EFFECT OF CO-FORMULATION OF 1,3-D AND CHLOROPICRIN ON EMISSIONS FROM SOIL

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The soil fumigants 1,3-dichloropropene (1,3-D) and chloropicrin (CP) are widely used in co-formulations for the pre-plant control of plant pests such as nematodes, weeds and fungi. Over recent years, more stringent regulations to control soil-air emissions of such fumigants has led to increased research efforts aimed at reducing emission potential.

Consideration of a number of field studies using co-formulations of 1,3-D and CP suggests that when applied together, emissions of CP are dramatically reduced compared to when this chemical is applied alone. However, no rigorous scientific study has specifically addressed this issue. Using laboratory soil columns and associated batch experiments, the aim of this study was to determine whether emissions of CP were reduced when applied as a co-formulation with 1,3-D.

Six formulations were used: Telone II (1,3-D only); Tri-Clor (CP only); Telone C-17 (~17% CP, 83% 1,3-D); Telone C-35 (~35% CP, 65% 1,3-D); Pic-Clor 60 (~60% CP, 40% 1,3-D) and Pic-Clor 80 (~80% CP, 20% 1,3-D). The formulations were applied at a target rate of approximately 155 kg/ha. As a percentage of the total amount applied, 1,3-D emissions were relatively consistent across all treatments (33.4-35.5%). For CP, however, emissions were strongly related to CP percentage in the formulation and hence the starting CP concentration in soil: Total CP emissions were 0.018, 1.5, 8.6, 16.9, and 14.5% of applied CP for C-17, C-35, PC-60, PC-80 and Tri-Clor, respectively (Figure 1).

Degradation studies, in which the same total mass (1,3-D+CP) of each formulation was added to soil, showed that half life of CP decreased with decreasing percentage of CP in the formulation (i.e., was dependent upon initial mass applied). A second degradation study confirmed that these half lives were similar in the absence of 1,3-D, i.e., the degradation effect was not dependent upon co-formulation (Figure 2). It is hypothesized that this faster degradation of CP at lower initial mass accounted for the large differences in column emission losses across the formulations, i.e., faster degradation resulted in less CP being available for emission.

The work potentially enhances our ability to predict CP fate and transport based on an improved understanding of the relationship between its initial

mass (ie. starting concentration) in soil and degradation rate. This information could be used to refine buffer zone estimates for chloropicrin for products where it is applied at lower rates.

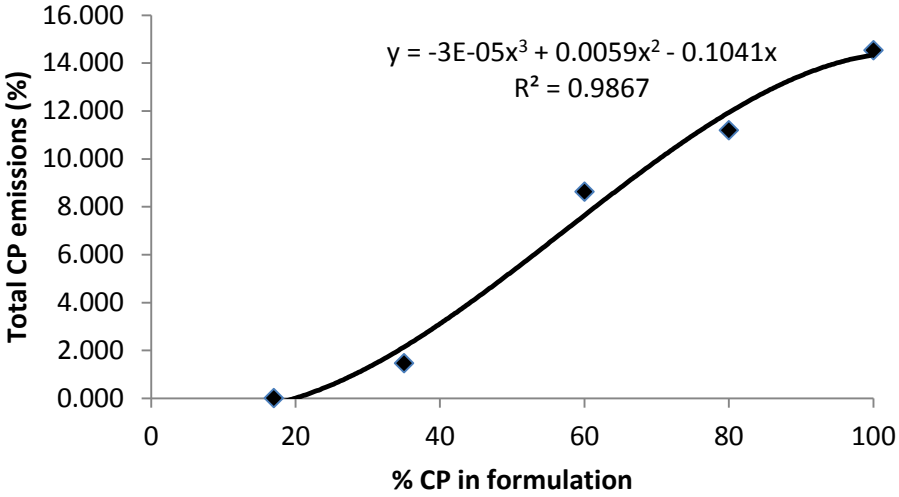

Figure 1: Relationship between percentage of CP in the formulation and CP emissions from the soil column. The third order polynomial fit is shown.

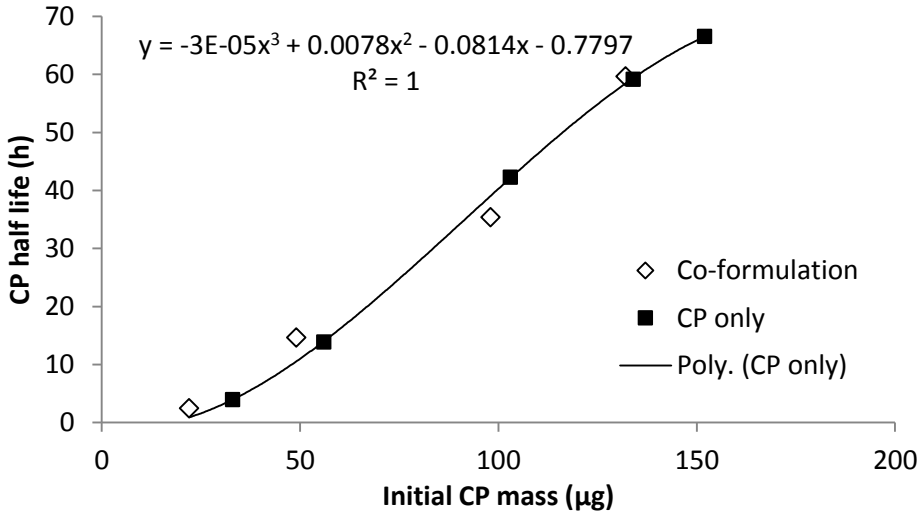

Figure 2: Relationship between initial mass of CP and half life. Open diamond points are, from left to right, for the co-formulations C-17, C-35, PC-60 and PC-80. Closed square points are for equivalent masses of CP added singly (absence of 1,3-D) in a coupled degradation study. Curve is the third order polynomial fit.