SOILFUME: A GRAPHICAL USER INTERFACE FOR DETERMINING FUMIGANT BEST MANAGEMENT PRACTICES

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The phase-out of methyl bromide has resulted in many producers attempting to find effective alternatives for pest control. Oftentimes the data that would allow for a meaningful choice or comparison on such things as dose efficacy, compound lifespan, and mobility are not readily available, difficult to calculate, or are presented in inconsistent formats. Our goal was to develop a tool that would let individuals interested in planning and fumigant comparison do so in a straightforward and intuitive manner.

SoilFume is a completely new Graphical User Interface (GUI) front-end for the generic two-dimensional finite element FORTRAN code (Wang et al., 2000). It is based very loosely on the DripFume (Wang and He, 2001) GUI but contains almost no legacy code. It has been completely re-developed in Microsoft (MS) Visual Basic 2005 - .NET 2.0 framework.

Our plan from the beginning was to develop a tool that users would find highly flexible and customizable. To do so we have integrated a MS Access database into the GUI to serve as the framework for data presentation and manipulation. In this way, an essentially limitless number of pests, compounds, environmental and field conditions can be entered and saved for use in calculations. However, to prevent this potential from becoming cluttered and overwhelming, we used the GUI to strictly organize all data into specific discreet steps, thereby preserving a comprehensible flow in the program.

Layout:
Pest Screen (Fig. 1a) – Provides a choice of potential pests. In SoilFume one of our primary goals is to have the program suggest fumigant based pest control options based on a selected pest problem. Once a particular pest or pest complex is chosen, the user also has the ability to access information on pests, id photo, range maps, etc. There is also an integrated dynamic database display for comparisons of the pest species. This functionality remains optional for those users who want to bypass pest control in order to concentrate on fumigant movement and evolution.

Chemical and Application Screen (Fig. 1b) – Provides a list of potential fumigants for selection and allows the user to choose between drip and shank application. At this time, the model only allows for a selection of up to three compounds per session. However to allow for inevitable FORTRAN model enhancements, SoilFume is able to handle and supply as many compounds as data is available. The chemical screen displays physical and chemical properties of each compound and allows for real-time creation and modification of new compounds. SoilFume also has the ability to provide additional information (proprietary names, chemical structure, MSDSs, etc.) through pop-up information boxes. A dynamic database display lets the user do quick comparisons of chemical properties. The application selector lets the user choose what type of method is used for chemical application. Currently the choices are drip irrigation or shank injection and each customizes the remainder of the interface to collect the appropriate input data.

Field Geometry – Currently allows for the definitions of bed width and depth of application consistent with those of the earlier software, DripFume. We intend to eventually have a dynamic drag and drop display with which to shape bed and furrow structure and place application points by the users.

Soil Properties – Gives the user the ability to define the properties of one, two, or three distinctive soil layers. Environmental Inputs – Presents a choice to consider rainfall data (can be entered as an MS Excel Spreadsheet format) and boundary temperatures in the calculations. Fumigation Inputs – Lets the user define the parameters for fumigation duration or application rate, irrigation time (if applicable), simulation duration, and surface film cover. A graphical display of soil infiltration rates is provided.

Output Navigator – (Fig. 2) This is the heart of the GUI presenting graphical data on cumulative volatilization loss (CVL), volatilization flux density (VFD), and concentration profile by time for a selected location or by location for selected lapsed times after fumigant application. Data processing for display is consistent with that used in DripFume, however all data display has been integrated into the SoilFume program. Excel is no longer required to view graphs but will remain an option for users wishing to process the raw data from the model output. In addition, the display manipulation potential has been significantly improved. Graphs now allow for zoom, pan, mouse-over data point display and, in the case of CVL and VFD, multiple curve display when dealing with multiple compound application. Future planned enhancements include: water content profiles, pest control efficacy charts, and 2D plots.

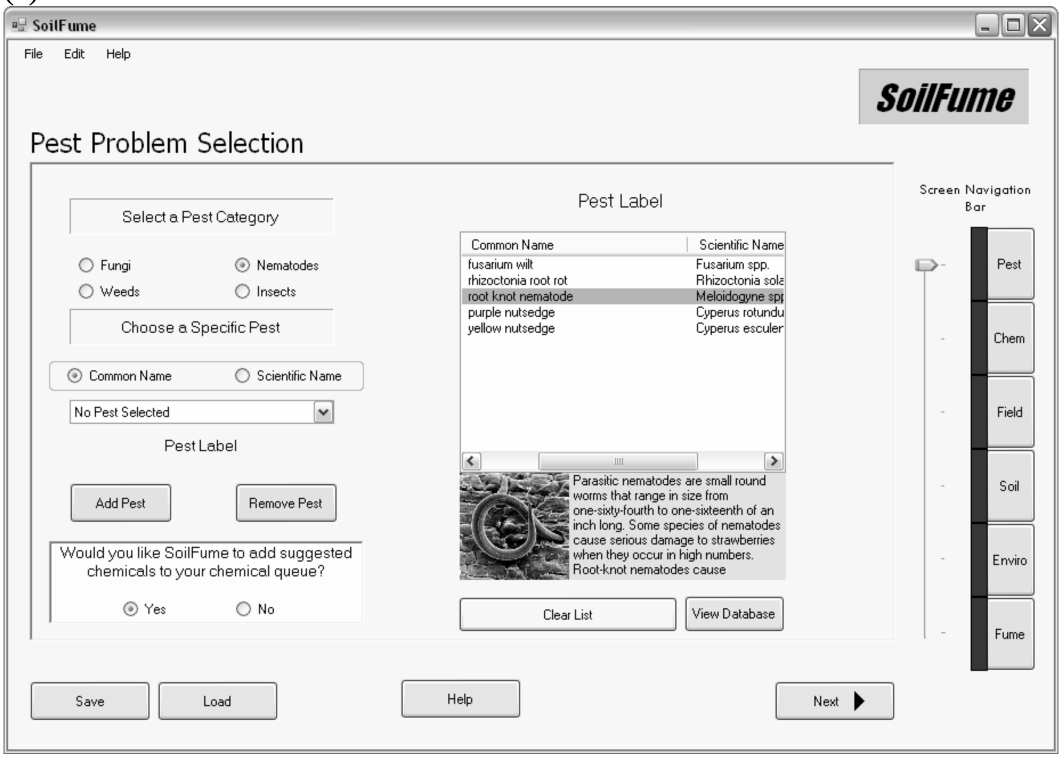
References:

Wang, D., Knuteson, J.A., Yates, S.R., 2000. Two-dimensional model simulation of 1,3-dichloropropene volatilization and transport in a field soil. Journal of Environmental Quality 29, 639-644.

Wang, D., He, J.M., 2001. DripFume: A Visual Basic Interface Program for Simulation Soil Fumigation by Drip Irrigation. Research Report, unpublished. University of Minnesota. (Available from the author: wangd@umn.edu)

Fig. 1. A display of the data input navigator showing (a) Pest Selection Screen – List View, (b) Chemical and Application Selection Screen – Database View

(a)



(b)

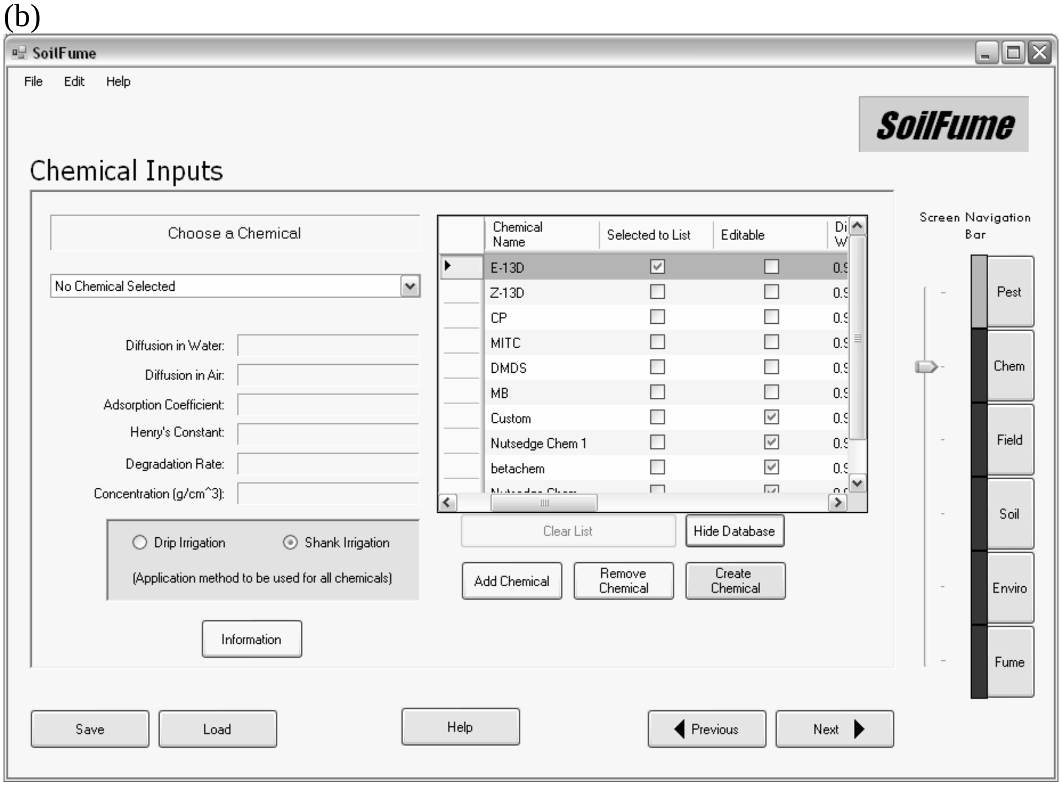
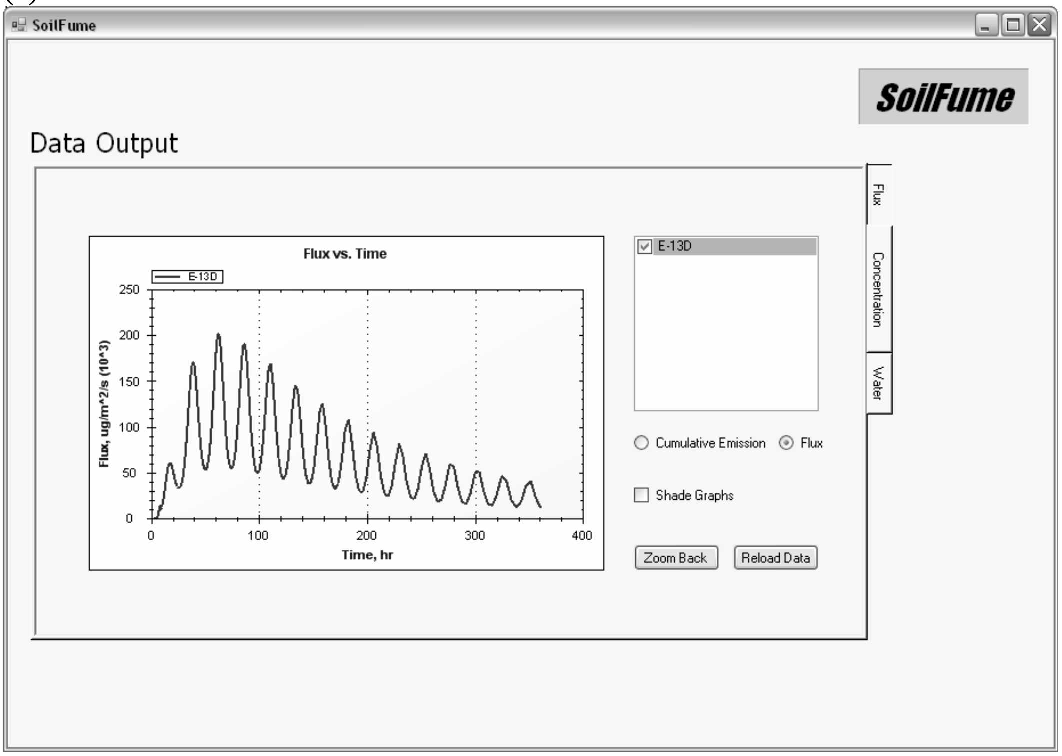


Fig. 2. A display of the data output screen showing (a) volatilization flux density, (b) concentration profile by location for selected lapsed times

(a)



(b)