FATE OF DIURON AND PARAQUAT IN SELECTED AGRICULTURAL SOILS OF SRI LANKA

By

JAYANTHA INDRASENA LOKU BANDA RATNAYAKE

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ABSTRACT

There is a growing concern on the fate of pesticides that are introduced continuously into the soil system. A sound understanding of the behavirour of pesticides in the soil environment is imperative to avoid the potentail hazards they may pose on the environment. Detailed studies on the adsorption, degradation and movement of commonly used pesticides in Sri Lankan soils is lacking. The research examined the chemical reactions and downward movement of diuron and paraquat in selected agricultural soils, and the effect of soil management practices on such interactions and movement.

Adsorption, leaching and plant uptake of diuron was studied in ten surface soils collected from ten different locations of Sri Lanka including alfisols, ultisols, inceptisols and entisols. Soil samples were equilibrated with solutions containing varyig concentrations of pesticides and after equilibration supernatant was analyzed. Diuron concentration was analyzed using UV spectroscopy and Gas Liquid Chromotography while paraquat concentration was analyzed using a colorimertic method. Adsorption data were fitted to Linear, Freundlich and Langmuir isotherms. Downward movement of paraquat was studied in packed columns where soil was packed to field bulk density levels. Diuron leaching in soils was studied using packed soil columns at two different bulk densities, *ie.*,1.0 and 1.5 Mg m^{-3}, as well as using organic manure amended an un-amended soils. Plant uptake of diuron was estimated by using 1-4 weeks old Guinea A (*Panicum maximum* L.). Plants grown in pots filled with diuron treated soils. Microbial degradation was studied using the soil sampled

from Nuwara Eliya, having the highest organic matter content. Losses of diuron due to volatilization were also estimated.

In seven soils, the adsorption data for diuron fitted well to linear isotherms, indicating that the amount adsorbed increases with linearly with increasing diuron concentration. However, in the other three soils, with low clay and organic matter contents, the adsorption data fitted well to Langmuir isotherm, indicating that adsorption sites for diuron are limited in these soils. Leaching losses of diuron in these three soils were also found to be much higher. In all soils, the amount of diuron leached was significantly higher at bulk density of 1.0 Mg m^{-3} than 1.5 Mg m^{-3}, whereas, application of compost significantly reduced leaching losses. Losses of diuron due to volatilization were negligible, unless directly exposed to solar radiation. Microbial degradation was undetectable within the short period of seven days even in the soil from Nuwara Eliya with high organic matter content. In all soils, plants took up major proportion of the applied diuron.

The adsorption data for paraquat in most soils fitted well to Linear and Freundlich isotherms, indicating that with increasing paraquat concentrations, the amount adsorbed increases linearly or exponentially. In soils having very low cation exchange capacity (<10 cmol(+)kg^{-1}), the adsorption data fitted well to Langmuir isotherm, which assumes that a maximum adsorption occurs when all adsorption sites are occupied. The leaching experiment indicated that in clay and loamy soils, the down ward leaching was very low, while in sandy soils, almost all of the paraquat applied was leached. The results indicate that retention of paraquat is substantial even in soils

with a moderate capacity to adsorb cations (CEC> 10 cmol(+)kg^{-1}) which may reduce potential adverse effects on non target organisms. Application of paraquat to sandy soils may lead to ground water pollution with possible adverse effects on non target organisms.

The fate of diuron and paraquat was largely influenced by properties of chemical and properties of the soil that they are applied to. Manipulation of soil properties or conditions such as organic matter content and compactness could overcome the detrimental effects on the environment.