Photoprotection for Agricultural Workers

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Abstract. Solar radiation, in particular ultraviolet radiation, may have harmful effects on the skin health. Excessive exposition to solar radiation increases the risk of skin cancer, in particular of melanoma. Agricultural workers are exposed to high levels of solar radiation and currently use less protective measures than in the past, which increases further the likelihood of suffering skin diseases. Application of photoprotection measures, including avoiding exposition during the hours of higher solar radiation, use of protective clothes and sunglasses, plastic or glass covers that filter UV in the greenhouses, sunscreens suited to the individual needs, and orally administered protectors, can make an effective contribution to reducing the risks derived from solar exposition of agricultural workers. Campaigns and interventions to increase the awareness of the dangers of inadequate solar exposition can also contribute to improve the present levels of photoprotection of agricultural workers.

Keywords: agricultural workers, farmers, solar radiation, skin cancer, melanoma, photoprotection.

SOLAR RADIATION AND ITS BIOLOGICAL EFFECTS ON HUMAN BEINGS

Solar radiation is essential for photosynthesis, and therefore for the existence of complex forms of life. In this respect, solar radiation is one limiting factor for agricultural production as well as for the productivity and complexity of ecosystems (Trnka et al., 2007). The sun emits electromagnetic radiation in a broad range of wavelengths, from 100 to 10⁶ nm (Badescu, 2008). Solar radiation is divided in five categories, which ordered by increasing wavelength are: ultraviolet C (UVC); ultraviolet B (UVB), ultraviolet A (UVA), visible light, and infrared (WHO, 1994). UVC radiation is very harmful for living beings and has germicidal properties, but virtually all the UVC radiation is absorbed by the atmosphere and does not reach the Earth surface (Martin et al., 2008). UVB radiation, although is filtered in a great proportion by the atmosphere, is the main responsible of skin damages produced by solar radiation (Lavker et al., 1995). UVA radiation is less harmful than UVB, but can increase the damaging effects of UVB radiation (Sams, 1989). Visible light can be perceived by the eye and at the intensities received has no relevant effects on skin health. Infrared radiation provides most of the calorific energy and may have negative effects on skin aging (Seo and Chung, 2006).

Exposition to solar radiation has some beneficial biological effects, including the synthesis of vitamin D, positive aesthetic and psychological effects, as well as therapeutically effects (Wirz-Justice et al., 1986; Holick, 2002). However, excessive exposition to solar radiation may result in very harmful effects for health. Acute effects mostly consist in
erythema, edema and thickening of epidermis and dermis, while chronic effects include photocarcinogenesis, immunossupression, and photoaging (Morison, 2004; Wulf et al., 2004). Photocarcinogenesis is the most important effect regarding mortality, and melanoma accounts for around 80% of the death by skin cancer (Oliveira et al., 2006). At this respect, there is a clear relationship between development of melanoma and exposition to solar radiation, and it has been demonstrated that the parts of the body receiving more solar radiation present a greater incidence of melanoma (Clark et al., 2007). Also, sunburning episodes increase considerably the risk to suffer melanoma (Solomon et al., 2004).

EXPOSITION TO SOLAR RADIATION BY AGRICULTURAL WORKERS

Outdoor workers are exposed to high levels of solar radiation, although the incidence of radiation received depends on a number of factors, e.g. if there is some level of protection provided by shading or by working in a safe cabin, wearing of protective clothing, or inclination of exposed parts of the body when working (Maier and Schmalwieser, 2010). In this respect, high occupational exposure to solar radiation has been associated with skin cancer (Hakansson et al., 2001). Agricultural workers constitute one of the groups of outdoor workers that is more prone to receiving excessive solar radiation (Holman et al., 1983; Serrano et al., 2009), as they may be working for many hours with a high solar radiation exposition. In particular, during the summer season, due to the warm weather, they are less likely to wearing protective clothing. Furthermore, some parts of the body, like the back and neck, may suffer of an increased exposure for agricultural activities that require body bending (Herlihy et al., 1994).

In the past, farmers protected their skin against solar radiation by using broad hats and a complete protection of most body parts, including legs, arms and neck. However, at present, probably motivated by the fact that tanned skin is associated with an improved aesthetic appearance, many workers do not use protection, and it is frequent that agricultural workers (both male and female) use few or no protection even in the hours of maximum solar radiation (Maier and Schmalwieser, 2010). In this respect, very few agricultural farmers take adequate protective measures against solar radiation, and this is especially true among the young farmers (Schenker et al., 2002). This increases considerably the probability of suffering from skin cancer and also induces photoaging. Furthermore, many agricultural workers are not aware of the serious risks of developing skin cancer as a result of excessive solar radiation.

PHOTOPROTECTION FOR AGRICULTURAL WORKERS

The application of photoprotection measures for agricultural workers should be more intense during the hours of more intense solar radiation (particularly in summer), and for light skin and young workers. Protection mechanisms include those that avoid outdoor exposure during the periods of high intensity of solar radiation and those that provide a protection against solar radiation (Wang et al., 2010).

Protective measures that avoid outdoor working during high solar radiation may be difficult to apply on many occasions, as agricultural workers, especially those having a working timetable, may have to work under the sun during the hours of maximum solar radiation (Serrano et al., 2009). However, if possible, agricultural workers should avoid exposure to solar radiation between 11 and 15 solar hours.

Other recommendations that help in providing protection against solar radiation for agricultural workers include (Robson and Diffey, 1990; IARC; 1992; Wang et al., 2010):

a) Using clothes opaque to UV radiation that cover most body parts, including the legs and arms. Closely-woven non-elastic cotton clothes represent a good option.
b) Using sunglasses with UV filters.

c) For greenhouses, the use of cover plastics and glass that filter UV radiation also provide protection to the workers.

d) Use of sunscreens of an adequate ultraviolet protection factor (UPF), which can be applied as a liquid, cream, or stick. There are different types of sunscreens that differ in the physical properties and that can be more suited to the individual preferences of the workers.

e) Use of orally administered protectors, such as vitamins A and E, or polyphenols. However, this system of protection should be complementary to the others and not exclusive, as its effectiveness is still unconvincing.

Despite the availability of methods for protection of agricultural workers from solar radiation, many of them do not make an adequate use of these protective measures. Therefore, campaigns and interventions aimed at stimulating the use of photoprotective measures should be implemented among agricultural workers. Implementation of these actions for increasing awareness of the importance of photoprotection has proved useful in other outdoor workers (Glanz et al., 2007).

**CONCLUSIONS**

Agricultural workers normally work many hours outdoors and are exposed to high levels of solar radiation. This excessive exposure to solar radiation may be harmful for the health of agricultural workers, mostly because it increases the risk of skin cancer. The use of available protective measures and of campaigns to increase awareness can make an effective contribution to reducing the risks of exposure to solar radiation.

**REFERENCES**


