
Trends And Patterns of Chemical Fertilizer Consumption in Kerala

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Abstract:

Fertilizers provide essential nutrients to plants such as nitrogen, phosphorus and potassium that are necessary for their optimal growth and development. Using fertilizers excessively or improperly can cause environmental problems such nutrient overflow into water bodies, soil deterioration, and air pollution. The total fertilizer consumption in 2021-2022 amounted to 63.94 million tonnes, indicating a marginal decrease of 5.4% from the previous fiscal year. In 2020-2021, India's chemical fertilizer consumption recorded 62.98 million tons, marking a substantial growth of over 82.5% since the baseline year of 2000-2001 (Centre for Science and Environment, 2022). The present study focus attention on the trends and pattern of chemical fertilizer consumption and Multi - dimensional drivers behind the surge in chemical fertilizer consumption in Kerala

Key words: Chemical fertilisers, Fertiliser consumption, Agricultural productivity

Introduction

Fertilizers are indispensable components of modern agriculture, playing a central role in sustaining global food production and addressing the nutritional needs of a growing population. Chemical fertilizers introduced a paradigm shift in Kerala's agricultural practices. Farmers started incorporating synthetic fertilizers containing essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K) into their cultivation methods. This transition enabled more efficient nutrient management, thereby optimizing plant growth. The impact of this shift was profound, resulting in increased agricultural productivity and crop yields, which played a pivotal role in addressing food security concerns and reducing the state's reliance on food imports

Review of literature

The study by Aryal. (2021) delves into the crucial issue of fertilizer use among farmers in South Asia. By analysing data from over 2,500 households across India, Nepal, and Bangladesh, the research highlights the significant contribution of nitrogen (N) fertilizer to global warming and environmental degradation.

The research conducted by Tuan and Lee (2021) examined the adoption of organic fertilizers in rice production in Vietnam using data from the 2014 Vietnam Household Living Standards Survey. The study highlighted the financial efficiency of organic fertilizer usage in rice production, with reduced reliance on inorganic fertilizers.

Bora (2022) delves into the intricate dynamics of chemical fertilizer use in the context of environmental sustainability, particularly focusing on rice cultivation in India. The study highlights the crucial role of fertilizer in bolstering crop productivity and ensuring food security. Particularly, districts within the Indo-Gangetic plains exhibit unsustainable levels of fertilizer application, leading to large surpluses of nitrogen. By assessing sustainability indicators, the study identifies regions necessitating targeted policy interventions to restore nutrient balance in the soil.



Yadava's study (2023) sheds light on the persistent challenge of inefficient chemical fertilizer use in Indian agriculture, despite its pivotal role in food security and employment. By employing slack-based Data Envelopment Analysis (DEA) on data spanning from 2006 to 2015 across 28 Indian states, the research evaluates the technical inefficiency of chemical fertilizer usage and its impact on agricultural yield. Nitrogen (N), Phosphorus (P), Potassium (K). The study identifies potassium (K) as having the highest potential for reduction, followed by phosphorus (P) and nitrogen (N).

Objectives of the Study

1. To analyse the trends and pattern of chemical fertilizer consumption in Kerala.
2. To investigate the multi-dimensional drivers behind the surge in chemical fertilizer consumption in Kerala

The Role of Fertilizers in Increasing Agricultural Productivity in Kerala.

Chemical fertilizers introduced a paradigm shift in Kerala's agricultural practices. Farmers started incorporating synthetic fertilizers containing essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K) into their cultivation methods. This transition enabled more efficient nutrient management, thereby optimizing plant growth.

Several key drivers facilitated the role of fertilizers in enhancing agricultural productivity in Kerala. Firstly, chemical fertilizers effectively replenished soil nutrient levels, particularly nitrogen, phosphorus, and potassium. Kerala's soils, like those in many other regions, often suffered from nutrient deficiencies. Fertilizers provided a solution by directly supplying these essential nutrients to crops, ensuring they received the nutrition necessary for optimal growth and yield. Secondly, the use of fertilizers led to a remarkable increase in crop yields. Crops such as rice, a dietary staple in Kerala, witnessed significant improvements in yields due to the application of fertilizers. This boost in production contributed to greater food security for the state's population. Higher yields translated into higher incomes for farmers, leading to improved living standards, better access to education and healthcare, and overall economic growth in rural Kerala. Lastly, the adoption of chemical fertilizers significantly reduced Kerala's dependence on food imports, particularly for staples like rice and wheat. The Green Revolution, driven by the use of fertilizers, increased local production and ensured a stable food supply, mitigating concerns about food security.

Trends in Consumption of Fertilisers and Pesticides in Kerala

In the fiscal year 2021-22, the total consumption of pesticides amounted to 484.05 metric tonnes, comprising 207.38 metric tonnes of chemical pesticides and 276.67 metric tonnes of bio-pesticides. This represents a slight decrease of 1.7 percent in overall pesticide consumption compared to the previous fiscal year of 2020-21. However, during this period, there was a marginal increase observed in the consumption of bio-pesticides. Analysing the pesticide consumption data over the past four years reveals a declining trend, with both chemical and bio-pesticide consumption decreasing by 60 percent each in the fiscal year 2021-22 compared to 2018-19 (Department of Agriculture Development and Farmers Welfare, Kerala, 2022).

Table1: Pesticide and Fertiliser (NPK) Consumption Pattern in Kerala (MT)

Year	Chemical Pesticides	Bio pesticides	Total	Nitrogen	Phosphorus	Potassium
2018-19	517.30	676.76	1194.06	73109	40802	67877
2019-20	291.01	343.80	634.81	75292	36797	55866
2020-21	224.53	268.37	492.89	89238	42613	75085
2021-22	207.38	276.67	484.05	76682	36327	50072

Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022

Table 1 presents data on pesticide and fertilizer consumption patterns in Kerala over a span of five years, from 2017-18 to 2021-22. It indicates the quantities of chemical pesticides and bio-pesticides used, along with the consumption of nitrogen, phosphorus, and potassium fertilizers (NPK). In 2017-18, specific quantities of chemical and bio-pesticides were not available, but fertilizer consumption data were recorded, with nitrogen at 138,213 metric tonnes, phosphorus at 43,295 metric tonnes, and potassium at 60,472 metric tonnes. Subsequently, from 2018-19 to 2021-22, the table shows a fluctuating trend in pesticide consumption, with varying quantities of chemical and bio-pesticides being utilized each year. In 2018-19, chemical pesticides were at 517.30 metric tonnes, bio-pesticides at 676.76 metric tonnes, and NPK fertilizer consumption totalling 1194.06 metric tonnes. The trend continued with fluctuations in subsequent years, such as in 2021-22, with chemical pesticides at 207.38 metric tonnes, bio-pesticides at 276.67 metric tonnes, and NPK fertilizer consumption totalling 76682, 36327, and 50072 metric tonnes respectively.

Table 1 also illustrates the percentage changes in pesticide and fertilizer (NPK) consumption patterns in Kerala across four consecutive years, from 2018-19 to 2021-22. The data show the percentage change in the consumption of chemical pesticides, bio-pesticides, and the total consumption, along with nitrogen, phosphorus, and potassium fertilizers. In 2018-19, significant decreases were observed in the consumption of nitrogen (-47.10%) and phosphorus (-5.76%) fertilizers, while there was a slight increase in potassium consumption (12.25%). Subsequent years showed varying trends, with notable declines in pesticide consumption in 2019-20, particularly for chemical pesticides (-43.74%) and bio-pesticides (-49.20%). However, there were minor increases in nitrogen (2.99%) and phosphorus (15.81%) fertilizer consumption during this period. The year 2020-21 saw further reductions in pesticide consumption, with decreases observed across all categories, albeit less pronounced compared to the previous year. Notably, there were substantial increases in nitrogen (18.52%), phosphorus (15.81%), and potassium (34.40%) fertilizer consumption during this period. In 2021-22, while the overall pesticide consumption decreased slightly (-1.79%), there were significant declines in the consumption of nitrogen (-14.07%) and phosphorus (-14.75%) fertilizers, along with a notable decrease in potassium (-33.31%) fertilizer consumption.

Table 2: Commodity and crop-wise consumption of pesticides, chemical and bio, 2019-20 to 2021-22 (MT), technical grade

Commodity	Chemical Pesticides			Bio pesticides			Total		
	2019-20	2020-21	2021-22	2019-20	2020-21	2021-22	2019-20	2020-21	2021-22
Cereals, Paddy	72.32	52.85	48.97	85.64	62.88	56.30	157.96	115.73	105.27

Vegetables	40.00	34.14	35.64	57.01	42.79	58.25	97.01	76.94	93.89
Spices	32.47	22.05	15.15	45.00	31.19	24.84	77.46	53.25	39.99
Coconut	78.05	52.89	46.22	81.70	63.66	58.43	159.75	116.55	104.65
Arecanut	17.20	12.35	10.68	19.73	19.89	23.11	36.94	32.24	33.79
Banana	50.97	50.24	50.72	54.72	47.94	55.74	105.69	98.19	106.46
Total	291.01	224.53	207.38	343.80	268.37	276.67	634.81	492.89	484.05

Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022

The Table 2 shows the consumption figures for cereals, paddy, vegetables, spices, coconut, arecanut, and banana. For each commodity, the consumption of chemical pesticides and bio-pesticides is listed separately, along with the total consumption. In 2019-20, the consumption of chemical pesticides ranged from 17.20 MT for arecanut to 78.05 MT for coconut, while bio-pesticide consumption varied from 19.73 MT for arecanut to 85.64 MT for cereals, paddy. Across all commodities, the total pesticide consumption for this year was 291.01 MT for chemical pesticides and 343.80 MT for bio-pesticides, resulting in a total of 634.81 MT. The subsequent years, 2020-21 and 2021-22, exhibit fluctuations in pesticide consumption across different commodities.

**Table 3: Consumption of Fertilizers/ha of gross cropped area in Kerala
(2004-05 to 2021-22) (in kg)**

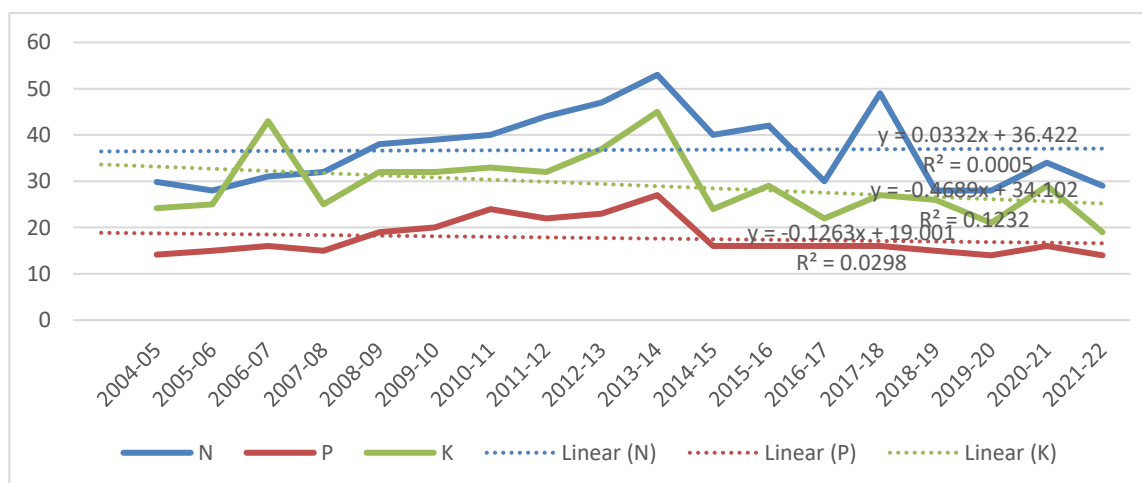
Year	N	P	K	Total (N+P+K)		N:(P+K)% (Kerala)
				Kerala	India	
2004-05	29.87	14.14	24.2	68.21	98.34	78
2005-06	28	15	25	68	104.5	70
2006-07	31	16	43	89	113.26	53
2007-08	32	15	25	72	117.07	80
2008-09	38	19	32	89	N,A	74
2009-10	39	20	32	91	N,A	75
2010-11	40	24	33	97	N,A	70
2011-12	44	22	32	98	N,A	81
2012-13	47	23	37	107	N,A	80
2013-14	53	27	45	125	N,A	73
2014-15	40	16	24	80	N,A	100
2015-16	42	16	29	87	N,A	100
2016-17	30	16	22	68	N,A	80
2017-18	49	16	27	92	N,A	114

2018-19	28	15	26	69	N,A	68
2019-20	28	14	21	63	N,A	80
2020-21	34	16	29	79	N,A	76
2021-22	29	14	19	62	N,A	88

Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022, "N" stands for nitrogen, "P" stands for phosphate (P_2O_5), and "K" stands for potash (K_2O)

Table 3 presents the consumption of fertilizers per hectare (ha) of gross cropped area in Kerala from 2004-05 to 2021-22, measured in kilograms (kg) of nitrogen (N), phosphate (P), and potash (K). The table also includes the total consumption of N, P, and K, as well as the percentage of N relative to the total of P and K. In 2004-05, the fertilizer consumption per hectare in Kerala was 29.87 kg of N, 14.14 kg of P, and 24.2 kg of K, resulting in a total consumption of 68.21 kg. Over the years, there have been fluctuations in fertilizer consumption, with varying trends observed for N, P, and K. For instance, in 2013-14, the consumption increased to 53 kg of N, 27 kg of P, and 45 kg of K, totalling 125 kg per hectare. Similarly, in 2021-22, the consumption decreased to 29 kg of N, 14 kg of P, and 19 kg of K, totalling 62 kg per hectare. The percentage of N relative to the total of P and K also fluctuated over the years, ranging from 53% to 114%.

Figure 1: Trends in Consumption of Fertilizers/ha of gross cropped area in Kerala (2004-05 to 2021-22) (in kg)



Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022, "N" stands for nitrogen, "P" stands for phosphate (P_2O_5), and "K" stands for potash (K_2O)

Table 4 provides a comprehensive overview of the percentage changes in the consumption of fertilizers per hectare (ha) of gross cropped area in Kerala from 2004-05 to 2021-22. The data encompass the consumption trends of nitrogen (N), phosphate (P), potash (K), and the combined total of N, P, and K over the specified period. The values reflect the dynamic nature of fertilizer consumption patterns in Kerala's agricultural landscape. In 2006-07, there was a substantial increase in N consumption by 10.7%, P consumption by 6.7%, and an extraordinary surge in K consumption by 72.0%, resulting in a notable overall increase of 30.9% in the total consumption of N, P, and K. Conversely, in 2014-15, significant decreases were observed across all fertilizer types, with reductions of 24.5% in N

consumption, 40.7% in P consumption, and 46.7% in K consumption, leading to an overall decline of 36.0% in total consumption. These fluctuations underscore the influence of various factors such as changes in agricultural practices, crop preferences, economic conditions, and government policies on fertilizer utilization trends in Kerala's agricultural sector throughout the analysed period.

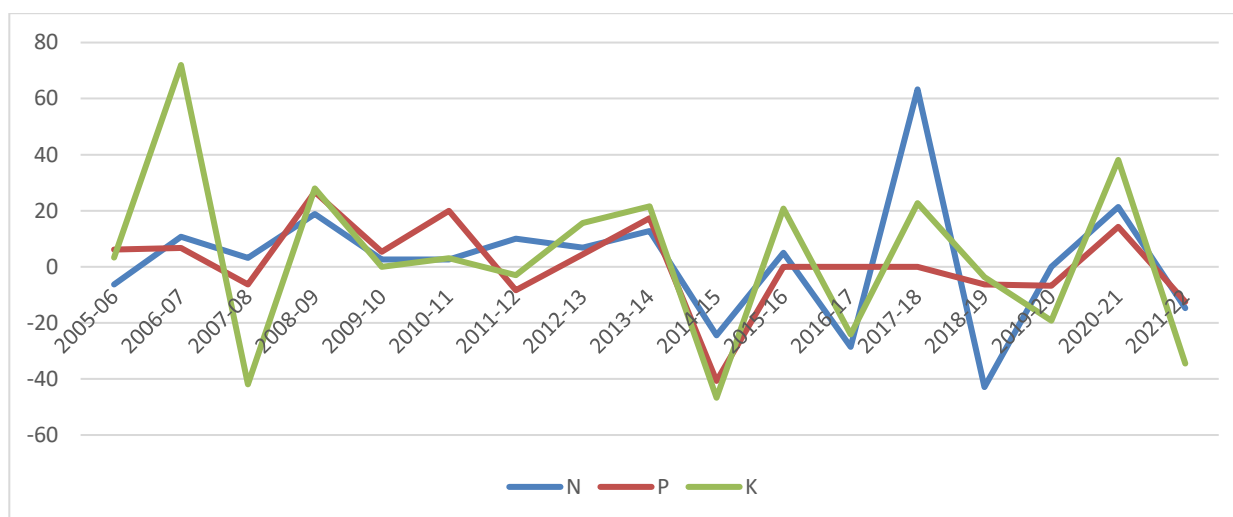
Table 4: Change over the Years in Consumption of Fertilizers/ha of gross cropped area in Kerala (2004-05 to 2021-22) (in %)

Year	N	P	K	N+P+K
2005-06	-6.3	6.1	3.3	-0.3
2006-07	10.7	6.7	72.0	30.9
2007-08	3.2	-6.3	-41.9	-19.1
2008-09	18.8	26.7	28.0	23.6
2009-10	2.6	5.3	0.0	2.2
2010-11	2.6	20.0	3.1	6.6
2011-12	10.0	-8.3	-3.0	1.0
2012-13	6.8	4.5	15.6	9.2
2013-14	12.8	17.4	21.6	16.8
2014-15	-24.5	-40.7	-46.7	-36.0
2015-16	5.0	0.0	20.8	8.8
2016-17	-28.6	0.0	-24.1	-21.8
2017-18	63.3	0.0	22.7	35.3
2018-19	-42.9	-6.3	-3.7	-25.0
2019-20	0.0	-6.7	-19.2	-8.7
2020-21	21.4	14.3	38.1	25.4
2021-22	-14.7	-12.5	-34.5	-21.5

Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022, "N" stands for nitrogen, "P" stands for phosphate (P_2O_5), and "K" stands for potash (K_2O)

Figure 2 shows the consumption of fertilizers per hectare of grass cropped area in Kerala from 2004-05 to 2021-22. The data is for nitrogen (N), phosphate (P), and potash (K). Fertilizer consumption in Kerala has been steadily increasing for all three types of fertilizers (N, P, and K) over the past 17 years. The largest increase is seen in nitrogen consumption, which has more than doubled since 2004-05. Potash consumption has seen the most modest increase, but it has still gone up by around 44% over the period. While the overall trend is upwards, there have been some year-to-year variations in fertilizer consumption. Nitrogen consumption dipped slightly in 2009-10 and 2013-14, while phosphate consumption dipped in 2015-16 and 2020-21. Potash consumption has seen the least year-to-year variation, with a generally consistent increase throughout the period.

Figure 2: Change over the Years in Consumption of Fertilizers/ha of gross cropped area in Kerala (2004-05 to 2021-22) (in %)



Source: Department of Agriculture Development and Farmers Welfare, Kerala, 2022,
for nitrogen, "P" stands for phosphate (P_2O_5), and "K" stands for potash (K_2O)

"N" stands

Conclusion

India's agriculture depends heavily on fertilizer use to increase crop yields and boost the nutritional value of food. With a population of more than 1.3 billion, securing a reliable and ample food supply is crucial. Fertilizers are essential for increasing agricultural output and supplying the population's nutritional demands. By promoting responsible fertilizer use, encouraging organic farming practices, and supporting smallholder farmers, Kerala can continue to harness the benefits of fertilizers while addressing the associated challenges in a holistic and sustainable manner.

The consumption of fertilizers per hectare of gross cropped area in Kerala from 2004-05 to 2021-22 shows fluctuating trend. With respect to nitrogen (N), phosphate (P), and potash (K), the overall trend for consumption in Kerala is slightly increasing during the period. However, there is a lot of variation year-to-year.

The consumption of nitrogen fertilizer increased from 2004-05 to 2011-12, but then decreased from 2011-12 to 2021-22. Consumption of phosphate fertilizer also increased from 2004-05 to 2011-12, but then decreased from 2011-12 to 2021-22. Consumption of potash fertilizer has been more stable, with a slight increase over the entire period. The fluctuations in fertiliser consumption underscore the influence of various factors such as changes in agricultural practices, crop preferences, economic conditions, and government policies on fertilizer utilization trends in Kerala's agricultural sector.

These variations underscore the importance of understanding local agricultural dynamics to tailor fertilizer management strategies effectively. The fluctuations observed in fertilizer usage underscore the dynamic nature of agricultural practices and highlight the importance of tailored fertilizer management approaches to optimize nutrient utilization and enhance agricultural sustainability. These insights are crucial for policymakers, agricultural authorities and farmers alike facilitating informed decision-making and the formulation of targeted interventions aimed at promoting sustainable agricultural practices and ensuring food security in Kerala.



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