

FATE OF PARAQUAT APPLIED TO COTTON PLANTS AS A DESICCANT

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Abstract

The desiccating ability of paraquat may depend on when it is applied during the day. If application is not soon followed by darkness the penetration pathway disintegrates quickly and further uptake is blocked. Paraquat is taken up quickly by the leaf; more is taken up during darkness. Translocation occurs during daylight and darkness.

Introduction

Desiccation is defined by Walhood and Addicott (1968) as the rapid loss of H₂O from the foliage following application of a toxic chemical. Cotton growers can no longer use arsenic acid for desiccation. Because the window for application of desiccants is often narrow, the desiccant needs to be effective after one application. Paraquat is a wise economic option as a desiccant but variable effectiveness has been noticed (Biles and Cothren, 1996; Bremer, 1995). Application time can affect the desiccating ability of paraquat.

Discussion

In daylight, bipyridinium herbicides, such as paraquat, act quickly and destroy their penetration pathway (Baldwin, 1963; Smith and Sagar, 1966; Brian, 1967). Widespread movement is evident only when darkness occurs soon after application (Smith and Sagar, 1966). Our research studied the effect of daylight and darkness on the uptake and translocation of paraquat by applying ¹⁴C-paraquat to single leaves over a time course. Uptake was measured by rinsing the ¹⁴C-paraquat from the leaf. Translocation within the leaf was measured by separating the leaf into parts and analyzing the part not associated with the site of application. The leaf rinses were counted with a scintillation counter; the leaf parts were combusted with an oxidizer and the result was counted with a scintillation counter.

Summary

Paraquat, whether it is applied in daylight or darkness, is taken up quickly. A large amount of paraquat is taken up within 1 minute and even more is taken up after 30 minutes. By 30 minutes after application, more paraquat is taken up by the leaf in darkness. Over 90% of the paraquat that

enters the leaf in 8 hours enters the leaf within the first 30 minutes. Translocation, within the leaf, peaks two hours after application during the day and as late as four hours after application during darkness.

References

- Baldwin, B.C. 1963. Translocation of diquat in plants. *Nature* 198:872-873.
- Biles, S.P. and J.T. Cothren. 1996. Proc. Beltwide Cotton Prod. Res. Conf. p. 1216-1217.
- Bremer, J.E. 1995. Timing does influence harvest aids. Southwest Farm Press. 5 Oct. 1995, p. 15.
- Brian, R.C. 1967. The uptake and adsorption of diquat and paraquat by tomato, sugar beet and cocksfoot. *Ann. Appl. Biol.* 59:91-99.
- Smith, J.M. and G.R. Sagar. 1966. Re-examination of the influence of light and darkness on the transport of diquat in *Lycopersicon esculentum*. *Weed Res.* 6:314-321.
- Thrower, S.L., N.D. Hallam, and L.B. Thrower. 1965. Movement of diquat, 1,1'-ethylene-2,2'-bipyridylum dibromide in leguminous plants. *Ann. Appl. Biol.* 55:253-260.
- Walhood, V.T. and F.T. Addicott. 1968. Harvest-aid programs: Principles and practices. p. 407-431. In F.C. Elliott, M. Hoover, and W.K. Porter, Jr. (ed.) *Advances in production and utilization of quality cotton: Principles and practices.* The Iowa State University Press, Ames.