

## Unveiling the Health Ailments of Greenhouse Workers

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In the present era of advancement in research and technology, there is a shift from open cultivation to protected cultivation which acquires advantage of the microclimate to improve the crop growth, development, productivity, quality and economic returns. Therefore, cultivation of plants under protected structures is constantly increasing and is predicted to reach the CAGR of 9.9 % by 2030. However, the climatic requirement of most of the crops grown under protected structures is not be conducive for the workers due to poor air exchange, high temperature and high humidity. Apart from that, UV radiation from the sunlight, air-borne pathogens, organic dusts, pesticides, aero-allergens, etc. could seriously impair the respiratory, cardio-vascular and digestive systems of the workers. Rahimi *et al.* (2020) reported that female labourers working in greenhouse exhibited increased white blood cells, reduced haemoglobin, haematocrit, mean corpuscular volume and mean corpuscular haemoglobin concentration when compared with open-field workers. Hence, the health of the greenhouse workers seems to be at risk with the expanding greenhouse industry.

### Weather parameters

Excessive heat inside the greenhouse caused by the trapping of solar radiation could lead to dizziness, heat rashes, heat stroke and even death. Based on the investigation conducted by Tiwari *et al.* (2023), higher heart rate of 156 bpm was noticed in the workers under walk-in tunnel polyhouse and the average working heart rate was found 20% higher under protected structures when compared with open field conditions. The amount of energy given off by perspiration rose by 60 % under 30°C, 70 % under 35°C and above 80% under 40°C. Water loss from body was around 300 g/h when the air temperature was >40°C along with mineral loss. Sweating and palpitation also increased with temperature. The heart rate (103/ min) and blood pressure (62/98 mmHg) were significantly

higher in walk-in tunnel polyhouses compared to other protected structures and open field. (Dahiya and Singh, 2017).

### UV-Radiation

The UV radiation imposes threats to human health like cancer, skin aging, skin burning, eye damage, suppression of immune system, etc (Fig. 1). Though the cladding materials of the polyhouse are fabricated with UV-stabilizers, they degrade eventually and transmit UV rays inside the structure. In a study conducted at Almeria, researchers recorded the maximum ultra-violet index (UVI) of 4.69 during the noon of July stating that the UVI from May to September crossed the risk limit (i.e. > 3).

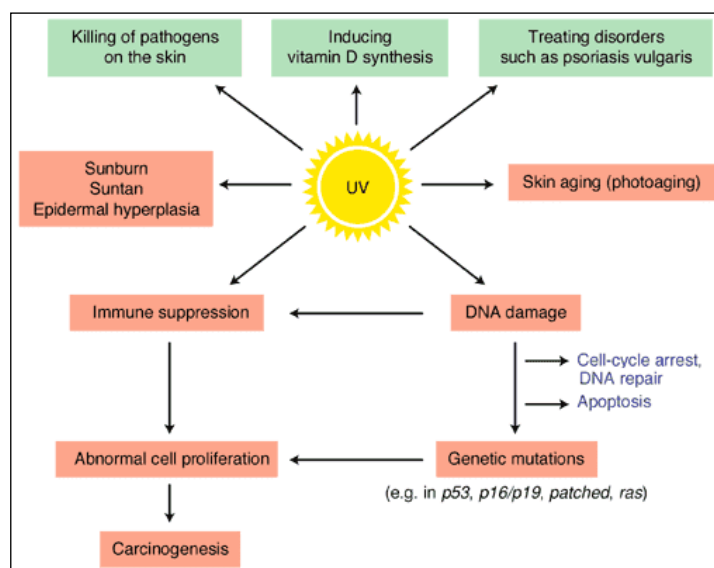


Fig. 1. Effect of UV-radiation of human health

(Source: Tang *et al.*, 2024)

### Chemicals

Also, the pesticides, fungicides and chemical fertilizers applied as a part of crop production keep circulating inside the polyhouse. In Brazil and US Agricultural Health Study, females working under protected cultivation experienced hyperthyroidism owing to the effect of various fungicides and organochlorine insecticides (Goldner *et al.*, 2010; Freire *et al.*, 2013). Nuraydin *et al.* (2018) opined that two-

thirds of the dermatological and respiratory related issues in greenhouse workers occur due to pesticide exposure. It was also reported that 96.2% of the greenhouse workers were exposed to chemicals while only 17.3% made use of protection kits. Further, Hanssen (2016) reported that female greenhouse workers in Ethiopia experienced shortness of breath (71 %), morning cough (44 %) and 34 % skin issues while these symptoms were comparatively lower in open field (48, 22 and 14 %, respectively). The underlying reason was associated with limited use of PPE kit and unhygienic sanitary practices. Xie *et al.* (2020) stated that pesticide exposure led to cardiovascular diseases, skeletal muscle system diseases and digestive diseases along with physical discomfort such as eye itching, sneezing, back pain, memory loss, decline in sleep, joint pain, swelling, abdominal pain and flatulence in the study group.

Petrelli and Figa-Talamanca (2001) observed delayed conception in exposed group attributed to the endocrine disruptive capacity of pesticides. Prolonged pesticide exposure led to irregular menstruation, reduced fertility, prolonged pregnancy, sudden abortion, still-births and developmental defects due to hormonal imbalances (Mrema *et al.*, 2017). A four-fold increase in spontaneous abortion was reported in the female greenhouse workers handling or exposed to pesticides like abamectin, imidacloprid, methiocarb, deltamethrin and pirimicarb in the Netherlands (Bretveld *et al.*, 2008).

### Organic dusts and allergens

Spores, minute insects, organic dusts and pollen impart allergic reactions to the workers. Piirila *et al.* (1994) identified tulip, freesia, alstromeria and chrysanthemum as the potential allergens in greenhouse cultivation. Pollens of flowers belonging to the families of Asteraceae, Ranunculaceae, Liliaceae, Scrophulariaceae and Gentianeae impose antigenic capabilities. Occupational asthma and allergy were found pre-dominant among workers in flower growing polyhouses owing to the aero-allergen and microbial exposure (Adhikari, 2016). Floriculture workers in greenhouse and packhouse experienced rising risk of obstructive lung disease, breathlessness (32.5 and 25.6 %) and chest tightness (23.7 and 18.1 %)

with the increasing service period, respectively (Shentema *et al.*, 2023). Such allergies have also been reported in bell pepper, okra, cucumber and eggplant. Hamaguchi *et al.* (2009) associated the inhalation of *A. niger* as the cause for hypersensitivity pneumonitis in the greenhouse workers. Madsen *et al.* (2014) stated that the microbial exposure were 100-104 times higher in the greenhouse conditions compared to the open field during fruit packing and plant clearing in cucumber.

### Preventive measures

The standard UVI and the appropriate protective measures have been given by World Health Organisation to create public awareness (Table 1). Workers need to maintain a body temperature near 37°C by sufficient and frequent water intake along with electrolytes, improved ventilation, deploying wooden structures instead of iron rods in polyhouse, shift in working time, higher rest allowances, etc. to cope up with the occupational heat stress (Simane *et al.*, 2022). Personal Protective Equipment (PPE) kit should be used while involving in operations such as spraying chemicals and high UVI index. Wearing masks and gloves could considerably reduce the allergic reactions caused by aero-allergens, spores, mites, pollens, etc. inside greenhouse.

**Table 1: WHO recommended UV protective measures**

UV-I indexes	Protective measures
1-2	No special protection needed
3-5	Hat, sunglasses, sunscreen, staying in shade during mid-day
6-7	Wide-brimmed hat, UV-protective sunglass, sunscreen (SPF 30+), long-sleeved shirt and pants, staying in shade during mid-day
Above 8	Better to stay indoor

### Conclusion

Though greenhouse cultivation has greater potential in improving the food production and nutritional security, the harmful effect of UV-radiation, organic dusts, pesticides, allergens and weather pose serious health issues such as lung diseases, allergies, heat stroke, renal diseases, skin diseases and cardio-vascular diseases in the workers. Hence, proper care and protective measures need to be

assured for the greenhouse workers by way of supplying PPE kit, accessible water and sanitation facilities.

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