

MONITORING CHLOROPICRIN UNDER DIVERSE SHANK APPLICATION SCENARIOS

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Concern over the acute toxicity and environmental impacts of soil fumigants has intensified the call for additional risk assessment and adoption of mitigation practices to ensure they meet current health and safety standards. From a regulatory perspective, risk assessment for fumigant emissions must take into account the dynamics of micro-scale meteorological conditions, with typical soil conditions and under the operational constraints of commercial agriculture production. Continuous and extensive air sampling of the near-surface atmosphere is essential for generating representative concentration profiles that can be used to estimate the volatilization rate. This can entail the simultaneous measurement of soil and ambient conditions combined with active (flow-through) air sampling methods across a vertical profile. Furthermore, fumigant applications must be made over areas large enough to generate sufficient fetch under conditions that are representative of commercial production practices.

In 2009, a series of soil fumigant flux studies were funded by the USDA, ARS, South Atlantic Area-Wide Pest Management Program for Methyl Bromide Alternatives to simulate 8 different shank application scenarios. Included in the scenarios were bedded, broadcast and low-disturbance shank application methods, various plastic tarps including low density polyethylene (LDPE), metalized and virtual impermeable films (VIF), co-formulation of chloropicrin with other fumigants, and several soil sealing methods. Application scenarios were designed to incorporate Good Agricultural Practices (GAPs).

Following the application of fumigants, chloropicrin emissions were monitored along a vertical profile in the center of each field and flux rates were estimated using the integrated horizontal flux method. Vapor and nonvapor concentrations of chloropicrin in the soil were measured up to 5 days after application. For all 8 application scenarios, peak atmospheric emission rates remained below $50 \mu\text{g m}^{-2} \text{sec}^{-1}$. Peak atmospheric emission rates of chloropicrin were highest in the broadcast shank applications and lowest in the bedded shank applications. Where LDPE was used to cover fumigated soil, cumulative atmospheric emission of chloropicrin ranged from 35% to 45% of the amount applied in the broadcast applications and from 9% to 10% in bedded applications. In conditions where soil moisture exceeded field capacity, chloropicrin in soil could be detected in the vapor and nonvapor phase 5 days after application. In conditions where soil moisture was below field capacity, chloropicrin could not be detected in soils 5 days after application except where a VIF was used to cover soil. Soil water contents above field capacity, uniform soil tilth in the fumigation zone and the use of metalized or VIF were all factors that reduced the atmospheric emission of chloropicrin.