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THE ROLE OF CHEMICAL FERTILIZERS AND PESTICIDES IN SUSTAINABLE AGRICULTURAL DEVELOPMENT IN INDIA

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ABSTRACT

The 'Sustainable Agriculture' concept lies in the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the natural resource base and avoiding ecological and environmental degradations, so that these needs can be met not only in the present, but also for future generations. Increased usage of fertilizers has played a significant role in accelerating the agricultural growth and productivity apart from application of modern farming techniques and better quality inputs. In this paper we have analyzed the annual growth rate trends in use of chemical fertilizers and pesticides, total food grains production and productivity in India. We have also tried to find out the impacts of chemical fertilizers and pesticides on total food grains production and productivity in India. The uses of chemical fertilizers and pesticides have started adversely affecting the sustainable agricultural development. So we should promote Organic Farming and use of Bio-fertilizers and pesticides in place of chemical fertilizers and pesticides which is eco-friendly and helpful in sustainable agricultural development.

KEYWORDS

Chemical fertilizers, agriculture development.

1.1 INTRODUCTION

ustainability' is one of the buzz-words of our time. It has been attached to any number of social and economic pursuits: we want sustainable economic growth, sustainable development, sustainable forestry, a sustainable population, sustainable cities, and so on. More importantly, we talk about the need for "sustainable agriculture".

Interest in sustainability peaked in the mid 1990s following the 1987 Bruntland Report, *Our Common Future*, where the authors note the rate of economic development is compromising the needs of future generations. Concerns centered on soil quality (particularly soil erosion), water scarcity and contamination, low productivity, and imbalances of pest populations, as well as, a number of social and economic equity issues. Although there are numerous definitions and visions of sustainable agriculture, they tend to have certain aspects in common: environmental health, economic profitability, and social and economic equity. From a biophysical or environmental perspective, agricultural production affects the ecosystem which sets the natural limit to growth. If the ecosystem is pushed too far, its integrity will be destroyed, ultimately leading to a decline in agricultural productivity. With respect to economic viability, sustainable agricultural systems ensure a positive balance between production income and input costs. Economically unsustainable farms may lose control of their ecological resources. At the same time, agriculture is inevitably social, given the network of interactions and relations that both emerge and influence farming activity. Inherent in the notion of sustainable agriculture is "its adaptability and flexibility over time to respond to the demands for food and fiber (both high and low), its demands on natural resources for production, and its ability to protect the soil and the resources". [1]

1.2. OBJECTIVES OF SUSTAINABLE AGRICULTURE

The fast development of technology for increasing production without giving due importance to the agro ecosystem balance resulted in disturbed biological relationships. The imbalances thus created lead to fast degradation of natural resource base. Thus the present productivity levels have become unstable and uneconomic. This necessitated maintenance of natural resources so as to meet future demand. Thus the concept of Sustainable Agriculture emerged. Sustainable Agriculture aims at production of safe and clean food without harming the quality of natural landscapes and with minimal impact on environment. However it should operate within socially acceptable system and economic viability.

1.3. INDIAN POLICIES FOR SUSTAINABLE AGRICULTURE

The Indian government's policies have always emphasized food grain self-sufficiency, which has not necessarily coincided with agricultural sustainability. The growth of agricultural production and productivity, which had risen significantly during 1970s and 1980s, declined during 1990s. These slowdowns have worsened since 2000, both overall agricultural production and food grains production have shown negative growth rates in 2000-01 to 2002-03 period. Decline in the growth rates of agricultural production and productivity is a serious issue considering the questions of food security, livelihood, and environment. As such, a critical examination of the approaches for sustainable agricultural development is necessary. This examination must be framed not only by India's ongoing need to ensure food self-sufficiency but also by the consequences of access to international markets. The conditions for development of sustainable agriculture are becoming more and more favorable. The multifarious harmful consequences of indiscriminate use of pesticides have posed a serious threat to the ecosystem. In view of the fact that increased use of pesticides has been seriously endangering the environmental sustainability, integrated approach to pest management needs adequate importance to make the agriculture eco-friendly.

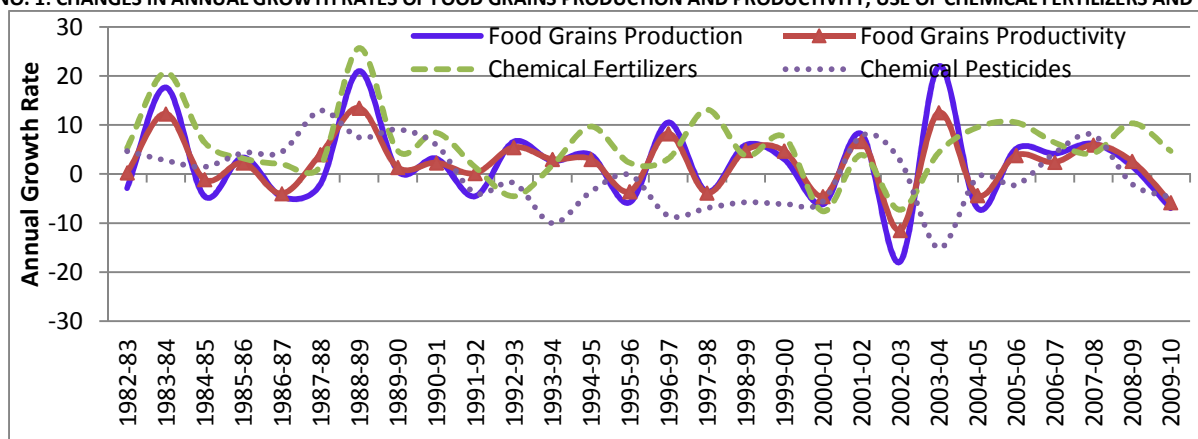
2. METHODOLOGY

The paper is based on secondary data obtained from the publication of department of chemical fertilizers and pesticides in India and economic survey of India. We have taken 30 years data of total food grains production and productivity, use of chemical fertilizers and pesticides of India level and data of 10 years for state level namely; Maharashtra, Bihar, Punjab and Rajasthan. We have tried to know the annual growth rate and the impacts of use of chemical fertilizers, chemical pesticides, total food grains production and productivity in India along with state level by using simple formula of growth rates and co-variations statistical tools.

3. IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON FOOD GRAINS PRODUCTION AND PRODUCTIVITY

Production fluctuates every year according to the monsoon. Production depends upon yield rate of the crops. Productivity depends on three factors inputs: Water, Fertilizers and Hybrid seeds. Each of these plays a role in determining yield level and in turn augmentation in the level of production. The fertilizers consist of three basic nutrients for agriculture: namely, Nitrogen (N), Phosphorous (P) and Potassium (K) apart from micro-nutrients. Increased usage of fertilizers has played a significant role in accelerating the agricultural growth and productivity apart from application of modern farming techniques and better quality inputs. Chemical fertilizers have played a significant role in the development of the agricultural sector. Use of chemical fertilizers has steadily increased over the years. [2]

FIGURE NO. 1: CHANGES IN ANNUAL GROWTH RATES OF FOOD GRAINS PRODUCTION AND PRODUCTIVITY, USE OF CHEMICAL FERTILIZERS AND PESTICIDES



Sources: Department of Chemical Fertilizers and Pesticides, New Delhi

Figure No.1 indicates that in India, food grains production is increasing continuously since 1981. Same way use of chemical fertilizers is also increasing continuously since starting in India. For five consecutive years, from 2004-05 to 2008-09, food grains production recorded an increasing trend. After 2009 food grains production is going down but use of chemical fertilizers is continuously increasing. The use of chemical pesticides is decreasing continuously from 1991 to 2010. In 1980-81 the total food grains production was 129.59 m. tons that increased to 176.39 in the year 1990-91. After reaching a record level it declined to 196.81m.tons in the year 2000-01. For five consecutive years, from 2004-05 to 2008-09, food grains production recorded an increasing trend. The chart indicates that total food grains productivity is increasing continuously since 1981 to 2009. Same way use of chemical fertilizers is also increasing continuously since 1981 to 2010 in India. But the use of chemical pesticides is decreasing continuously from 1991 to 2010. We have seen total food grains productivity and use of chemical fertilizers are continuously increasing in India. We have seen more fluctuations in use of chemical pesticides. It is clear there are positive growth trends in total food grains production and productivity in India. We found maximum positive growth trends in use of chemical fertilizers, but we found maximum negative growth trends in use of chemical pesticides in India. The use of chemical fertilizers supports and pesticides does not support growth of total food grains production on the other hand use of chemical fertilizers and pesticides support growths of total food grains productivity in India.

We have tried to find out changes in annual growth rates of chemical fertilizers, chemical pesticides, total food grains production and productivity in India by calculating growth rates for all India total. Further, we will try to know the impact of chemical fertilizers and pesticides on food grains production and productivity through the figure no. 2 and 3.

FIGURE NO. 2: IMPACTS OF USE OF CHEMICAL FERTILIZERS AND PESTICIDES ON ALL INDIA FOOD GRAINS PRODUCTION

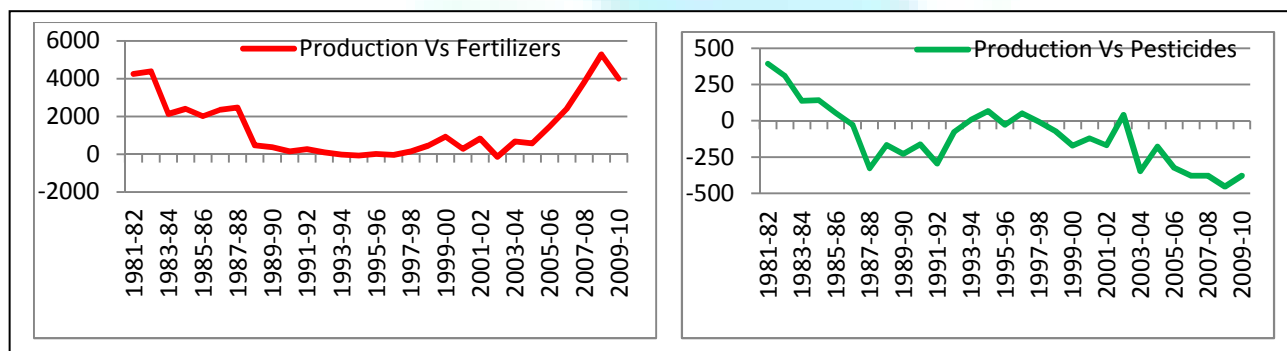


Figure No.2 indicates, there are 25 years positive and 4 years negative co-variations between total food grains production and use of chemical fertilizers out of 29 years whereas, 9 years positive and 20 years negative co-variations between total food grains production and use of chemical pesticides in India. It is clear from chart of co-variations that food grains production is supported by use of chemical fertilizers but unsupported by use of chemical pesticides in India. The chart shows negative impacts of chemical pesticides on total food grains production in India. Use of chemical pesticides affected the total food grains production in India.

FIGURE NO. 3: IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON ALL INDIA FOOD GRAINS PRODUCTIVITY

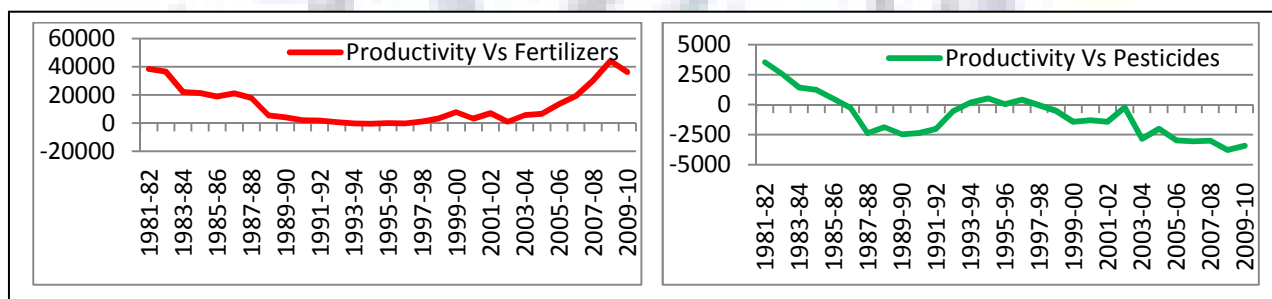


Figure No.3 indicates that, there are 25 years positive and 4 years negative co-variations between total food grains productivity and use of chemical fertilizers out of 29 years whereas, 9 years positive and 20 years negative co-variations between total food grains productivity and use of chemical pesticides in India. The total food grains productivity is supported by use of chemical fertilizers but unsupported by use of chemical pesticides in India. Chemical fertilizers and pesticides support growths of total food grains productivity in India. Further, we will try to find out the impact of chemical fertilizers and pesticides on food grains production and productivity in different states by using co-variations statistical tool through the figure no. 4 to 11.

FIGURE NO. 4: IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON FOOD GRAINS PRODUCTION IN MAHARASHTRA

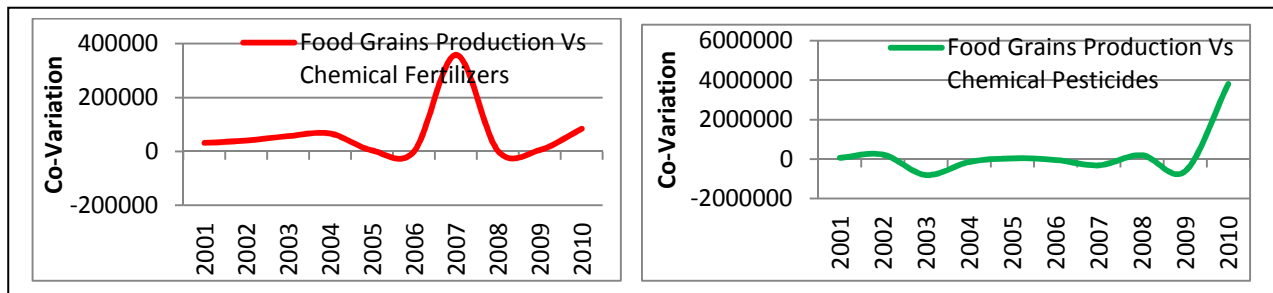


Figure No.4 indicates that there are 10 years positive co-variations between total food grains production and use of chemical fertilizers out of 10 years whereas 5 years positive and 5 years negative co-variations between total food grains production and use of chemical pesticides in Maharashtra. Use of chemical fertilizers and pesticides does not affect the total food grains production in Maharashtra. In 2007, use of chemical fertilizers was more that year sudden increase in total food grains production was seen. After that when use of chemical fertilizers was less then there was sudden fall in total food grains production. It means use of chemical fertilizers support the total food grains production.

FIGURE NO. 5: IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON FOOD GRAINS PRODUCTION IN BIHAR

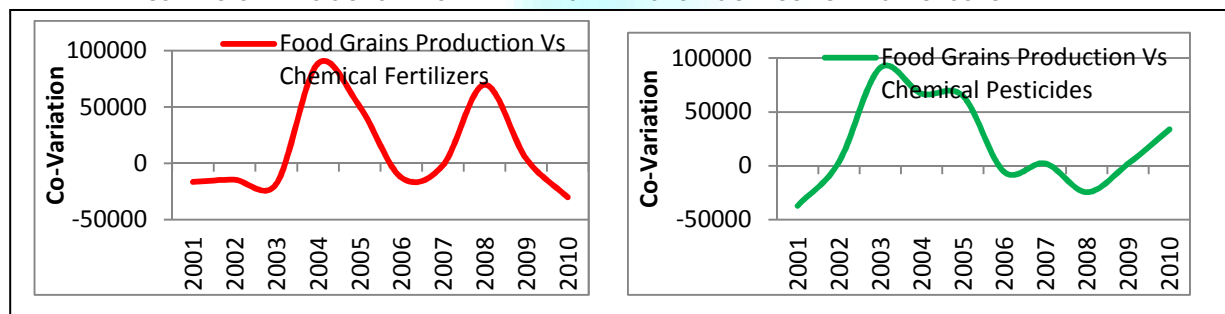


Figure No.5 indicates that there are 4 years positive and 6 years negative co-variations between total food grains production and use of chemical fertilizers out of 10 years whereas 7 years positive and 3 years negative co-variations between total food grains production and use of chemical pesticides in Bihar. When chemical fertilizers and pesticides were used in less quantity, fall was observed in total food grains production. On the other hand, when chemical fertilizers and pesticides were used in more quantity, again fall was observed in total food grains production which can be clearly seen in charts during 2004-05 and 2008-09.

FIGURE NO. 6: IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON FOOD GRAINS PRODUCTION IN PUNJAB

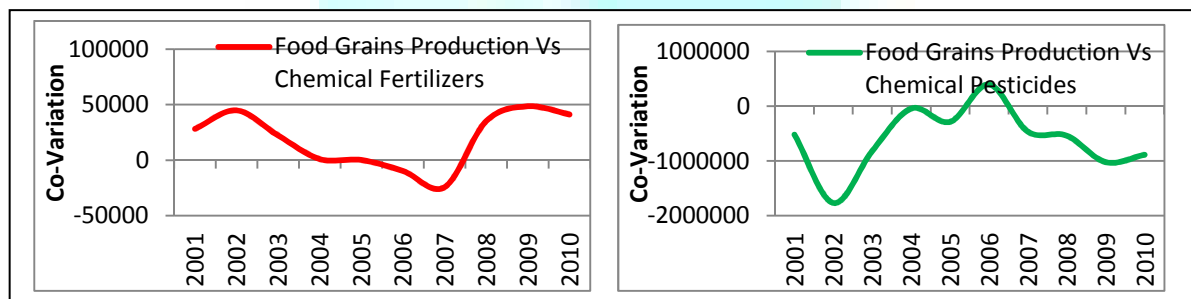


Figure No.6 indicates that there are 8 years positive and 2 years negative co-variations between total food grains production and use of chemical fertilizers out of 10 years whereas 1 years positive and 9 years negative co-variations between total food grains production and use of chemical pesticides in Punjab. Chemical pesticides affected the total food grains production in Punjab.

FIGURE NO. 7: IMPACTS OF CHEMICAL FERTILIZERS AND PESTICIDES ON FOOD GRAINS PRODUCTION IN RAJASTHAN

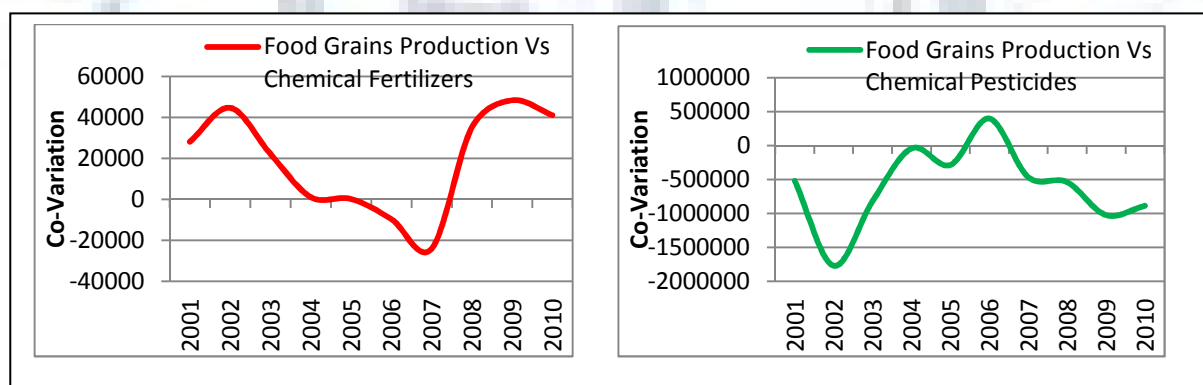


Figure No.7 indicates that there are 6 years positive and 4 years negative co-variations between total food grains production and use of chemical fertilizers out of 10 years whereas 6 years positive and 4 years negative co-variations between total food grains production and use of chemical pesticides in Rajasthan. It is clear from the chart of co-variations that food grains production is supported by both use of chemical fertilizers and pesticides in Rajasthan. We have seen more fluctuations in co-variations between total food grains production, use of chemical fertilizers and pesticides in Rajasthan.

FIGURE NO. 8: IMPACTS OF USE OF CHEMICAL FERTILIZERS AND PESTICIDES ON TOTAL FOOD GRAINS PRODUCTIVITY IN MAHARASHTRA

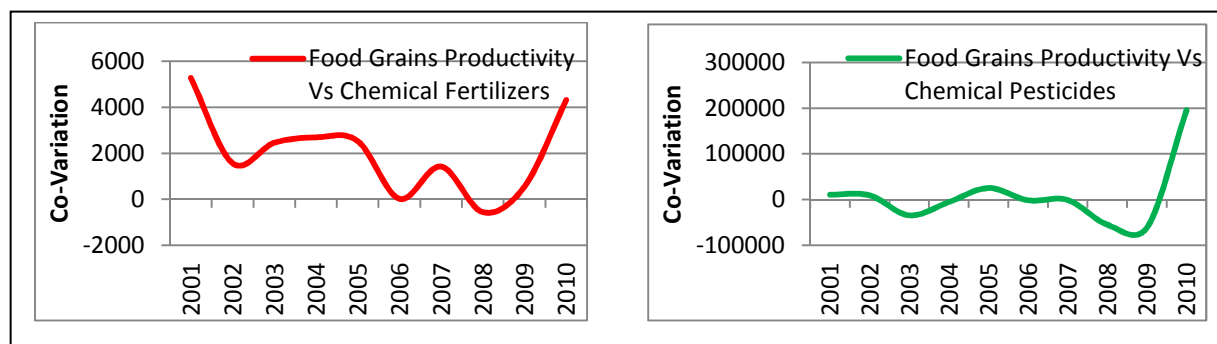


Figure No.8 indicates that there are 9 years positive and 1 year negative co-variations between total food grains productivity and use of chemical fertilizers out of 10 years whereas 4 years positive and 6 years negative co-variations between total food grains productivity and use of chemical pesticides in Maharashtra. It is clear from chart of co-variations that total food grains productivity is supported by use of chemical fertilizers in Maharashtra. Use of chemical fertilizers is more favorable in total food grains productivity than use of chemical pesticides.

FIGURE NO. 9: IMPACTS OF USE OF CHEMICAL FERTILIZERS AND PESTICIDES ON TOTAL FOOD GRAINS PRODUCTIVITY IN BIHAR

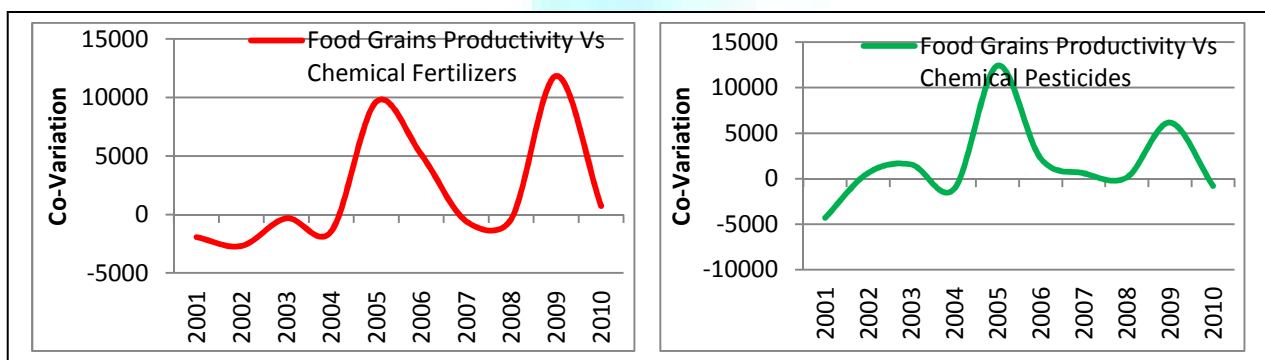


Figure No.9 indicates that there are 4 years positive and 6 years negative co-variations between total food grains productivity and use of chemical fertilizers out of 10 years whereas 7 years positive and 3 years negative co-variations between total food grains productivity and use of chemical pesticides in Bihar. Total food grains productivity is more affected by use of chemical fertilizers in Bihar.

FIGURE NO.10: IMPACTS OF USE OF CHEMICAL FERTILIZERS AND PESTICIDES ON TOTAL FOOD GRAINS PRODUCTIVITY IN PUNJAB

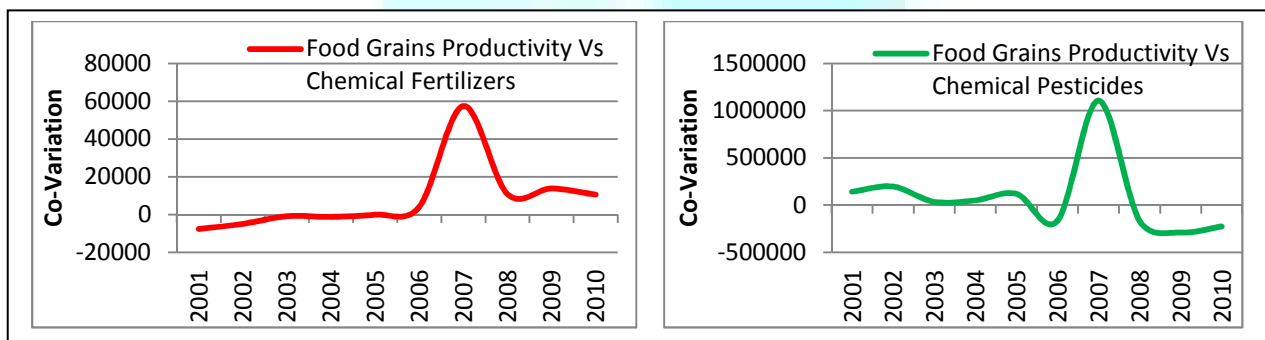


Figure No.10 indicates that there are 5 years positive and 5 years negative co-variations between total food grains productivity and use of chemical fertilizers out of 10 years whereas 6 years positive and 4 years negative co-variations between total food grains productivity and use of chemical pesticides in Punjab. After 2008 total food grains productivity is more affected by use of chemical pesticides than use of chemical fertilizers. So we can say that chemical pesticides much affected the sustainable agriculture development in Punjab.

FIGURE NO. 11: IMPACTS OF USE OF CHEMICAL FERTILIZERS AND PESTICIDES ON TOTAL FOOD GRAINS PRODUCTIVITY IN RAJASTHAN

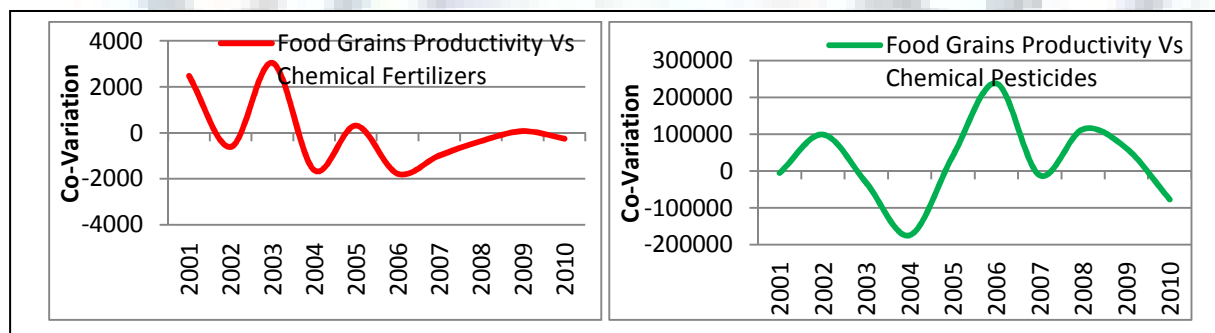


Figure No. 11 indicates that there are 4 years positive and 6 years negative co-variations between total food grains productivity and use of chemical fertilizers out of 10 years whereas 5 years positive and 5 years negative co-variations between total food grains productivity and use of chemical pesticides in Rajasthan. It is clear from chart of co-variations that food grains productivity is unsupported by both use of chemical fertilizers and pesticides in Rajasthan. Total food grains productivity is more affected by use of chemical fertilizers than use of chemical pesticides. Total food grains productivity is going down day by day in Rajasthan.

5. CONCLUSION

The analysis shows, that the use of chemical pesticides is comparatively most affecting factors than use of chemical fertilizers for total food grains productivity. There is much variation in growth rate trends of use of chemical fertilizers and pesticides, total food grains production and productivity in India along with Bihar and Rajasthan since 1982 to 2010. Bihar is the only state which is most affected by use of chemical fertilizers for total food grains production and productivity. The total food grains production and productivity in India shows positive growth rate trends along with Maharashtra and Rajasthan. The use of chemical fertilizers affects total food grains production and productivity in India to a lesser extent. Use of chemical pesticides affects total food grains production and productivity in India along with Bihar and Punjab comparatively to a larger extent. Excessive use of chemical pesticides affected the total food grains production and productivity in India and most affected states are Maharashtra and Punjab. Punjab has most affected state by the use of chemical pesticides. It means pesticides are most adverse affecting factor for ecological balance and sustainable agriculture development.

6. SUGGESTIONS

There has been a spectacular increase in the use of chemical fertilizers over past three decades. Considering the present situation of agriculture and its problems and resulting environmental degradation, sustainability of Indian agriculture is the only scientific solution on the agricultural problems due to excessive use of chemical fertilizer and pesticides. Use of chemical pesticides has started adversely affecting the sustainable agricultural development. We should promote the use of **Bio-pesticides** in place of chemical pesticides which is eco-friendly and helpful in sustainable agricultural development. These days not a single state is spared of the effect of use of chemical fertilizers and pesticides. Each and every state is affected by this by any reason. To increase the food grains production and productivity i.e. food grains self sufficiency sustainable agriculture is the only way. Sustainable agriculture is the only solution to the challenges of food security and environmental stability.

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