APPLICATION OF DAZOMET (BASAMID^R) AS SOIL FUMIGANT: GENERATION, MOVEMENT AND DISSIPATION OF MITC AND PEST CONTROL

A. Gamliel[1], Y. Cornfeld[1], A. Grinstein[1], M. Austerweil[1], B. Steiner[1] **M. Assaraf[2]***, L. Klein[2], J. Katan[3]

[1]Institute of Agricultural Engineering, ARO, The Volcani Center Bet Dagan 50250 Israel; [2]Dead sea Bromine Group, P.O.B. 180, Beer Sheva 84101, Israel; [3]Faculty of Agricultural, Food and Environmental Quality Sciences, The Hebrew University of Jerusalem, Rehovot 76100 Israel

Introduction

One of the potential alternatives for soil fumigation is Basamid granular (dazomet), Basamid granular is a micro-granular formulation of the active ingredient dazomet (tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione). It does not contain halogens, which can be an advantage with regard to environmental impact. Basamid granular is a relatively inert solid material, which undergoes degradation to the active agents when incorporated in soil. The breakdown of dazomet is rapid in various moist aerobic soils. Methyl Iso-Thio-Cyanate (MITC) is the major product of dazomet breakdown (98%). Other breakdown products in very low amounts include CS_2, HCHO, H_2S and NH_3. Basamid is registered in Europe and other countries as soil fumigant. It is assumed that movement of the chemical downward is limited. The chemical was not tested in arid and semi-arid agriculture, which is characterized with deep soil plough and intensive irrigation, such as Mediterranean countries and the USA.

The main objective of the current study is to provide a data base for Basamid activity as soil fumigant, and develop application technologies in order to enable it's future use for soil disinfestation in semi-arid and irrigated regions.

Material and methods

Breakdown of Basamid to MITC was studied in special closed containers and soil columns. Concentrations of MITC in the containers were continuously measured using the Solid-phase micro-extraction (SPME) methods and analysis by gas chromatography. Soil columns were used to assess the movement of Basamid and its breakdown products in soil. Inocula of the tested organisms were placed at different depths from the column top during packing. Basamid was mixed with soil at the top 5 cm of the column. The column was then irrigated with water at different periods following Basamid application, until leaching was evident at the bottom of the column. Leachates were collected and analyzed for MITC.

Field Plots were established to test the efficacy of dazomet in fields with history of infestation with soilborne pathogens. Plots were cultivated and irrigated to a depth of 50 cm. Basamid at the indicated rates was spread on the surface of each plot using manual spreader (Ermas, France), and incorporated to a depth of 20 cm with rototiller. String with tested propagules were buried at the center of each plot at the indicted depths immediately following the application of Basamid, and then the plots were mulched with transparent plastic film.

Results

MITC generation in soil increased gradually, reaching maximal peak after 24 hours. These results can indicate that exposure to Basamid during the first 5 hours after application may be insufficient to pest control, due to a low MITC concentration. This was further elaborated in soil columns and in the field. The degradation of MITC and its dissipation last few days. In all our experiments MITC could be traced 6-7 days after application.

MITC generation increased at a higher temperature and the maximal peak was evident earlier at the elevated temperature. At higher soil temperatures maximal MITC peak was higher, too. The dissipation of MITC was faster at high temperatures and slower at low temperature. The effect of soil temperatures on MITC generation is reflected in fungal toxicity; the toxicity of Basamid increased at high temperatures and decreased at cool (17C) soil temperatures. Effective pathogen control in soil columns was achieved when leaching was delayed to 8 hours from application. Analysis of lychates at the bottom of the column showed linear increase in MITC amounts as leaching was delayed. This phenomenon enables Basamid incorporation and irrigation without concern of MITC escape before soil mulching was completed.

In the field the efficacy of Basamid to control fungi at deeper layers is not high. This can be due to the fact that Basamid was not incorporated to that depth, or MITC does not move downwards effectively. During the last three years, several experiments were conducted to evaluate the possible use of Basamid as soil fumigant. The results show effective control of crown rot of tomatoes and sudden wilt of melons when Basamid was applied at a rate of 45 gr/m^2. Improved control was accomplished when Basamid was combined with solarization.

Concluding remarks

- ❖ Basamid is based on the degradation and generation of toxic gaseous ingredients, primarily MITC, and others. Soil incorporation enables its use for the control of fungi and weeds.
- ❖ MITC generation and dissipation depends on chemical and physical factors, especially temperature and moisture. Additional factors, such as soil pH and other should be elaborated.
- ❖ Basamid incorporation into deep layers is insufficient. Other methods for deeper incorporation should be further explored.
- ❖ All experiments were carried out using LDPE tarp. It is necessary to study the effect of VIF plastics.
- ❖ Dosage-response of Basamid at different conditions should be further studied.
- ❖ Combination of Basamid with soil solarization is a promising approach. Combination with other agents should also be studied.