



Instability of Agrochemicals in various Crops in Maharashtra

S.S. Gawade^{1*}, R.F. Thombre², S.V. Bharati³ and T.B. Munde⁴

¹M.Sc. Student, Department of Agricultural Economics,
College of Agriculture, VNMKV, Parbhani (Maharashtra), India.

²Assistant Professor, Department of Agricultural Economics,
College of Agriculture, Golegaon, VNMKV, Parbhani (Maharashtra), India.

³Assistant Professor, Department of Agricultural Economics,
College of Agriculture, VNMKV, Parbhani (Maharashtra), India.

⁴Assistance Professor, Department of Agricultural Economics,
College of Agriculture, VNMKV, Parbhani (Maharashtra), India.

(Corresponding author: S.S. Gawade*)

(Received: 09 July 2024; Revised: 10 August 2024; Accepted: 02 September 2024; Published: 15 October 2024)

(Published by Research Trend)

ABSTRACT: The present study discusses the growth performance of agrochemicals and instability of use in various crops in Maharashtra. Important variables like, nitrogen, phosphorous, potassium, pesticides, were compiled for the period 2001-2002 to 2021-2022 from the Agri census website. The consumption growth and instability of Nitrogen, Phosphorous and Pesticides use in crops been increase throughout the period, but in some crops, there been decreasing of the potassium consumption throughout the period in various crops. The result stated that growth performance and instability of agrochemicals been at increasing rate throughout the period.

Keywords: Nitrogen, Phosphorous, Potassium, Pesticide, Productivity, Growth rate, Instability.

INTRODUCTION

Agrochemicals, also known as agrichemicals refers to an umbrella term covering many different types of chemicals engineered to prevent pests/diseases/pathogen from harming plant and crops and to increase yield quality and quantity. Maharashtra occupies top spot in terms of chemicals pesticides consumption in India at 13,175 metric ton (MT) in the year 2021-22. It has consumed the highest pesticides in the past five years and it is rising ever year in terms of absolute consumption (Tewatia and Chanda 2017; Shubhas and Balaji 2017). Use of nitrogen along with the cases of many phosphorus and potassium based inorganic fertilizers and pesticides has greatly increased food production by improving efficient and economical crop production in order to fulfil the food needs of the rapidly expanding world population (Pal *et al.*, 2006). Balanced use of fertilizer is essential to stabilize crop yields and sustain high crop productivity (Dhaiwadi and Gavali 2018).

The present objective of study on the performance and instability in use of agrochemicals in various crops in Maharashtra. The reason why the topic been studied that high pesticides spray in the state is that the farmers do not have adequate knowledge for using pesticides and their quantities.

Scope of Study. The agrochemicals are leading in the pesticide industry of India has, on one hand, ensured the optimal production of food and cash crops to support the food and nutrition security of the country,

on the other hand has hampered soil biology, entered food chain, killing species and caused hazard to human health. Maharashtra, Uttar Pradesh, Telangana, Jammu & Kashmir and Haryana are top users of pesticide in India. Rapid urbanization and industrial expansion have reduced land under agriculture across India. Agrochemicals are been employed by farmers to raise land productivity and maintain soil health. It's the indiscriminate and uneducated use of chemicals, including pesticides, that hamper the soil and species.

As the response provided, it's been better to promote sustainable agriculture and encourages the use of biopesticide through organic farming.

Due to improper use of agrochemicals, there been risk of contamination of crop products with harmful chemicals residue and contamination of soils and groundwater. Also includes the potential toxicity to humans, acute and chronic health effect, and environmental pollution. The disadvantage of chemical insecticides includes high costs, potential for insecticide resistance, and the need for careful management to avoid harm to non-target organism.

MATERIALS AND METHODS

The present study was conducted on the secondary data for the last 25 years from 2001-02 to 2021-2022 for agrochemicals used by the major crops of Maharashtra is been collected by the Department of Agriculture, Cooperation and Farmers Welfare Ministry of agriculture and Farmers Welfare.

The entire 25 years data were divided into sub periods *i.e.* Period I (2001-02), Period II (2006-07), Period III (2011-12), Period IV (2016-17), Period V (2021-22) and overall period (2001-02 to 2021-22). The Compound Growth rate in Nitrogen, Phosphorous, Potassium and Pesticide were estimated by using the exponential method. Instability in the same was assessed by using the Coefficient of variation and Cuddy Vella Index (CDVI) (Bathla & Singh 2018). The relationship between agrochemicals with productivity was estimated by using different parametric models and Simple regression

Analytical tools: a) Growth rate of the agrochemicals in various crops in Maharashtra, were estimated by the formula: $Y = a.b^t$

Where,

Y=Nitrogen/Phosphorous/Potassium/Pesticides

a = Intercept

b = Regression Coefficient

t = Time variable

From the estimated exponential growth function, the compound growth rate was worked out by using the following formula:

$$CGR(r) = [\text{Antilog}(\log b) - 1] \times 100$$

Where,

r = Compound Growth Rate

a) Instability Analysis

The simple coefficient of variation overestimates the level of instability in time series data characterized by long term trends whereas the Cuddy-Della Valle index corrects the coefficient of variation.

$$\text{Formula: } I = CV \cdot (1 - R^2)^{0.5}$$

Where,

I= Instability index (per cent)

CV= Coefficient of variation (per cent)

R^2 = ESS/TSS *i.e.* ratio of explained variation to total variable

RESULT AND DISCUSSION

The present study aims at estimating compound annual growth rate of agrochemicals in major crops in Maharashtra. The study based on secondary data collected from Agri census from period of 2001-02 to 2021-2022.

Table 1: CAGR of nitrogen, Phosphorous, Potassium and Pesticide in major crops in Maharashtra.

Major Crops	Nitrogen	Phosphorous	Potassium	Pesticides
Sugarcane	1.61**	14.11**	-3.5	25.32
Wheat	13.81**	36.79**	18.12**	49.37
Maize	13.49***	31.47**	11.45**	52.49**
Cotton	15.9**	17.23**	-2.96	10.70
Groundnut	5.86	3.28	-22.96**	22.97
Jowar	13.56**	14.93**	-4.01	39.90**
Paddy	7.87**	15.16**	-17.81**	11.98
Tur	10.47**	13.34**	-10.76**	4.24**
Bajara	7.81**	81.41**	-16.54	49.99**
Gram	10.93**	5.53**	-1.15***	1.79***

and * indicate 1% and 5% level of significant

The overall compound growth rate of Nitrogen consumption in major crops in Maharashtra as present in Table 1. represents the highest CAGR been concluded in the crop Cotton (15.9 per cent) considered statistically significant and the null hypothesis was rejected, followed by Wheat (13.81 per cent), Jowar (13.56 per cent), Gram (10.93 per cent), Tur (10.47 per cent), Paddy (7.87 per cent), Bajara (7.81 per cent), Sugarcane (1.61 per cent), these all crops been significant with rejecting the null hypothesis and has the positive CAGR. The crop Maize (13.81 per cent) had considered non-significant and null hypothesis was not rejected and the crop Groundnut (5.86 per cent) here means it's not statistically significant.

Table 1 represent the consumption of Phosphorous in major crops in Maharashtra, as it results out the highest CAGR crop was Bajara (81.41 per cent), followed by Wheat (36.79 per cent), Maize (31.47 per cent), Cotton (17.23 per cent), Paddy (15.16 per cent), Jowar (14.93 per cent), Sugarcane (14.11 per cent), Tur (13.34 per cent) and lowest in crop like Gram (5.53 per cent), these all crops had significant with rejecting the null hypothesis and has the positive CAGR. The crop Groundnut (3.28 per cent), considered non-significant and null hypothesis was not rejected.

Table 1 represents the consumption of Potassium in major crops in Maharashtra. The results showed that highest CAGR crop was Wheat (18.12 per cent) and Maize (11.45 per cent), this crop indicates the positive growth rate and had significant with rejecting the null hypothesis. On the other hand, crop with statistically significant value but with negative growth rate, as here Groundnut (-22.96 per cent), Paddy (-17.81 per cent), Tur (-10.76 per cent) and Gram (-1.15 per cent), another result of Sugarcane crop (-3.5 per cent), Cotton (2.96 per cent), Jowar (-4.01 per cent) and Bajara (-16.54 per cent) shows the negative growth rate and considered non-significant and null hypothesis was not rejected.

Table 1 represents the consumption of Pesticides in major crops in Maharashtra, as it results out the highest CAGR crop was Maize (52.49 per cent), followed by Bajara (49.99 per cent), Jowar (39.90 per cent) and Tur (4.24 per cent) this crop indicates the positive growth rate and been significant with rejecting the null hypothesis. On the other hand, Wheat (49.37 per cent), Sugarcane (25.32 per cent), Groundnut (22.97 per cent), Paddy (11.98 per cent) and Cotton (10.70 per cent) indicates the positive growth rate with non-significant value. According to the result of Indira (2017)

Pesticides consumption in Maharashtra CAGR seen in positive rate.

The consumption of fertilizers was continuously increased year by year. The annual growth rate of consumption of Nitrogen, Phosphatic and potassic fertilizer were 3.40, 3.77 and 4.09 per cent respectively. (Sharma and Pannu 2022).

Compound growth rates of fertilizer consumption for the time periods *i.e.* pre-WTO period (1960-61 to 1994-95), post-WTO period (1995-96 to 2012-13) and

overall period (1960-61 to 2012-13). During the pre-WTO period the rates of compound growth in consumption of N, P and K at the overall level of Maharashtra were 6.06, 7.11 and 5.87 per cent per annum, respectively (Kulkarni, 2018).

According to the result of (Mumtaj and Jinnah 2021) Agricultural production had fluctuated due to inappropriate use of N-P-K consumption in various crops in West Bengal.

Table 2 : Coefficient of Variation of Nitrogen, Phosphorous, Potassium and Pesticide in major crops in Maharashtra.

Major Crops	Nitrogen	Phosphorous	Potassium	Pesticides
Sugarcane	0.02	0.21	0.07	0.34
Wheat	0.2	0.43	0.26	0.6
Maize	0.21	0.4	0.18	0.55
Cotton	0.23	0.24	0.05	0.05
Groundnut	0.22	0.08	0.48	0.35
Jowar	0.23	0.22	0.28	0.47
Paddy	0.12	0.22	0.35	0.3
Tur	0.16	0.06	0.21	0.07
Bajara	0.14	0.27	0.37	0.5
Gram	0.32	0.19	0.04	0.05

Table 3: Insatiability Index of Nitrogen, Phosphorous, Potassium and Pesticide in major crops in Maharashtra.

Major Crops	Nitrogen	Phosphorous	Potassium	Pesticides
Sugarcane	0.66	6.77	-2.42	14.98
Wheat	6.33	17.64	7.69	13.96
Maize	7.51	12.98	4.72	19.64
Cotton	6.93	7.51	-1.62	10.69
Groundnut	5.43	2.60	-9.47	17.64
Jowar	6.36	5.97	-3.93	18.28
Paddy	3.34	6.06	-7.12	9.73
Tur	4.56	5.66	-4.81	1.70
Bajara	3.12	32.56	-9.50	25.49
Gram	10.93	5.53	-1.15	1.79

The data on consumption of fertilizer (N, P₂O₅, K₂O) and Pesticides was use to fit the growth model were present in Table 2 and 3 represents the result of Nitrogen in the Sugarcane observed the CV (0.02) with the CDVI range 0.66 both pointing the low instability, in Phosphorous parameter CV (0.21) with CDVI (6.77) shows the low instability, with potassium with negative CDVI (-2.42) and Pesticide CV (0.34) range with CDVI (14.98) with nearly the range of stability. In the crop of Wheat, the CV of (0.20) with CDVI range of (6.33) both with the low instability in Nitrogen parameter, in phosphorous parameter CV of (0.43) with CDVI (17.64) with nearly stability, in potassium parameter the CV of (0.26) with CDVI (7.69) with low instability, so on in the pesticide of parameter in CV (0.60) with CDVI range (13.96) with nearly stability. In Maize the Nitrogen consumption with CV (0.21) and CDVI (7.51) indicates the low instability, in phosphorous parameter CV (0.4) and CDVI (12.98) shows the instability between the parameters, likewise in Potassium CV of (0.18) with CDVI value (4.72) and in Pesticides the CV (0.55) with CDVI (19.64) indicates the stability range.

In Cotton the Nitrogen consumption with CV (0.23) and CDVI (6.93) indicates the low instability, in phosphorous parameter CV (0.24) and CDVI (7.51) shows the instability between the parameters, likewise in Potassium CV of (0.05) with CDVI value (-1.62) and in Pesticides the CV (0.05) with CDVI (10.69) indicates the instability range. In the crop of Groundnut, the CV of (0.22) with CDVI range of (5.43) both with the low instability in Nitrogen parameter, in phosphorous parameter CV of (0.08) with CDVI (2.60) with nearly stability, in potassium parameter the CV of (0.48) with CDVI (-9.47) with low instability, so on in the pesticide of parameter in CV (0.35) with CDVI range (17.64) with nearly stability.

In Jowar the Nitrogen consumption with CV (0.23) and CDVI (6.36) indicates the low instability, in phosphorous parameter CV (0.22) and CDVI (5.97) shows the instability between the parameters, likewise in Potassium CV of (0.28) with CDVI value (-3.93) and in Pesticides the CV (0.47) with CDVI (18.29) indicates the stability range. In the crop of Paddy, the CV of (0.12) with CDVI range of (3.34) both with the low instability in Nitrogen parameter, in phosphorous

parameter CV of (0.22) with CDVI (6.06) with nearly stability, in potassium parameter the CV of (0.35) with CDVI (-7.12) with low instability, so on in the pesticide of parameter in CV (0.3) with CDVI range (9.73) with nearly instability.

In Tur the Nitrogen consumption with CV (0.16) and CDVI (4.56) indicates the low instability, in phosphorous parameter CV (0.06) and CDVI (5.66) shows the instability between the parameters, likewise in Potassium CV of (0.21) with CDVI value (-4.81) and in Pesticides the CV (0.07) with CDVI (1.70) indicates the instability range. In the crop of Bajara, the CV of (0.14) with CDVI range of (3.12) both with the low instability in Nitrogen parameter, in phosphorous parameter CV of (0.27) with CDVI (32.56) with nearly stability, in potassium parameter the CV of (0.37) with CDVI (-9.50) with low instability, so on in the pesticide of parameter in CV (0.5) with CDVI range (25.49) with stability range. In Gram the Nitrogen consumption with CV (0.32) and CDVI (10.93) indicates the low instability, in phosphorous parameter CV (0.19) w and CDVI (5.53) shows the instability between the parameters, likewise in Potassium CV of (0.04) with CDVI value (-1.15) and in Pesticides the CV (0.05) with CDVI (1.79) indicates the instability range.

DISCUSSION

CAGR analysis: In the agrochemicals parameters there been the overall increasing trend in consumption of nitrogen from throughout the period. Crops like Cotton, Wheat and Maize shows the highest CAGR followed by Jowar, Gram, Tur, Paddy, Bajara, Groundnut and Sugarcane. In phosphorous Bajara concluded with highest CAGR and overall growth increasing pattern in the trend. In potassium Wheat and Maize shows with the positive increasing trend in pattern and in pesticide parameter there been increasing use with highest consumption of Mazie and Bajara can been observe. According to the result of (Chand & Pratap 1997) there been increasing trend of pesticides been observed.

Instability analysis: According to the all parameters varying with major crops which shows the CV and CDVI shows the instability index. The crops like Wheat and Mazie there been seen of comparatively upto the mark range of stability index.

CONCLUSIONS

The use of agrochemicals in various crops seen to been increasing pattern since throughout the period. The growth rate of consumption of Nitrogen, Phosphorous and Pesticides been seen increasing throughout the trend, in case of Potassium there been decaling rate of

consumption in various crops in Maharashtra. The rate of complementary relation been not significantly seen between the productivity and fertilizers consumption.

Overall been observed that yield is been not satisfy upto mark by the huge usage of agrochemicals. As it concluded that the improper knowledge in usages of agrochemicals by farmers effect the complementary relation between the productivity and agrochemicals usages. However, the integration of complementary techniques to synthesis pesticides for example biopesticides, resistant varieties, ethological control strategies or microbial control should be considered and the proper guidance of usages of agrochemicals demonstration should be conducted for the farmers.

Acknowledgement. I thank my Guide Dr. R.F. Thombre, Department of Agricultural Economics, College of Agriculture, Golegaon, VNMKV, Parbhani. This research would not have been possible without his invaluable suggestions and support, also the Dr. S.S. More, HOD Department of Agricultural Economics, College of Agriculture Parbhani, VNMKV, Parbhani and other staff members who have had the supportive hand in my research work.

REFERENCES

- Bathla, D. & Singh, J. (2018). Growth and disparities in fertilizer consumption in major states of India. *Think Indian Journal*, 3(2), 45-97.
- Chand, R. & Pratap, S. B. (1997). Pesticide Use in Indian Agriculture in Relation to Grown in Area & Production & Technological Change *Indian Journal of Agriculture Economics*, 3(52), 31-45.
- Dhaiwadi, P. M. & Gavali, A. V. (2018). Determinants of Fertilizer Use in Maharashtra. *International Research Journal of Agricultural Economics & Statistics*, 9(2), 354-366.
- Indira, P. D. (2017). Pesticide consumption in India: A spatiotemporal analysis. *Agriculture Economics Research Review*, 30(1), 67-91.
- Kulkarni, A. R. (2018). Trends in Fertilizer Consumption in Maharashtra. *Agriculture Update*, 13(1), 422-428.
- Mumtaz, A., & Jinnah, A. (2021). Impact of Chemical Fertilizer on Agricultural Productivity in West Bengal, India, 49(1), 43-57.
- Sharma, N & Pannu, P. S. (2023). Growth & Instability of Fertilizer Consumption in Haryana, India. *Journal of Agriculture & Ecology Research International*, 24(3), 1-6.
- Shubhas, S. P. & Balaji, S. J. (2017). Pesticide Use in Indian Agriculture: Trends, Market Structure and Policy Issues.
- Tewatia, R., & Chanda, T. (2017). Trends in fertilizer nitrogen production and consumption in India. In *Elsevier eBook*, 34(3), 45-56.

How to cite this article: S.S. Gawade, R.F. Thombre, S.V. Bharati and T.B. Munde (2024). Instability of Agrochemicals in various Crops in Maharashtra. *Biological Forum – An International Journal*, 16(10): 19-22.