

Properties of an ideal soil fumigant and the alternatives in development and practice

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Properties

- Chemical
- Biological
 - Target
 - Non-Target
- Economic

Ideal chemical Properties

- Low molecular weight
- Low vapor pressure (gas at room temperature)
- Non-Flammable
- Non-Toxic, non-reactive

Examples

- Methyl Bromide
- Chloropicrin
- Telone (1,3,D)
- Iodomethane (MeI)
- MITC (Metham Sodium, Basamid)
- DMDS (Dimethyl Disulfide)
- Sodium azide
- Propargyl bromide
- Structural
 - Phosphene
 - Vikane

Basic Principal

- Objective in soil fumigation is to establish a lethal concentration and maintain the concentration for a sufficient period of time to kill the organism

Fumigant Dose:

Concentration in air or water over time

$\text{Dose} = \text{Concentration} \times \text{Time} = \% \text{ Kill}$

Fumigant pathway

- Released from shank or drip application
- Dissolves in soil water
- Vapors move through air spaces between soil particles
- Establish a dynamic equilibrium- air water
- Taken up by weed seed, fungal spores etc
- Ultimately metabolized or lost by off-gassing through soil and plastic mulch

Ideal Biological Properties

- Highly toxic to weeds and fungi
- Non-persistent
- Easily contained by plastic or water
- Spectrum of activity- weed, fungal, bact.
- Easily transported
- Low usage rates, 500-2000 ppm drip,
<350-400 lbs/acre

Non – Ideal Characteristics

- High diffusion through plastics
- High mammalian toxicity
- Vapor pressure - i.e. MBr “boils”
- Micorrhiza and other beneficial organisms
- Residual fumigant & phytotoxicity

Economics of ideal Fumigant

Currently: Methyl Bromide sets
price standard

Ultimately: Market price by benefit