

# Integrated Crop and Pest Management Practices in Relation to Global Climate Change

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So long as the man's requirements for his economic activities were small as compared to the global stocks of critical resources, he could count on improving his welfare needs. However, when his economic activities and needs increased with exponential rate, his requirements have begun to exploit the physical limits of nature. This has resulted into declining of earth's resource-base and life-support system. The major manifestations of these impacts are deterioration of forest ecology, diversification of living beings and increase in transparency of earth's atmospheric protective shield to harmful solar UV-radiations. These all have serious implications for the future well-being of mankind. Because of mankind's own activities and intentions, global climate will certainly change. Global climate includes temperature, rainfall, storm, wind pattern, ocean current and sea level. These elements in turn, are ultimately related to the global heat flows and temperature patterns. This climate change is also referred as 'Global Warming' or the anthropogenic (man-made) greenhouse effect, which is going to have major impact on the food security system on an unprecedented scale.

## **Global vs Local Issues**

No doubt, people are talking about global environmental issues, but one must first correlate it with those of local ones. There has been attempt to divert attention by trying to define what are global environmental issues, and therefore, require global negotiations and commitments, and what are local issues which are generally left to national action. So, for instance, desertification and soil erosion have become local problems regardless of the fact that they affect millions of people today, while ozone depletion, which is the result of the over consumption of a few industries causing damage to ozone layer which has become a global issue. The global environmental

facility of United Nation Development Programme (UNDP), United Nation Environment Programme (UNEP) and the World Bank, set up as a major global initiative to transfer funds to the developing countries in the area of environment, lends only for so called global issues.

It is a well-known fact that the quantity of certain greenhouse gases has been increasing rapidly in the earth's atmosphere (Table 1.1). The Intergovernmental Panel on Climate Change (IPCC), set up under auspices of UNEP and WMO, expects the concentration of carbon dioxide (CO<sub>2</sub>) to double in the atmosphere any time in between 2025 and 2050 at present rate of emissions. IPCC also predicts that the rise in the global temperature (range of 1.5-4.0°C) will not be uniform across the globe. Human activities have already raised CO<sub>2</sub> by 25% above pre-industrial levels and are expected to double some time in next century.

**Table 1.1 Atmospheric Concentrations of the Key Greenhouse Gases**

	Pre-industrial (1750-1800)	Present Day (1990's)	Current Rate of Change
Carbon Dioxide (ppmv)	280	353	1.8
Methane (ppmv)	0.8	1.72	0.015
CFC-H(pptv)	0.0	280	9.5
CFC-12 (pptv)	0.0	484	12.0
Nitrous Oxide (ppbv)	288	310	0.8

### **Greenhouse Effect**

The natural greenhouse effect is essential for life on planet. Man's activities, mainly fossil fuel burning since the last century (Table 1.2), has raised the atmospheric concentration of number of gases principally CO<sub>2</sub> which has greenhouse properties, with the result that significant global warming may occur in next few decades. About 18 billion tonnes of CO<sub>2</sub> are added to the atmosphere each year from burning of fossil fuel (Kumar 1991; Ghosh 1992). There are other gases like Chloro-fluorocarbons (CFC's), Nitrous oxide and methane (CH<sub>4</sub>) contribute to global warming. Relative contributions of CO<sub>2</sub>, methane, CFC's, nitrous oxide and others to global warming are 81%, 15%, 11%, 4% and 9% respectively. Thus, earth's climate may be significantly modified in the next 125-150 years. On the whole, the results will be adverse and may also be catastrophic.

With an ever increasing rate of population growth mainly in case of developing countries, the demand for food, fodder, and fuel has increased tremendously resulting into over exploitation of natural resources, as a result of which there has been a number of adverse impacts on environment.

### **Carbon Dioxide (CO<sub>2</sub>)**

The greenhouse gas which has been changed mostly by humans in terms of its effect

Few Pages are not available

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pollution issues in industrial and transport sectors and discharge of untreated sewage are of immediate concern to us as these have disastrous effects on public health. Since, science policy and services need to be better integrated, scientific information and research findings should be communicated to decision/policy makers in a manner that suggests policy consequences. The shift from chemical to ecological agriculture should, however, be gradual. A sudden switchover could spell disaster and discourage farmers from taking to this course. The adoption of ecological farming is not as simple as one may presume. It is highly knowledge-intensive, labour-oriented and complex system integrating several organic recycling processes. A high degree of motivation, firm commitment and innovative ability seem to make successful ecological farmers.

- Tomato plants of two genotypes Pusa Ruby (susceptible) and SL-120 (resistant) were exposed to elevated CO<sub>2</sub> level of 550 ppm and root-knot nematode, (RKN) race 1 was inoculated on 15<sup>th</sup> days of exposure. Histopathological studies revealed earlier development of RKN by the presence of adult female in Pusa Ruby on 20<sup>th</sup> DAI and giant cells were observed in both resistant and susceptible genotypes. SL-120 succumbed to nematode attack and there was no any hypersensitive reaction notified in infected cells. Significantly, higher peroxidase (PO) and superoxide dismutase (SOD) activity was observed under elevated CO<sub>2</sub> and higher enzyme activity was observed at 3<sup>rd</sup> DAI. Then, the enzyme activity started decreasing from 7<sup>th</sup> up to 14<sup>th</sup> DAI, irrespective of genotype and CO<sub>2</sub> exposure. Though higher enzyme activity was observed in resistant SL-120, the nematode continued to develop and complete its life cycle as studied by Berliner et al. (2014).
- Effect of elevated temperature on spot blotch (*Bipolaris sorokiniana*) disease in wheat was reported by Viani et al. (2013) in relation to change in favourable hours and rate of incubation period completion throughout Indo-Gangetic plains. For spot blotch, rate of incubation period completion was described as a linear increase in rate with temperature up to approximately 29°C, then an exponential decline with temperature up to the maximum temperature of approximately 36°C in which disease development checked. Rate of one incubation period completed per hour was modelled as  $(0.002T-0.03) \{1-\exp [0.15(T-36)]\}$ . Based on favourable hours and rate of incubation period, spot blotch infection was simulated under ambient as well as elevated temperature levels (+1.5°C) throughout Indo-Gangetic plains. Under controlled chamber, elevated temperature (+1-3°C) increased spot blotch severity.

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