Small UV dosimeters were constructed using polysulphone film of 3 different thicknesses (0.025, 0.076, or 0.127 mm; X-Mac Polysulphone, Wyoming, WY, USA) inserted into plastic 35-mm slide holders (window size = 2.3 x 3.5 cm; Fig. 1).

Dosimeters were exposed to ambient solar conditions for different time intervals and on different days over a range of sky conditions and temperatures during June and July in New Orleans, LA (30° N latitude).

Calibrations against broad-band UV sensors indicated that ∆A330 of the polysulphone film was related in a non-linear fashion to plant-effective UV doses when calculated using either the Caldwell (1971) or the Flint & Caldwell (2003) weighting functions (R² = 0.90-0.95 for exponential regression models) (Figs. 5, 6).

Under ambient summer conditions, saturation occurred after about 4.6 h of UV exposure, which was the time required to achieve a total effective UV dose of 3 kJ/m² (Caldwell; Fig. 6) or 12 kJ/m² (Flint & Caldwell; Fig. 5).

Different calibration relationships existed for the different film thicknesses (Figs. 5, 6) with the differences being the greatest between the thinnest film (0.025 mm) and the other two thicknesses.

Different calibration relationships also existed for ambient solar and greenhouse UV lamp conditions (data not shown).

After 1 h of exposure in a greenhouse, mean UV doses declined linearly with increasing soil cover. These findings indicate, 1) that these inexpensive dosimeters may be of value in measuring solar UV doses in the context of research examining the effects of soil deposition and other factors on UV exposure of decomposing leaf litter in dryland ecosystems.

Introduction

Under field conditions UV exposure of ground-level leaf litter is influenced by numerous factors including time of year, cloud cover, by overstory plants, and soil cover by soil and litter debris (Dunne 1999, Webb 1995).

Polysulphone films have greater thermal stability than traditional UV measurement methods (Kollas et al. 2003), an important factor when considering their effectiveness in dryland ecosystem experiments. In addition, these films are cost effective and portable, making them ideal for use in the field (Dunne 1999, Webb 1995).

However, the effectiveness/accuracy of the film may be influenced by variables such as the thickness of the film, duration and intensity of exposure and degree of soil cover (Paris & Kimb 2004).

In this study we wished to 1) test the effectiveness of different thicknesses of polysulphone films as dosimeters of plant effective UV and 2) explore the utility of these dosimeters in measuring solar UV doses in the context of research examining the effects of soil deposition and other factors on UV exposure of decomposing leaf litter in dryland ecosystems.

Methods

Calibrations against broad-band UV sensors indicated that ∆A330 of the polysulphone film was related in a non-linear fashion to plant-effective UV doses when calculated using either the Caldwell (1971) or the Flint & Caldwell (2003) weighting functions (R² = 0.90-0.95 for exponential regression models) (Figs. 5, 6).

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Results

Under both ambient field and greenhouse conditions, changes in the optical absorbance (∆A330) of polysulphone film was found to be closely correlated with plant effective UV dose. These findings are consistent with work by others that have shown this film to reliably measure human erythemal UV doses.

However, saturation of the film occurred within several hours of exposure. Thus, these dosimeters can only effectively measure UV doses for periods less than one hour.

Additionally, the action spectrum of UV exposure to plants (and plant materials) may be different than that which affects human erythemal absorbance (280-330 nm) (Flint et al. 2004).

There may be ways to expand the effective range and duration of polysulphone dosimeters by using conjunction with other materials to capture information about expanded UV spectrum exposure (Paris & Kimb 2004).

Under greenhouse conditions, these dosimeters appear to be able to detect attenuation effects of UV by soil, but they have yet to test if they radiate in the field have yet to be explored.

Future studies are aimed at extending the duration of these dosimeters and employing them in the field to quantify how soil coverage influences UV exposure and photodegradation of leaf litter.