Original Research Article

Pesticide Consumption trends in India

ABSTRACT

Aims: The main aim of this study is to examine the growth rate of consumption of pesticides in India and Tamil Nadu.
Place and Duration of Study: The study was carried out using the time series data on pesticide consumption collected from secondary sources from 1990 to 2020 for India and for Tamil Nadu, the data werecollected from 2011 to 2021.
Methodology: The compound annual growth rate is used to calculate the growth rate of consumption of pesticides. The data is segmented for every 10 years and decadal growth rate was also examined.
Results: The overall compound annual growth rate of pesticide consumption isnegative(-0.44 per cent) and the decadal average was found to be -5.27%, -0.73% and 1.81% for the decades 1990-2000, 2001-2010 and 2011-2020respectively for India. The growth rate for different types of pesticides was found to be declining (-2.26 per cent) for insecticides, however it is increasing for fungicides (2.65 per cent) and herbicides (0.99 per cent). CAGR indicates that there is no change in growth of pesticide consumption in Tamil Nadu.
Conclusion: The trend in the pesticide use has been decreasing over the period and it shows that the total quantity of pesticides used in the country has been continuously decreasing which is a healthy sign for the environment. It may due to increase in the area of organic farming, practices like IPM and increase in the use of biopesticides.

Keywords: (Pesticides, consumption, compound annual growth rate, Tamil Nadu, India)

1. INTRODUCTION

Agriculture is the backbone of the Indian economy and 54 per cent of the country's population depends on agriculture and allied activites and it contributes to 13.9 per cent of the GDP of the country (Pathania et al., 2020). In addition to this direct contribution, the agricultural sector also has an indirect contribution in the development of Indian economy. The per capita increase of one per cent in agricultural growth results in 1.5 per cent increase in per capita non-agricultural growth (Yaqoob et al., 2022).Hence, it becomes significant for a country to develop the agricultural sector which is quite challenging as agriculture is associated with various risks which makes it hard to predict the outcomes. The losses due to pests are high both in developed and developing countries. This loss can be mitigated by various measures and the most common is the use of chemical pesticides. The losses due to crop failure have been decreased from 23.3 per cent to 15.7 per cent in India since the phase of green revolution (Dhaliwal et al., 2015).

The introduction of pesticides in India dates back to 1948 and the production of pesticides in the country began since 1952. India stands in twelth position worldwide and third in Asia in pesticide use (Nayak and Solanki 2021).The production of pesticides is increasing at an annual compound growth rate of 3.83 per cent from 2014 to 2019 (Annual Report of the Department of Chemicals and Petrochemicals, 2019-20). The export of pesticides has been increasing due to production of pesticides from ₹ 6492 crores in 2013-14 to ₹ 15522 crores in 2019-2020 whereas India imported about 106.6 thousand metric tonnes of pesticides in 2019-20 (Ministry of Agriculture and Farmer's Welfare). The usage of pesticides in Indian agriculture started during the period of green revolution and it is being used till date and is one of the

most crucial inputs in the present day agriculture. India has an area of about 111.2 million hectares cultivated under chemical pesticides by 2020-21. The pesticide consumption is the highest for cereals, followed by cash crops and vegetables (Directorate of Plant Protection, Quarantine and Storage). Tamil Nadu stands sixth in pesticide consumption in India consuming 1834 metric tonnes of pesticides in 2020-21.The pesticides even it provides numerous benefits, the negative impacts due to the use of pesticides have been a matter of concern in the present years worldwide. 8 lakh casualities are reported in developing countries due to pesticides since green revolution (Bhardwaj and Sharma, 2013). Therefore, it becomes essential to trace the consumption trends of pesticides in the country.

1.1 Objectives

The major objectives of the present study are:

- To examine the growth of pesticide consumption in India
- To examine the pesticide consumption trends in Tamil Nadu which helps to understand the pesticide use pattern in the country.

2. MATERIAL AND METHODS

2.1 Data sources

The secondary data wereused for the study. The data were collected from authenticated websites like Indiastat which is compiled from the information by the Ministry of Agriculture and Farmer's Welfare and the Ministry of Chemicals and Fertilizers. The data on the consumption of different types of pesticides from 1990 to 2020 were gathered from FAO-STAT. Thus, the time series data were collected for the past 30 years and split into three decades for the country. The data of 10 years only were used for Tamil Nadu.

2.2 Method of Data Analysis

Compound Growth Rate Analysis was used to analyse the trends in consumption of pesticides.

2.3.1Compound Annual Growth Rate(CAGR)(Das and Mishra (2020))

The most common tool used for calculating the growth rate is the compound annual growth rate and this study follows the method adopted by Das and Mishra (2020).This method analyses the trend in pesticide consumption and the final result is expressed in percentage per annum.

The growth in the consumption of pesticides is calculated using the formula:

$Y = ab^t$

where Y refers to the consumption of pesticides

a refers to the constant term or intercept

t is the time in years

$b = 1 + r/100$

where r indicates the rate of compound growth rate of consumption per annum.

Reduced form of the equation is obtained by taking logariths on both sides,

$\log Y_t = \log a + t \log b$

Assuming A= log a and B = log b, then,

$\log Y_t = A + B\ t$

The compound annual growth rate per annum can be calculated as

$r = (\text{Antilog } B - 1) \times 100$

This gives the growth or downfall in the pesticide consumption pattern over the years and is expressed in percentage per annum.

3. RESULTS AND DISCUSSION

3.1 Pesticide Consumption in India

To get a realistic picture of pesticide consumption pattern in the country over the decades (1990-2020), Compound Annual Growth Rate is computed and the results are presented in Table 1.

Table 1: Compound Annual Growth Rate (CAGR) of pesticide consumption in India

Time Period	CAGR (per cent per year)
1990-2000	-5.27***
2001-2010	-0.73
2011-2020	1.81*
1990-2020	-0.44

*** Significant at 1% level, * Significant at 10% level

(Source: Calculated by authors, data collected from Indiastat)

It is evident from Table 1 that there were wide fluctuations in the consumption pattern over the decades.The overall trend in pesticide consumption for the past 30 years was negative (-0.44 per cent). The decade 1990-2000 has a high rate of decline (-5.27 per cent) in consumption and it was statistically significant at one per cent level. There was adecreasing trend (-0.73 per cent) observed in the second decade (2001-2010) which is almost stagnant as compared to the previous period. However, the subsequent decade (2011-2020) has shown a positive trend in growth i.e. 1.81 per cent. The overall decline in the pesticide consumption may be due to the improvements and adoption of innovative technologies like Integrated Pest Management or may be the use of new types of products which are applied in lesser quantities.

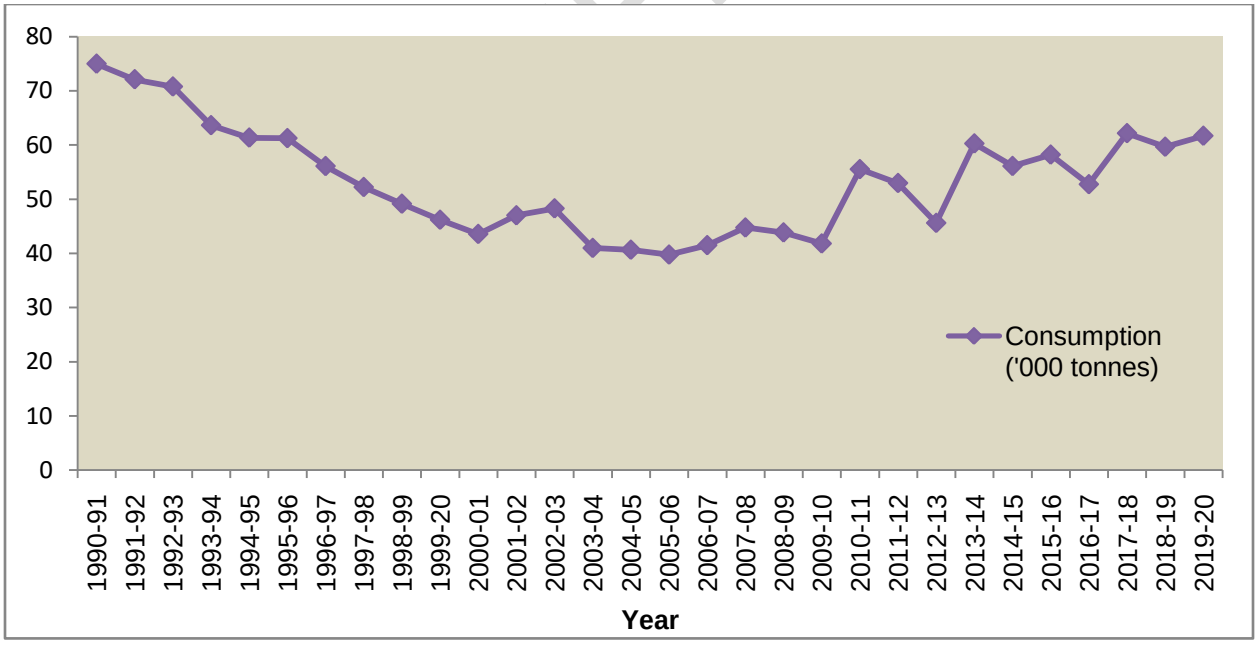

Figure 1: Pesticides Consumption trend in India (1990-2020)

(Source: Calculated by authors, data collected from Indiastat)

The trend in the growth rate of pesticide consumption for India is shown in Figure 1. The use of pesticides has been found to be continuously declining from 1990-1991 to 2000-2001 which was indicated by a high negative rate of 5.27 per cent. After that the growth is nearly stagnant (-0.73 per cent) upto 2009-2010.

The period after 2010 is subjected to wide variations. The agricultural year 2010-2011 is when the country produced record food grains of 241 million tonnes since independence. The sudden increase in the pesticide consumption in the year 2010-2011 could be the increased production which is naturally associated with increased input use. The year 2012-2013 is considered to be the drought year in Maharashtra which is one of the leading consumers of pesticides in India and the year 2016-2017 is considered to be the drought year in India and hence a downfall in pesticide consumption was observed.

3.2 Consumption of different pesticides in India

The term pesticides is an umbrella term which includes many chemicals like insecticides, herbicides, fungicides, molluscicides, nematicides, rodenticides and so on. Different pesticides are used in different quantities throughout the country.In agriculture, the most commonly used pesticides are insecticides which accounts for 51 per cent followed by fungicides and herbicides (Food and Agricultural Organization, 2018). The trend in the consumption of different types of pesticides in India over the period of 30 years are computed and presented in Table 2.

Table 2: Compound Annual Growth Rate (CAGR) of consumption of different pesticides in India between 1990 and 2020

Pesticides	CAGR (per cent per year)
Insecticides	-2.26**
Fungicides	2.65***
Herbicides	0.99*

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

(Source: Calculated by authors, data collected from FAO-STAT)

The consumption of insecticides has been found to have a decline in consumption at a rate of 2.26 per cent per annum over the period between 1990 and 2020 and it is significant at 5 per cent level.The inefficiency of chemical pesticides to control in cotton brought a technological outbreak in biological control of Helicoverpa and Spodoptera(Kranthi et al., 2002). This may be the reason for the decreasing trend as majority of the pesticides in India is diverted to cotton. However, an increasing trend was observed for fungicides and herbicides.The consumption of fungicides was found to increase at a rate of 2.65 per cent per year and is also statistically significant at one per cent level and the consumption of herbicides increasing at 0.99 per cent per annum and it is significant at ten per cent level. This may be due to the increase in the share of herbicides in total pesticide production from 17 per cent in 2015-2016 to 20 per cent in 2019-2020 (Jamaludheen et al., 2022).

3.3 Pesticide Consumption scenario in Tamil Nadu

The data on the consumption of pesticides in Tamil Nadu over the years is given in Table 3.

Table 3: Consumption of Pesticides in Tamil Nadu

Year	Consumption (in metric tonnes)
2011-12	1968
2012-13	1766
2013-14	2142
2014-15	2096
2015-16	2096
2016-17	2092
2017-18	1929
2018-19	1901

2019-20	2225
2020-21	1834
CAGR	0.081%

(Source: Ministry of Chemicals and Fertilizers and Ministry of Agriculture and Farmer's Welfare, Indiastat)

The compound annual growth rate of pesticides over the period of ten years from 2011 to 2021 is 0.08 per cent per annum. The pesticide consumption is almost stagnant in Tamil Nadu. In Tamil Nadu, Ariyalur is the major pesticide district (Department of Agriculture, Chennai, 2018-2019). The pesticides are used in both liquid and dust formulations. The liquid formulation is preferred more in comparison to dust formulation.

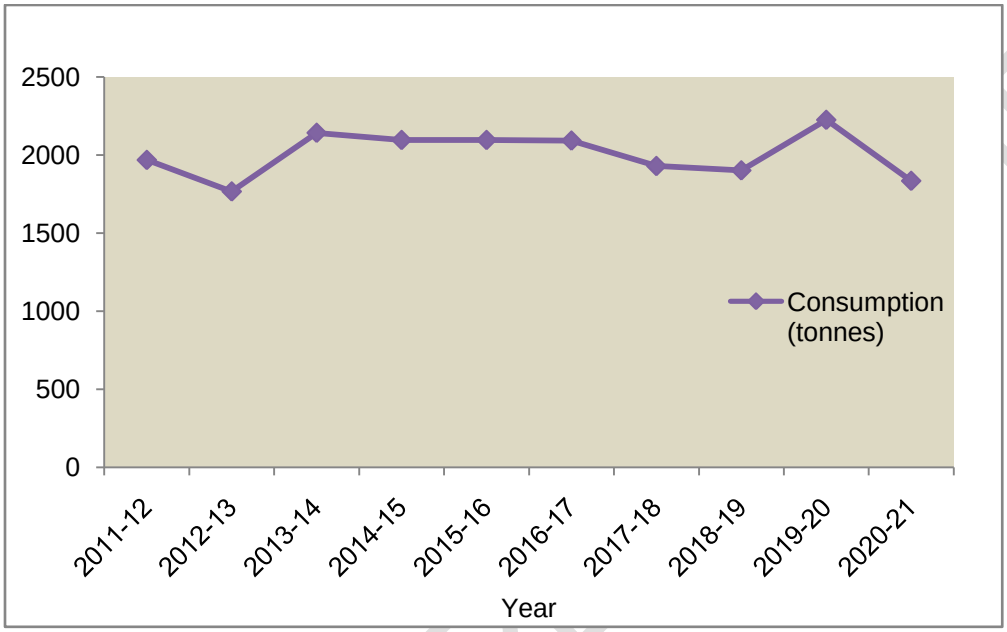

Figure 2: Pesticide Consumption trend in Tamil Nadu (2011-2021)

(Source: Calculated by authors, data collected from Indiastat)

The pesticide consumption trends in Tamil Nadu for the past decade is shown in Figure 2. The consumption pattern of pesticides in Tamil Nadu is almost constant over the years. The pesticide consumption was at its highest over the decade in the year 2019-2020. The aftermath is witnessed as the impacts of COVID 19 in the country which led to a shut down of many markets in the country and the state leading to a downfall in agricultural production and the input use.

4. CONCLUSION

The overall trend in the pesticide consumption for the country over the past 30 years was found to be declining. The consumption of insecticides from 1990 to 2020 was also on decline while the fungicides and herbicides were increasing over the years. The consumption of pesticides in Tamil Nadu was almost stagnant from 2011 to 2021. The pesticide market in India is one of the very influential markets for the economy. Hence, the analysis of the consumption patterns of pesticides becomes a necessary phenomenon. In reality the pesticide use in India is less when compared to other countries and per hectare consumption of pesticides is also not so high. Inspite of this, the developing countries reports 99 per cent of pesticide poisoning mortalities even though they consume only 20 per cent of the global pesticide consumption (Jeyaratnam, 1985). It was seen that nearly 30 per cent of the markted pesticides fail to meet the international standards (World Health Organization, 2001). Therefore, the knowledge regarding the pesticide consumption provides a clear picture on the type of pesticides consumed in larger quantities. Nowadays, the concern regarding the negative externalities of pesticides have resulted in

awareness among the farmers in some communities. However, to have a greater understanding of the exact case the micro level information on the pesticide consumption is essential. The overall decline in the consumption of pesticides in the country is a healthy sign and the study suggests that the awareness regarding the proper handling of pesticides and the organic farming shall be widely disseminated.

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