

FIELD EVALUATION OF CHLOROPICRIN AND DIMETHYL DISULFIDE FUMIGATION

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Introduction

Liquid fumigants have been used for many years in the production of vegetables in the Southeast. The fumigant of choice has traditionally been methyl bromide. Price and availability is limiting methyl bromide use in Georgia. Alternative fumigants have been tested to give similar effects as methyl bromide. Dimethyl disulfide mixed with chloropicrin (79:21) is one alternative.

Minimizing buffer zones is a major concern for vegetable producers in Georgia. Current buffer zones for application of fumigants such as chloropicrin have endangered vegetable production in Georgia as it is known today. Current research on fumigant release rates have been evaluated on small plots basis. This experiment will be for a large plot size to determine the rate of gas emission from low density polyethylene (LDPE) and Blockade mulch films.

Methods and Materials

Three individual plots were selected of approximately 1 acre in size. Plots were more than 1 mile apart. Two fields (Altman and Davis) were classified as loamy sand and the other sand (Rigdon). All three fields were had cotton planted the previous year. Fumigants were applied on February 7 at 12:30 PM to Altman, 3:15 PM to Davis and 5:30 PM to Rigdon field sites. Paladin™ a mixture of dimethyl disulfide and chloropicrin (79:21) was applied at 75 gpa with a prebedder injecting fumigants 8 inches deep with three knives 11 inches apart. Next, Vapam at 75 gpa was applied 4 inches deep with coulter knives 4 inches apart on a pre-shaped bed and covered with the mulch film. The final bed was pressed and covered with a white on black LDPE (1.25 mil) mulch film.

Soil samples of 365 cm³ were obtained from each plot with a soil probe (4.8 cm diameter by 20 cm deep). Gravimetric moisture content basis was determined for each sample by weighing the soil and placing the soil in a 105°C oven for 24 hours and then reweighing. Next, the samples were evaluated for soil field capacity. Soil samples (7.6 cm diameter by 15 cm deep) were collected before any tillage operation for field

capacity analysis. Soil samples were placed on a ceramic plate. Each sample was saturated with water for 24 hours to equilibrate. The porous ceramic plate with saturated soil was pressurized to 1/3 bar of pressure. After 24 hours in this chamber, the moisture content in the soil was determined with the above method. Soil samples were finally sent to the University of Georgia Soils Lab for classification.

Chloropicrin was measured with a gas detector pump (GASTEC GV100S) and a detector tube (Sensidyne #172S). An inverted HDPE funnel (1.9 L) with a rubber stopper measuring 16.5 cm in diameter fill opening by 22 cm high with a 2 cm drain was glued (silicon) to plastic mulch beds (Figure 1). Chloropicrin gas collected inside the funnels for a known period of time (1-10 minutes). After the known period, a 100 ml sample was drawn through the detector tube from the inside of the funnel by the gas detector pump. The chloropicrin detector tubes had a range of 0.05 – 16 ppm.

Dimethyl disulfide was measured with a handheld volatile organic compound (VOC) monitor (MiniRae 2000) with a range of range of 0-10,000 ppm. DMDS measurements were taken immediately after the chloropicrin inside the inverted funnel.

Samples of the accumulated gas inside the funnels were taken from 3 to 130 hours after application.

Results and Discussion

Field capacity of the soil for each site was determined as follows: Altman, 8.3; Davis, 11.8 and Rigdon, 6.8 %/dry weight of soil. Soil moisture content at time of fumigation for each field was Altman, 6.4; Davis, 7.6 and Rigdon, 5.5 %/dry weight of soil. Percent field capacity for each field was Altman, 77; Davis, 65 and Rigdon, 80 percent. At the time of fumigant application Davis field had large clods in the upper 2-4 inches of bed.

The measured results of the chloropicrin and dimethyl disulfide are shown in figures 2 and 3. All showed similar gas emission patterns. A spike was observed for each field site at 40 hours after application. Funnels were being attached at the same location and the mulch films were showing fatigue. This could contribute the excessive values obtained during the sampling period. Once noted, sample location was changed each time a gas sample was measured for the remainder of the test.

Figures 4 and 5 illustrate the accumulated gas emission for the entire test for chloropicrin and dimethyl disulfide. The amount of chloropicrin emission (figure 4) was reduced at the Blockade mulch Altman field site by 63 percent compared to the LDPE mulch Davis field. Loamy sand soil type of Davis field reduced chloropicrin gas emission by 12 percent compared to sand soil type of Rigdon field. There were similar trends for the dimethyl disulfide emission (figure 5) was reduced by 9 percent when Blocakde mulch (Altman field) compared to the LDPE for same soil type.

Changing soil types showed more reduction of 16 percent when comparing loamy sand (Davis Field) to sand (Rigdon field).

This field test showed as prior test have shown a VIF plastic mulch type film will reduce gas emissions.

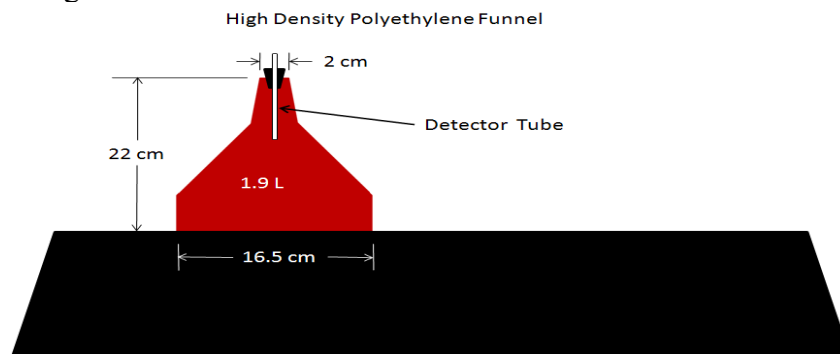


Figure 1. Schematic of fumigant sampling system.

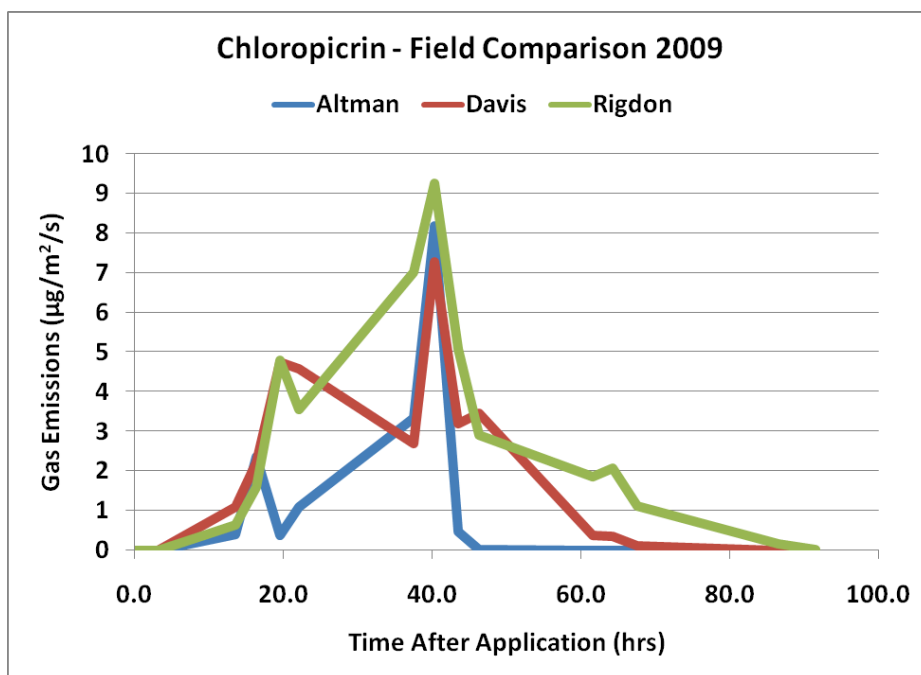


Figure 2. Chloropicrin gas emissions for three field sites Spring 2009.

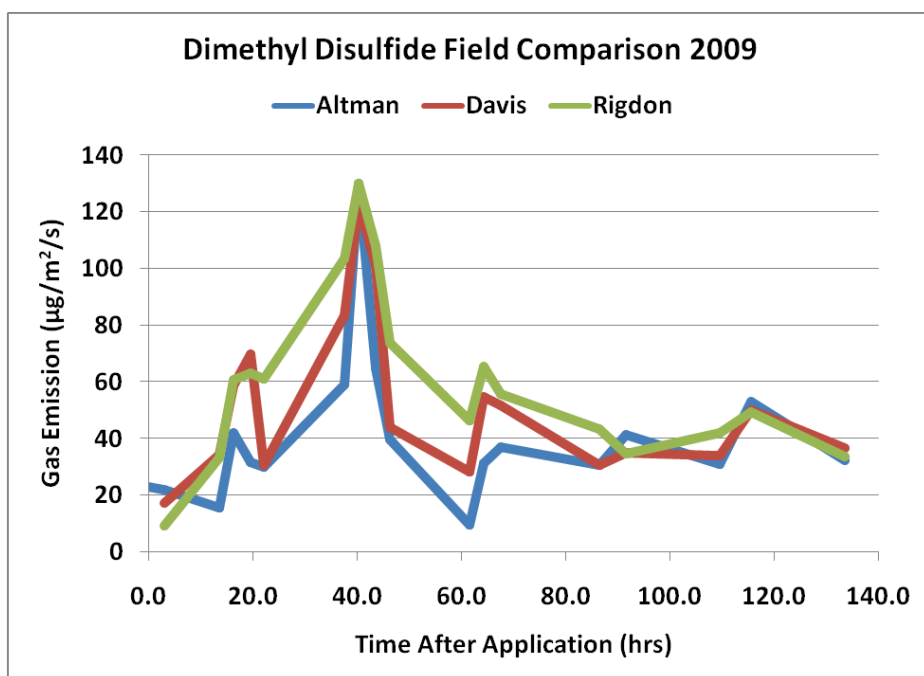


Figure 3. Dimethyl disulfide gas emissions for three field sites Spring 2009

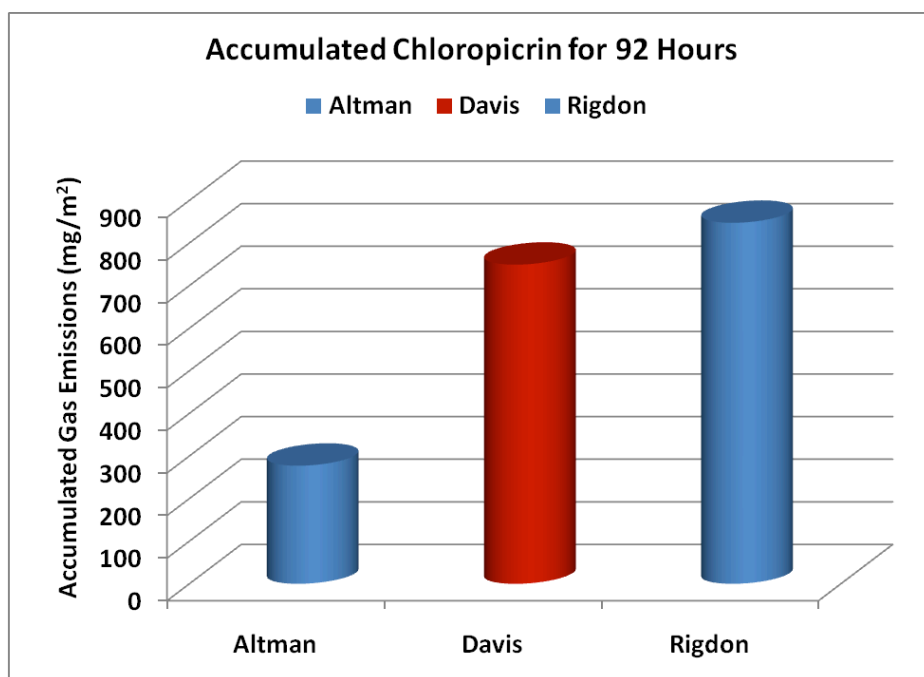


Figure 4. Accumulated chloropicrin gas emission for three field sites Spring 2009.

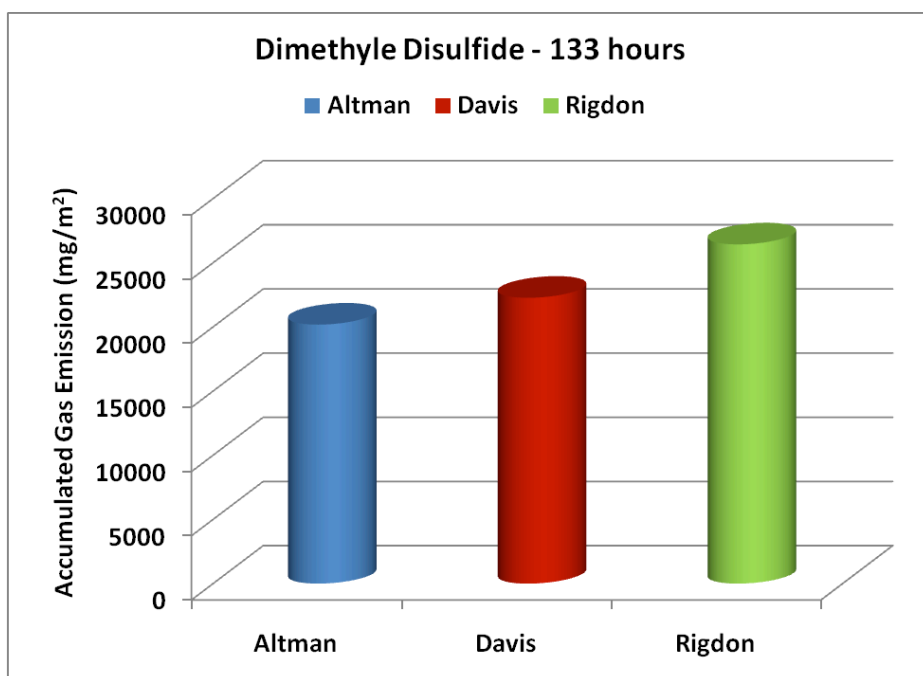


Figure 5. Accumulated dimethyl disulfide for three field sites Spring 2009.