Green House Floriculture And Its Impact On Human Health : An Assessment From Maval, Pune

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ABSTRACT :

Maval Taluka of Pune District in Maharashtra has developed commercial Greenhouse floriculture in the recent years. There are several Greenhouses which use hi-tech methods to cultivate flowers for domestic and international sales. Study of the Greenhouse environment was carried out with respect to parameters like Carbon–dioxide concentration, Atmospheric humidity and Pollen concentration (SPM), and application of toxic pesticides. The study confirms that high CO_2 and SPM concentration along with high relative humidity causes several health hazards among the Greenhouse workers. Toxic pesticides also cause adverse health effects.

Keywords *– floriculture, health hazard, greenhouse Carbon-dioxide concentration, pollen concentration*

1. INTRODUCTION:

Pune district occupies an area of about 15642 sq. km, which is 5per cent of the total area of Maharashtra state. The study area, Maval Taluka, is one of the 13 talukas of Pune district, Maval falls within one of the core areas of commercial flower cultivation. Maval region has traditionally been an agricultural and pastoral economy. However, in the post-liberalization period, floriculture has been one of the most promising options made available to the Maval region. Maval possesses almost all the requisite factors for floriculture, i.e. fertile soils, irrigation facilities, yearlong congenial climate, nearness to Mumbai, all-season connectivity by roads and railway, Mumbai airport facility, availability of cheap labour etc *(NABARD, 1996)*.

This flower cultivation is practiced in high tech greenhouses. The green house technology uses the green house effect of natural warming of earth resulting due to trapping of long wave radiation (heat) emitted from the earth. Trapping of this outgoing energy keeps the earth warm. In a similar condition, a green house uses heat trapping material which covers the cultivated area. This material may be glass, polyethylene sheets or plastic. As temperature and other factors like humidity, air circulation in a green house can be largely controlled, they provide ideal conditions for cultivation of exotic flowers *(Randhava and Mukhopadhyay, 1985).*

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The present paper is based on primary survey of 300 workers working in 74 green houses, which cultivate Rose and Gerbera flowers. It aims as assessing the impact of greenhouse environment and processes on the health status of the workers.

Fig. 1. Location of the Study Area

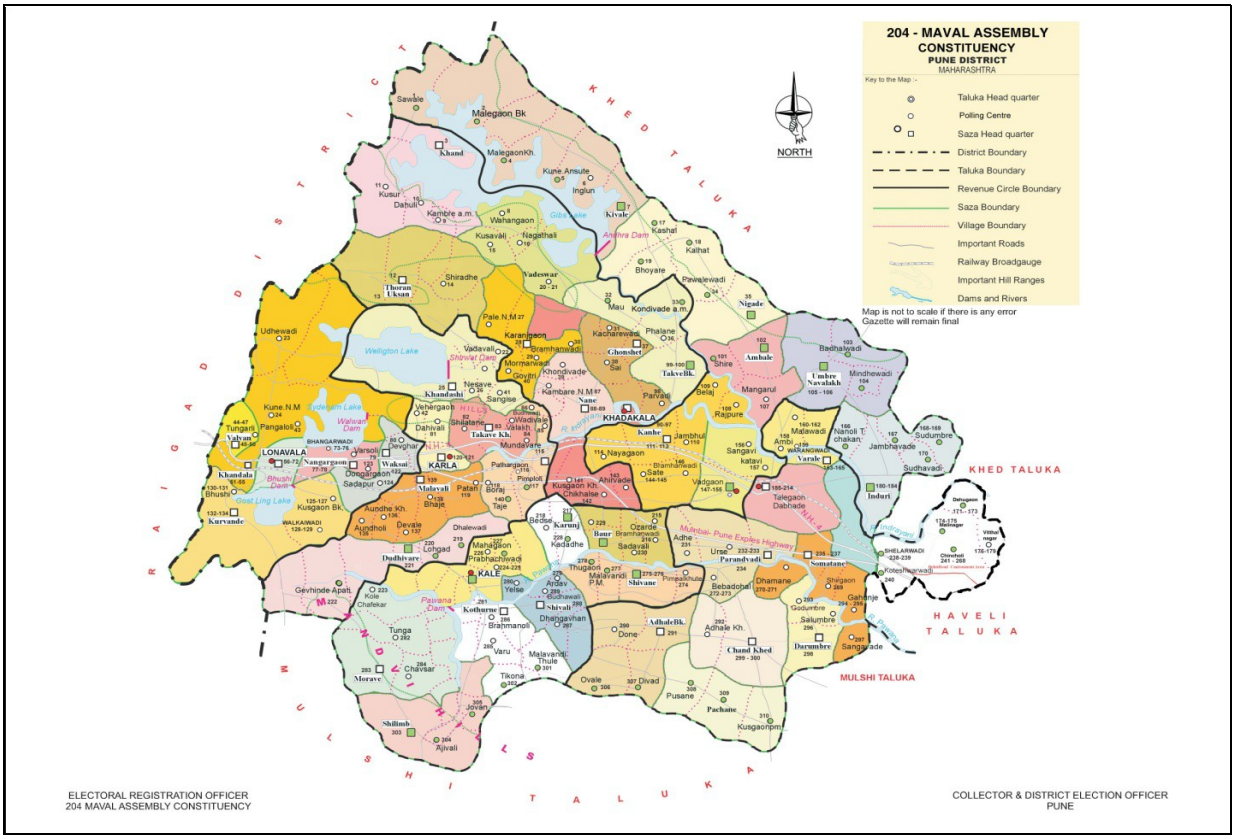

Fig. 1.1 The study Area (Maval Tehsil, Dist. Pune)

2. AIR QUALITY ANALYSIS :

Air inside the poly house has significantly different properties than the open atmospheric air. This difference may be a result of deliberate activities, which aim at alteration of air properties in the way that is beneficial to the plants. The following three parameters were analyzed for the air quality analysis. These were -

1. Concentration of Carbon-dioxide Concentration;
2. Atmospheric Humidity;
3. Concentration of SPM (Suspended particulate matter).

2.1. Carbon-dioxide Concentration:

Carbon dioxide is the basic requirement for any plant and is the raw material in the process of photosynthesis. Atmospheric air has a low CO_2concentration, about 0.035% or 350 ppm. Such concentration is the bare minimum that is required by plants. The ideal concentration of CO_2 for floriculture plants is considered to be 3500 to 10000 ppm. High CO_2 concentration accelerates the process of photosynthesis, thereby improving the plant health and flower production. CO_2 concentration of such levels is attained artificially. This artificial CO_2 enrichment is common in the closed green houses, for which, three methods are used. These are -

1. Use of CO_2 burner
2. Supply of Pure CO_2
3. Fuel Gasses

CO_2 being heavy, tends to concentrate near the ground level and does not diffuse much outside the green houses through top vents.

2.2. Atmospheric Humidity:

This refers to the vapour content in the green house air. Humidity is an important climatic parameter of the air, which directly affects transpiration and photosynthesis processes. If appropriate humidity levels are not maintained, it may result in outbreak of some diseases in the plants. Most of the green house crops require 60-80% of RH inside the green house. In order to achieve the requisite humidity levels, different methods are adopted *(Manohar and Kathinathare, 2007)*. These include spraying of water in the greenhouse, use of Misters and artificial foggers, roof sprinklers etc.

2.3 Pollen Concentration:

Pollen are tiny particles released from trees, flowering plants and grass. plants produce these particles to reproduce. In order to carry out fertilization, and to form seeds, the pollens must be transferred from one flower to the other of the same species. The pollens are very light and can be easily carried into suspension by winds. The pollen count is a measurement of number of pollen grains per cubic meter.

3. CLIMATIC DATA COLLECTION :

The data regarding the climatic parameters were collected from the green houses in primary or secondary form. In the Talegoan floritech park, most of the green houses record the CO_2 concentration levels and humidity. This record is generated daily, and was made available to the researcher by some green house units.

For obtaining data regarding pollen count, the requisite equipment i.e. the rotorod system was not available. The researcher therefore tried to make an indigenous apparatus, which would work on the same principle. Guidance for making the apparatus was taken from a scholar and researcher in the field of Botany. The apparatus consisted of a cylindrical drum mounted vertically on a flat base. The drum was balanced on a pivot and was enabled to rotate by connecting it to a simple motor. The surface of the drum was coated with a long-lasting adhesive tape. This rotation rate of the drum was adjusted to approximately 30 RPM, which was sufficient to trap the pollens of the ambient air. In each of the selected green house, the apparatus was placed in working condition for a period of six hours. The adhesive tapes were collected and the numbers of pollens trapped were observed under a simple microscope. The numbers of pollens trapped were used to estimate the approx. pollen count cu/m. The limitation of the pollen count observation may be the fact that an indigenous, non-standardized procedure has been followed for the same. However, these values are only indicative of pollen presence in the ambient air. Further, at all the nine sample sites, the same apparatus was used, hence these values would provide logical conclusion, when compared within the sites.

4. OBSERVATIONS:

4.1. Fig. 2.1 shows the variations in the Relative Humidity variations over a period of one month. These values were taken for the month of November, which is the flowering season for Rose. For the entire period of one month, all the sample green houses show RH values ranging between 60% and 80%. This average value has been derived by taking the arithmetic average of the highest and the lowest RH values. It was observed that the highest humidity levels are generally attained at night where the lower temperatures bring down the saturation point of the air, thereby increasing the relative humidity. It does not mean that the actual moisture content of the air rises in the air. Relative humidity during day time is a function of irrigation as well as temperature. In order to compensate for the higher day time temperatures, methods like fogging and sprinklers are used, which maintains the humidity at the desired levels.

4.2. Pollen count of the greenhouse cultivating Roses is above moderate levels of concentration. Out of the nine sample sites, only one site (Site 4) shows pollen concentration to a moderate level. At site no. 8 and 9, the pollen count rises near 100 cu/m which fall into a high concentration zone. Fig. 2.3 depicts the pollen counts measured at all sites.

4.3. The secondary data obtained by the nine sample sites was analyzed for Carbon-dioxide concentration. The enrichment of CO_2 is possible in these greenhouses since most of the

rose cultivation structures are closed and which do not allow fading away of CO_2. In Talegoan Floritechpark, CO_2 enrichment is done by using CO_2 burners. Secondary data of each greenhouse was obtained for a period of one month (November). The daily observations of CO_2 concentration were used for a monthly average. The observations show that during the period of analysis, the CO_2 levels in the green houses are near 1000 ppm, which are almost 3 times that of the ambient air (fig.2.2.)

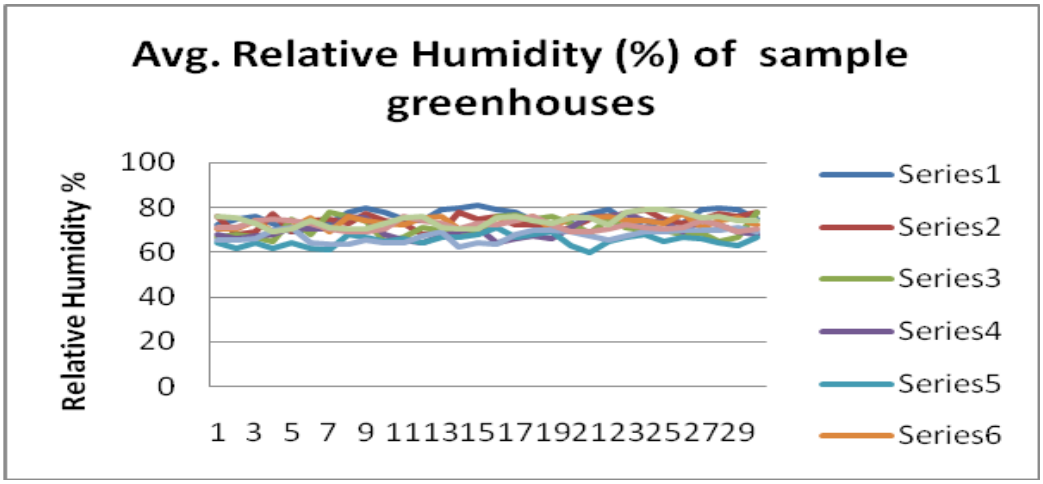

Fig. 2.1. Average Relative Humidity of Sample Greenhouses

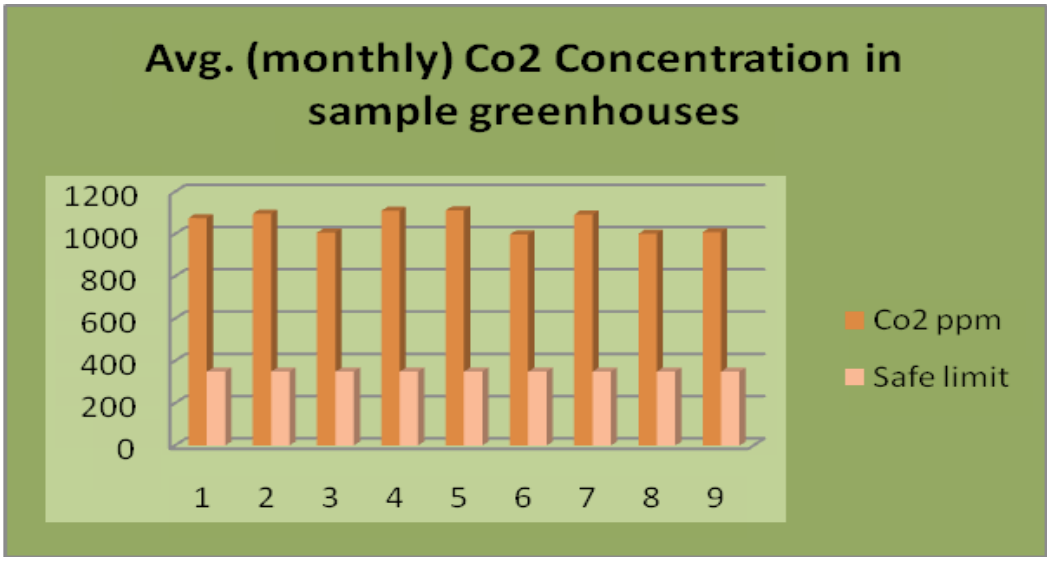

Fig. 2.2. Average Monthly CO_2 Concentration in Sample Greenhouses

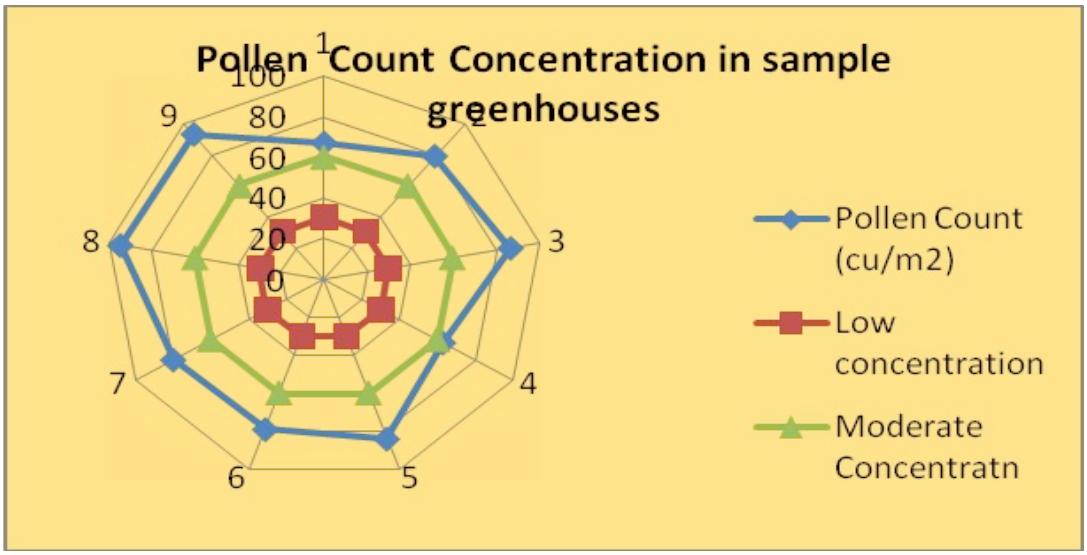

Fig. 2.3. Pollen Count Concentration in Sample Greenhouse

5. FLORICULTURE AND HUMAN HEALTH:

The indoor environment of green house is significantly different than that of the natural outdoors. Here, the climatic conditions are deliberately orchestrated to suit the growth of the target crop. Since these conditions are confined to the closed space of the green house, it may not directly cause any pollution outside. However, the conditions suitable for plants may not be ideal for human health. It has been observed that the workers of the green houses spend an average cumulative of time of about 5 hours in the green house. Various health problems have also been reported by the workers, such as Nausea, giddiness, chronic headache, asthma and other lung and nasal infections, irritation of eyes and a general feeling of discomfort, weariness and mental tension. The indoor environment of the green houses can provide a logical explanation of such health problems.

5. 1. The primary survey showed that all green houses use pesticides in heavy doses, to control the insects, diseases and pests. The commonly used pesticides have active ingredients like Acephate, Dazomate, Dicofol, wettablesulphur, Biternol etc. Presence of these chemicals could not be traced in the soil sample. Two reasons may be cited for this. Firstly, many of these minerals get degraded and mineralized in the soil. Secondly, the standard procedure of soil testing cannot ascertain the presence of these toxins in soil.

However, presence and effects of these toxins can be ascertained indirectly, through their effects evident on human health. Some of these pesticides like Dazomate and Acephate release biologically active harmful gasses like MIC. Since the green house structures are closed to prevent CO2 diffusion, these harmful gasses also must be concentrating near the surface. An average worker, spending 4-5 hours of cumulative time in the green house, is certainly at a risk of direct inhaling of these gasses.

Regular application of the pesticides warrants adequate safety measures like face masks, hand gloves and eye-gear to the workers. Nevertheless, the workers in the study area do not use any of these safety measures. It was observed during the primary survey that that 97% of the workers do not take any precautions against direct contact with pesticides. Reasons for this neglect of safety of workers may be for cost cutting, or due to a general lack of knowledge, or due to negligence. Whatever be the reason, working in a green house definitely puts a worker to a risk of a slow poisoning. Irritation of eyes, headache and nausea are clear indications of the effects of this poisoning.

5. 2. High levels of CO_2 are another factor which can adversely affect human health. High concentration and displace Oxygen in the air. This may show symptoms like fatigue, rapid breathing, rapid heart rate, and emotional upsets (Ref. www.oshanswers, Canadian Centre for Occupational Health and Safety). An experiment conducted by Eric J Griezet. al. (Carbon Dioxide Inhalation Induces Dose-dependent and Age-related Negative Affectivity, 2007, PlosONE2(10): e 987. doi:10.1371/journal.pone.0000987 at www.plosone.org) shows that direct inhalation of CO_2 in high concentration induces symptoms of panic. The green house CO_2 levels may not be as high to cause panic attacks, but a prolonged exposure to moderately high CO_2 levels would be sufficient to cause irritation or discomfort. A very large proportion (78%) of the surveyed workers has reported a feeling of discomfort, breathlessness and fatigue.

5. 3. Pollen allergy and related symptoms is another health hazard affecting the green house workers. Hay fever or Rose fever is a common phenomena resulting due to pollen allergy (www.medicinenet.com). The pollen count observed in the sample green houses is above moderate levels, i.e. 60-90 cu/m. This pollen concentration in ambient air condition may not have much effect on human health. This is because pollen are extremely light and wind borne. On dry, warm days, pollens become light and are carried to great distances by wind (www.ehow.com/info_8007037_pollen-count). However, being in suspension, they may also be carried away higher in the air, away from the breathing zone of humans. Inside a green house, the combination of moderate or high pollen count with a high Relative humidity shall dangerous for health. Due to high Relative Humidity (60%-80% in the sample sites), the pollens shall absorb water, become relatively heavy. They do not rise high in the air but remain near the surface, within the breathing zone of the workers. Personal discussion with medical practitioners in the town of Kamshet revealed that many green house workers suffer from asthma-like symptoms, chest congestion, and prolonged nasal congestion, which are actually allergic reactions. The allergies may be a result of pollen breathing, high humidity, toxic air or a combination of all these. Even without pollen concentration, humid weather would aggravate asthma attacks among those who are already asthmatic. Presence of pollens and secondary allergies would then complicate the matters further.

6. CONCLUSION:

The study confirms that the green house environment does cause health hazards among the workers. The high relative humidity combined with high pollen concentration causes various types of allergic reaction. Discomfort, uneasiness and Panic symptoms can be related to the high CO_2 concentration in the green houses. Handling of poisonous pesticides without proper safety measures show signs of toxic effects like headache, vomiting and nausea.

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