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Trend in growth and instability of chemical fertilizer consumption in Chhattisgarh state

Meenakshi Chandra, Vikash Lunawat, Shubham Pandey and Satyanarayan Soni

Abstract
The present study was undertaken with the specific objective to assess the trend in growth and instability of chemical fertilizer consumption in Chhattisgarh state for the time period of 2005-06 to 2019-20. To analyse the growth and instability Compound Growth Rate (CGR) and Cuddy Della Valle instability index (CDVI) has been used respectively. This study is based on secondary sources of information obtained from various agricultural departments, published articles, etc. Consumption of fertilizers in the state showed an increasing trend throughout the years except the year 2017-19. The estimated compound growth rates (CGR) of total fertilizers (NPK) during 2005-06 to 2019-20 were found to be statistically highly significant (3.40%) at 1% significance level. The instability index value of total fertilizer (NPK) consumption over the years (2005-2020) was estimated as 9.91 which indicates the lower instability in consumption of fertilizers in state. The high growth with low instability indices represents the desirable situation as it implies a steady increase in fertilizer consumption.

Keywords: Fertilizer use, CGR, instability, trend

Introduction
Agricultural sector plays a very crucial role in the economy of the country as it contributes about 20.2 (Economic Survey 2020-21) per cent share in the GDP of the country. Among all the modern inputs, fertilizer has been universally accepted as an integral part of package of practice for raising agriculture to a higher technological plank. Considerable increase in the usage of chemical fertilizers started with the introduction of green revolution in 1960s.The use of fertilizer depends largely on the availability of irrigation facilities and availability of working capital with the farmers for acquiring the purchased inputs.

India is one of the major countries in the production and consumption of fertilizers. The consumption of fertilizers varies significantly from state to state. As per the parliamentary standing committee report titled 'Study of System of Fertilizer Subsidy' submitted in the Lok Sabha in March 2020, the consumption of urea was in a high distorted ratio as compared to the desired NPK ratio of 4:2:1. The national usage ratio stood at (6.7): (2.4):1. It has also been reported that the consumption in states like Punjab and Haryana where agriculture is dominant was as high as (31.4): 8:1 and (27.7): (6.1):1 respectively. The Government of India has been consistently pursuing policies conductive to increased availability and consumption of fertilizers in the country. As per the reports of Ministry of Chemicals and Fertilizers, Government of India, the sales / consumption of different fertilizers substantially increased during 2019-20 as compared to 2018-19 (Urea increased by 5.29%, DAP increased by 15.67%, MOP increased by 3.45%, NPKS increased by 9.95%).

In Chhattisgarh, agriculture is counted as the chief economic occupation specifically paddy dominated mono-cropped state with more than 80 percent kharif cultivable area under paddy. Total consumption of fertilizers in the state during agricultural year 2018-19 was 1145.96 Tonnes.

Review of Literature
Bhagyamma and Bhat (2017) [7] examined the pattern and growth of fertilizers consumption in Karnataka state and found that the NPK usage pattern in Dharwad district had negative growth rate (-5.77%) over the years (2004-2015). They observed that amongst all the three major nutrients, usage of phosphatic fertilizer showed highest negative growth (-7.70%) followed by nitrogen (-3.95%) and potassic fertilizer (-3.39%) in the district whereas in Davangere district, it was observed that usage of nitrogenous (5.38%) and phosphatic (3.07%) fertilizers had

positive growth rates while potassic fertilizer showed negative growth rate (-0.66%).

Makadia and Patel (2014) [5] observed significant increase in N and P fertilizer consumption in their study in all the regions of Gujarat state throughout the time period whereas consumption of K increased significantly in all the regions along with Gujarat as a whole except North Gujarat. The lowest instability index for N was reported throughout the time period except Period-I in South Gujarat region.

Jaga and Patel (2012) [4] conducted a study with an objective to examine the pattern of growth of fertilizer consumption in India during 1951-52 to 2009-10. The study revealed that the fertilizer consumption had increased up to 2649 million tonnes in 2009-10 since 1951-52 in the country.

Mala (2013) [6] studied the fertilizer scenario in India and revealed that the irrigation is the prime condition for the application of fertilizers. But in the country almost 70 per cent of cultivated area was dependent on rain which consumed only 20 per cent of total fertilizers that's why despite being the second largest consumer of fertilizers per hectare consumption of fertilizers in India was quite low as compared to most of other developing countries.

Methodology

This study is based on secondary information and the data is collected from various sources such as Directorate of Agriculture of C.G.; Economics and Statistics, Ministry of Agriculture, Govt. of India etc. Compound Growth Rate (CGR) and Cuddy Della Valle instability index (CDVI) has been used respectively as analytical tools to examine the growth rate and instability index of chemical fertilizer consumption in the state for the period 2005-06 to 2019-20. The analytical tools are formulated as under:

Compound Growth Rate (CGR)

$Y = AB^t$

Taking logarithms on both sides

$log\ Y = log\ A + t\ log\ B$

Assuming, $log\ Y = y$

$log\ A = a$

$log\ B = b$

We get, $y = a + bt$

Where,

t = 1, 2, 3 ……n

y = area/production/productivity of crops.

After regression between y and t

We have value for a and b

Where,

a = Constant

b = regression coefficient

As, $b = 1 + r$

Hence,

$r = b - 1$

Therefore,

$r = (Anti - log\ of\ b - 1) \times 100$

Where,

r = Compound growth rate

Cuddy Della Valle instability index (CDVI)

CDVI = CV √X

Where,

Co - efficient of variation (CV) = S.D /Mean * 100

X = 1 - $\bar{R}^2$

$\bar{R}^2$ = adjusted coefficient of determination.

The ranges of CDVI are given as follows:

- Low instability = between 0 and 15
- Medium instability = greater than 15 and lower than 30
- High instability = greater than 30

Results and Discussion

The findings of the present study as well as relevant discussion have been presented under: Table 1 represents the Nutrient-wise (NPK) fertilizer consumption in Chhattisgarh over the years 2005-2020. It was observed from the table that the consumption of fertilizers in the state showed an increasing trend throughout the years except the year 2017-19. Figure 1, 2 3 and 4 represents the graph showing trend in nitrogenous, phosphorus, potash and total fertilizers consumption in the state respectively.

Table 2 indicates the compound growth rate and instability indices of the fertilizer (NPK) use in the state. The estimated compound growth rates (CGR) of N during 2005-06 to 2019-20 was found positive and statistically highly significant (3.21%) at 1% significance level. Also, the CGRs of consumption of P and K fertilizers were found to be positively significant at (4.45%) 1% and (1.59%) 10% levels over the years respectively.

Table 1: Nutrient-wise Fertilizer Consumption in Chhattisgarh

(000 Tonnes)					
Sr. No.	**Year**	**N**	**P**	**K**	**Total**
1	2005-06	232	104	38	374
2	2006-07	272.22	116.00	48.01	436.23
3	2007-08	272.26	116.96	52.65	441.87
4	2008-09	267.61	134.26	60.95	462.82
5	2009-10	315.83	162.32	58.99	537.14
6	2010-11	321.99	171.19	68.99	562.17
7	2011-12	356.4	177.33	61.84	595.57
8	2012-13	375.18	180	46.52	601.7
9	2013-14	357.27	162.65	47.74	567.66
10	2014-15	373.14	175.53	56.73	605.4
11	2015-16	390.78	189.74	57.11	637.63
12	2016-17	388.95	220.99	63.41	673.35
13	2017-18	330.08	169	51.38	550.46
14	2018-19	312.52	177.68	63.32	553.52
15	2019-20	449.68	225.53	62.14	737.35

Source: Agricultural Statistics at a Glance.

The instability index value for N, P and K consumption in Chhattisgarh over the years (2005-2020) were observed 10.92, 11.18 and 13.83 respectively which indicates the lower instability in consumption of fertilizers.

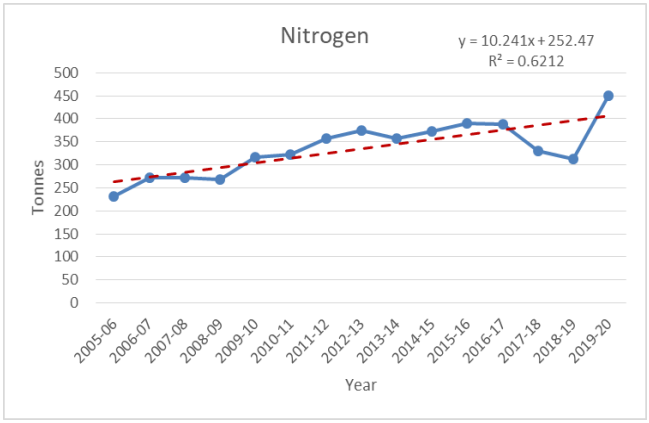

Fig 1: Trend of Nitrogenous fertilizer consumption in Chhattisgarh

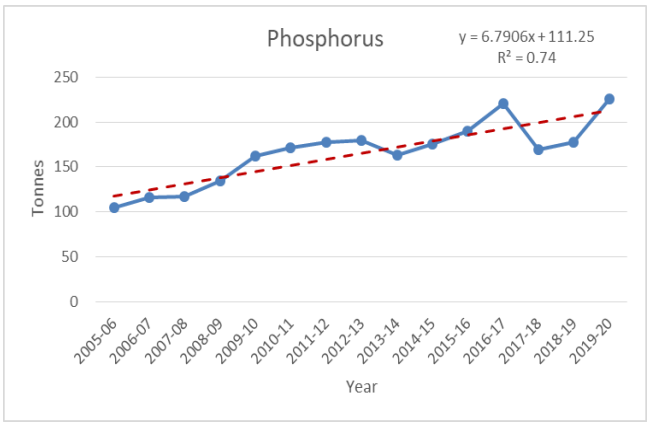

Fig 2: Trend of Phosphorus fertilizer consumption in Chhattisgarh

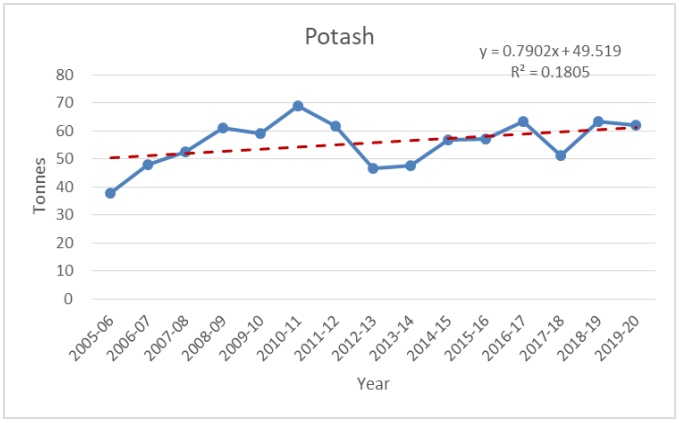

Fig 3: Trend of Potash fertilizer consumption in Chhattisgarh

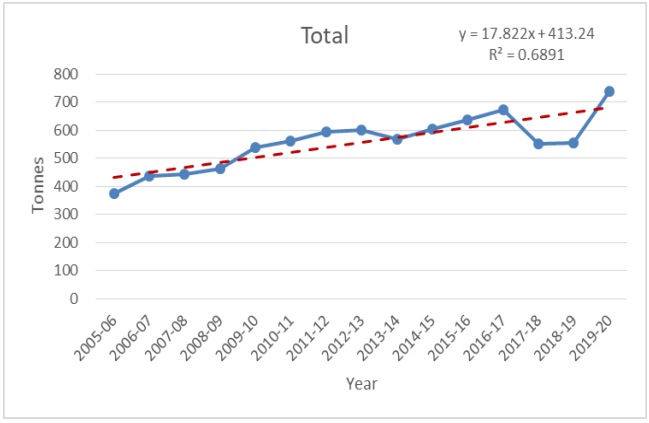

Fig 4: Trend of Total fertilizer consumption in Chhattisgarh

Table 2: Nutrient-wise compound growth rate and instability index of fertilizer consumption in Chhattisgarh

Particular	N	P	K	Total
CGR%	3.212271***	4.459255284***	1.592434*	3.409515765***
p value	0.000392	0.0000347	0.095375	0.000115698
CDVI	10.92912	11.18742206	13.83217	9.919637808

Note: *, ** and *** indicates significance of values at P=0.10, 0.05 and 0.01 respectively.

The CGR of total fertilizer consumption in the state during the study period was found positive and highly significant (3.40%) at 1% level of significance. The instability index of total fertilizer consumption was registered 9.91 which indicates lower instability.

In general, it can be concluded that the high growth with low instability indices is desirable situation as it implies a steady increase in fertilizer consumption.

Conclusion

The role of agricultural sector in country's economy is very significant (20.2% share in GDP). Considerable increase in the usage of chemical fertilizers started with the introduction of green revolution in 1960s. Consumption of fertilizers in Chhattisgarh shows an increasing trend throughout the years. The CGR of fertilizer consumption in the state is significant at 1% and instability index value was estimated 9.91(Low instability) for the study period 2005-2020. This situation of high growth and low instability signify desirable situation of fertilizer consumption

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