjab, Haryana, Andhra Pradesh, and Tamil Nadu, fertilizer application per acre was comparatively higher, but in Rajasthan, Orissa, and Madhya Pradesh, it was quite low. Haryana has achieved remarkable growth in its agricultural sector, which not only has made it self-sufficient in food grains production but also has elevated it to the second largest contributor to India's central pool of food grains [12]. In India, the average fertilizer 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.

2. METHODOLOGY

The secondary time series data for the period 1990-91 to 2019-20 was collected on the consumption of fertilizer nutrients in Haryana. To meet the objective of this study, secondary data was collected from the Directorate of Economics and Statistics (Agricultural Statistics at a glance) and the fertilizer Association of India (Fertilizer Statistics). The periods of the study were 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.

2.1 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 the 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:
CGR per cent = (Antilog b - 1) x 100

Where, b is the regression coefficient.

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

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

3. RESULTS AND DISCUSSION

3.1 The Trend in Fertilizer Nutrient Consumption in Haryana

The perusal of data in Table 1 showed that consumption of fertilizer 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 percent. The compound annual growth rates (CGRs) showed a positive trend in respect of nitrogen (N_2O), phosphorus (P_2O_5), and potash (K_2O) consumption with growth rates of 3.09, 3.06, and 12.50 percent, respectively for the overall period. The highest growth of consumption has been registered in potassic fertilizer. The results exhibited an increasing trend in the consumption of nitrogenous, phosphatic, and potassic fertilizers. This may be due to the rapid expansion of irrigation, the spread of HYV seeds, distribution of fertilizers to farmers at affordable prices, expansion of dealer's network, improvement in fertilizer availability, and virtually not 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 [13] 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 in 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 conform with Makadia and Patel [14]. During 2010-11 there is a negative growth rate in phosphatic fertilizer and a considerable decline in fertilizer use. On the other hand nitrogen and total fertilizer show positive and slow growth *i.e.,* 0.35 and 0.68 percent due to a rise in the price of fertilizer in India after the implementation of Nutrient based subsidy scheme [15].

Table 2 presents the Standard Deviation and instability of fertilizer consumption in Haryana. The coefficient of variation (CV) of fertilizer was found at 25.47, 29.17 and 86.06 percent 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 the overall period, the variability was 26.71 percent. The instability of Nitrogen fertilizer consumption 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 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

Table 1. Fertilizer consumption and Growth rate in Haryana: 1990-2020

('000 tonnes)

Year	Nitrogen (N_2O)	Phosphorus (P_2O_5)	Potash (K_2O)	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
2005-2006	847.43	252.57	28.67	1128.67
2010-2011	974.05	335.95	47.63	1357.62
2015-2016	1037.10	290.59	19.70	1347.39
2019-2020	1049.07	317.00	42.21	1410.45
Annual growth rate				
1990-91 to 2019-20	3.09	3.06	12.50	3.20
1990-91 to1999-00	5.19	3.59	4.46	4.82
2000-01 to 2009-10	3.76	4.13	18.65	4.14
2010-11 to 2019-20	0.95	-0.59	5.67	0.68

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.

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.

Table 2. Mean and instability of fertilizer nutrient consumption in Haryana

Period		Nitrogen (N_2O)	Phosphorus (P_2O_5)	Potash (K_2O)	Total Fertilizer
1990-91 to 2019-20	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
1990-91 to1999-00	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
2000-01 to 2009-10	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
2010-11 to 2019-20	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

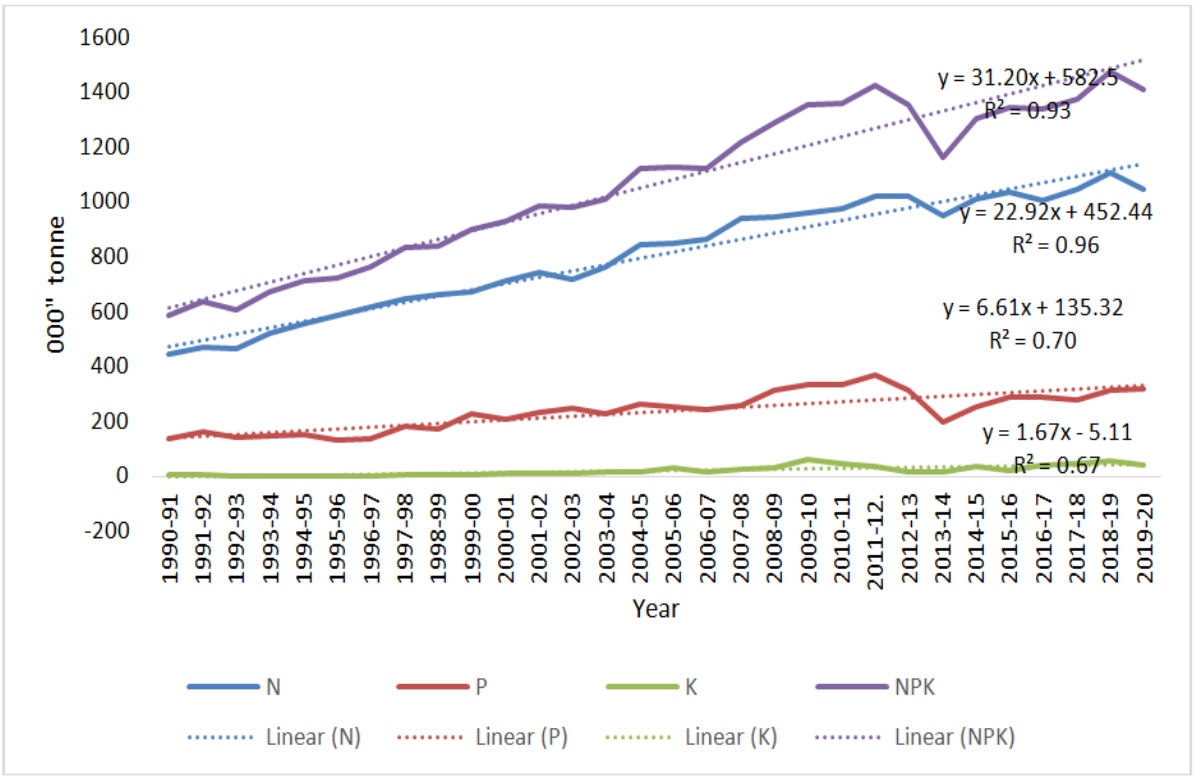

Fig. 1. Fertilizer consumption in Haryana

Table 3. 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
Annual growth rate					
1990-91 to 2019-20	3.45	3.19	14.71	3.78	-
1990-91 to1999-00	5.30	3.54	8.08	3.47	14.68
2000-01 to 2009-10	3.83	4.73	19.88	-5.66	-27.36
2010-11 to 2019-20	1.41	-0.59	13.85	14.82	-

Table 4. Mean and instability of fertilizer consumption in Haryana

Period		Urea	DAP	MOP	SSP	CAN
1990-91 to 2019-20	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
1990-91 to1999-00	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
2000-01 to 2009-10	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
2010-11 to 2019-20	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

3.2 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 percent 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 increased with an annual growth rate of 14.71 percent and DAP and SSP with an annual growth rate of 3.19 and 3.78 percent during the overall study period. CAN Fertilizer is not being consumed in Haryana since 2014.

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 percent for Urea, DAP, MOP, SSP and CAN, respectively for the overall period. The 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 percent 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.

4. CONCLUSION

As other resources like land and water are under severe strain, fertilizer 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 fertilizers, higher growth was noticed in potash, and has the 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 periods.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mala P. Fertilizer scenario in India. Int J Soc Sci Interdiscip Res. 2013;2(1):62-72.
2. Kumar S, Akhsu. Growth and pattern of fertilizer consumption in Haryana. Int J Res Econ Soc Sci. 2017;7(4):138-48.
3. United Nations Department of Economic and Social Affairs Population Division. World population prospects. 2012 revision, Methodology of the United Nations and projections, estimates and projection, Working Paper No. ESA/P/WP. 2014;235.
4. United States Census Bureau; 2014 [cited Apr 11 2016]. Available:http://www.census.gov/population/international.
5. Chadha D, Meena GL. Nikita, Sharma, V. Indian J Econ Dev. Spatial and temporal analysis of fertilizer consumption in Rajasthan. 2019;7(5):1-7.
6. Rani A. Consumption of chemical fertilizers in Haryana: An empirical study. ZENITH Int J Bus Econ Manag Res. 2014;4(7):105-12.
7. Sharma VP, Thaker H. Demand for fertilisers in India: Determinants and Outlook for 2020. Indian J Agric Econ. 2011;66(4):638-61.
8. Pathak AK, Dubey P, Pandey S. Overview of fertilizer industry in India. Int J Soc Sci Interdiscip Res. 2014;3(7):7-15.
9. Kumar LMP, Indira M. Trends in fertilizer consumption and foodgrain production in India: A co-integration analysis. SDMIMD J Manag. 2017;8(2):45-50. DOI: 10.18311/sdmimd/2017/18025.
10. Jaga PK, Patel Y. An overview of fertilizers consumption in India: determinants and Outlook for 2020-A review. Int J Sci Eng Technol. 2012;1(6): 285-91.
11. Praveen KV, Singh A, Kumar P, Jha GK, Kingsly I. Advancing with fertilizers in Indian agriculture: trends, challenges, and research priorities. Agric Econ Res Rev. 2020;33(confspl):49-60. DOI: 10.5958/0974-0279.2020.00017.8.
12. Sihmar R. Growth and instability in agricultural production in Haryana: A District level analysis. Int J Sci Res Publ. 2014;4(7):1-2.
13. Vijay P, Hrima T. Demand for Fertiliser in India: Determinants and Outlook for Research and publications. IIM Ahmedabad. 2011;1-32.
14. Makadia JJ, Patel KS. Regional spatiotemporal growth and instability of fertilizer consumption in Gujarat state. Int Res J Agric Econ Stat. 2014;1(5):16-22.
15. Aayog NITI. Demand & supply projections towards 2033: Crops, livestock, fisheries and agricultural inputs. The Working Group Report February. 2018;186.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/89815