

## PHOTOLYSIS OF FOLIAR-APPLIED PARAQUAT IN GRASS AND DICOT WEEDS

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A non-selective herbicide paraquat has long been widely used in nearly all parts of the world. Slade has shown that photochemical degradation of paraquat can occur on the surface of plants in daylight and 4-carboxy-1-methyl pyridinium chloride and methylamine hydrochloride are formed. The amount of decomposition of paraquat on plants will depend on the intensity of daylight as well as the plant species applied as plant species may differ in the speed of paraquat uptake into plant tissue. A portion of paraquat may photodecomposes inside the leaf tissue during the process of uptake. Photodegradation on plants is an important process of paraquat degradation in the environment. However, the photodegradation of paraquat was studied a little mainly in late 1960s and further understanding of the photodegradation of paraquat on plants is demanding.

This paper reports how much, how fast, and in which part of leaf-tissue paraquat photodecomposes when paraquat is foliar-sprayed to weeds. Ten micro-liters (44,400 DPM) of ring-labelled <sup>14</sup>C-paraquat were applied to leaf surface of weeds immediately after foliar spray of commercial paraquat to weeds at the recommended dose. The treated plants were placed under sunlight for 20 days. Temporal changes in the amount of fraction A (rain-washable), fraction B (associated with cuticular wax) and fraction C (uptaken into leaf-cells) were measured. During the experiment the average daily solar radiation and UV-B radiation were 8.62MJ/m<sup>2</sup> and 53.13KJ/m<sup>2</sup>, respectively. In *Erigeron annuus* plants, paraquat was uptaken rapidly into leaf-cells; maximum cumulative uptake (MCU) (85.9% of the applied) occurred 6 hours after application. Approximately 42% of the paraquat in leaf-cells was photodecomposed 3 days after application (DAA), leaving ~50% of the applied in dead leaf-tissue. In *Setaria viridis* plants, paraquat uptake into leaf-cells proceeded slowly for 3 days; MCU was 50.5% of the applied. During this slow process of the uptake 41% of the applied was photodecomposed mainly on leaf-surface. At 3 DAA 5.5 and 3% of the applied were on leaf-surface and rain-washable, and bound to cuticular wax, respectively. The paraquat residue in dead leaves at 20 DAA was ca. 48% and 46% of the applied in *Erigeron annuus* and *Setaria viridis* plants, respectively. These results indicate that photolysis of foliar-sprayed paraquat is significant, and proceeds primarily on leaf-surface or inside leaf-cells depending on the speed of uptake by weeds.