

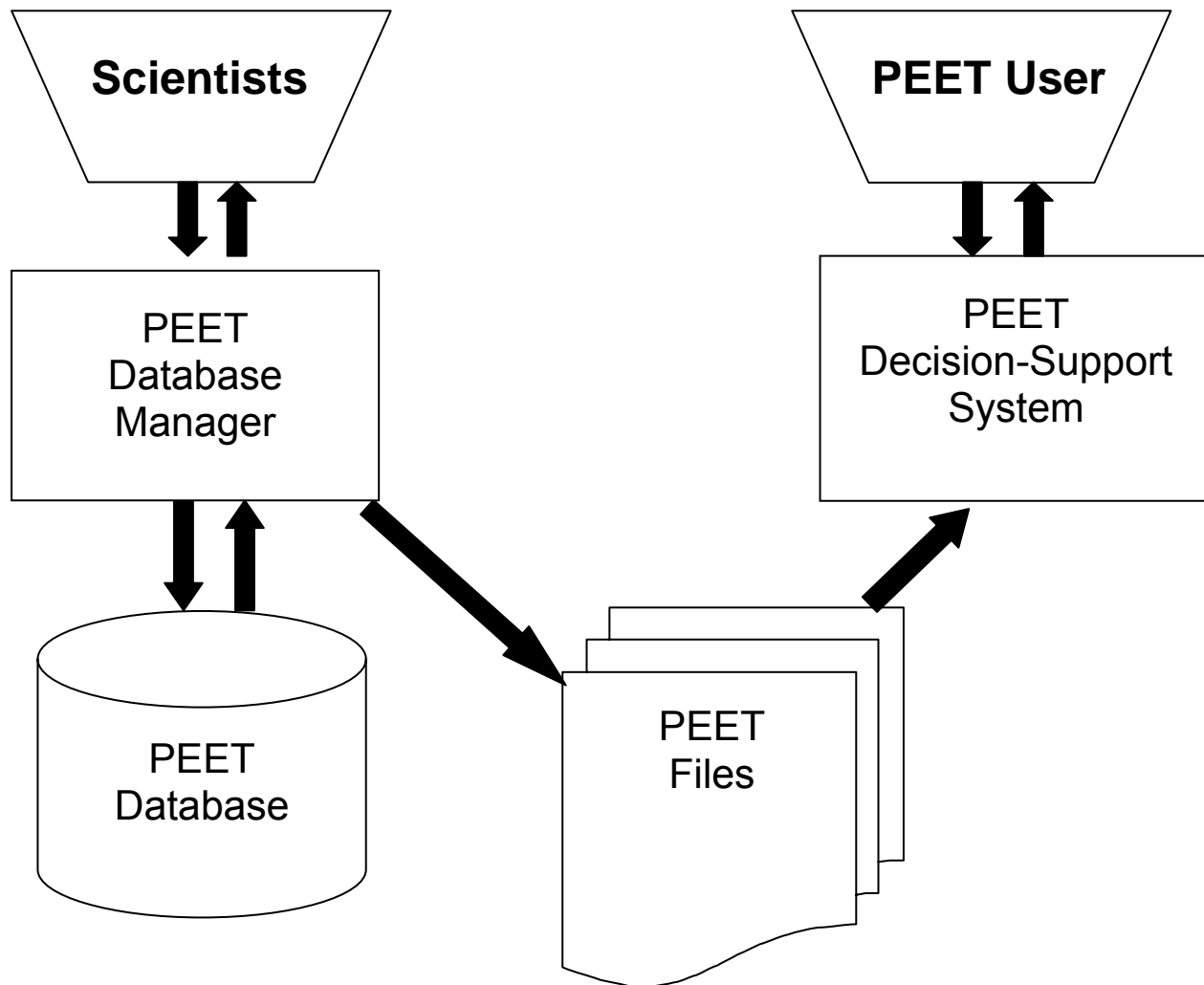
PEET Database Management

By

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The Pesticide Economic and Environmental Tradeoffs (PEET) decision support system requires a large amount of data for each crop and area of application. The diagram below illustrates the manner in which data are entered, manipulated, and finally made available to the PEET decision support system.

As illustrated below, the PEET Database Manager assists experts entering and modifying data so PEET can be used in an area and crop of interest. This software stores the data in a Microsoft Access database which was designed to aid in data management by insuring integrity and completeness of the data. Since most users will not have a database manager on their computers, these data are transferred to flat files which are then distributed with and used by the PEET decision-support software. Since the decision support system is implemented as a Java Web Start application, each time a user uses the system while connected to the internet, the software automatically looks for a more recent version of the software or data. If one exists, those data are automatically downloaded and used. In that way, the user will automatically be using the most recent data provided by the scientist.



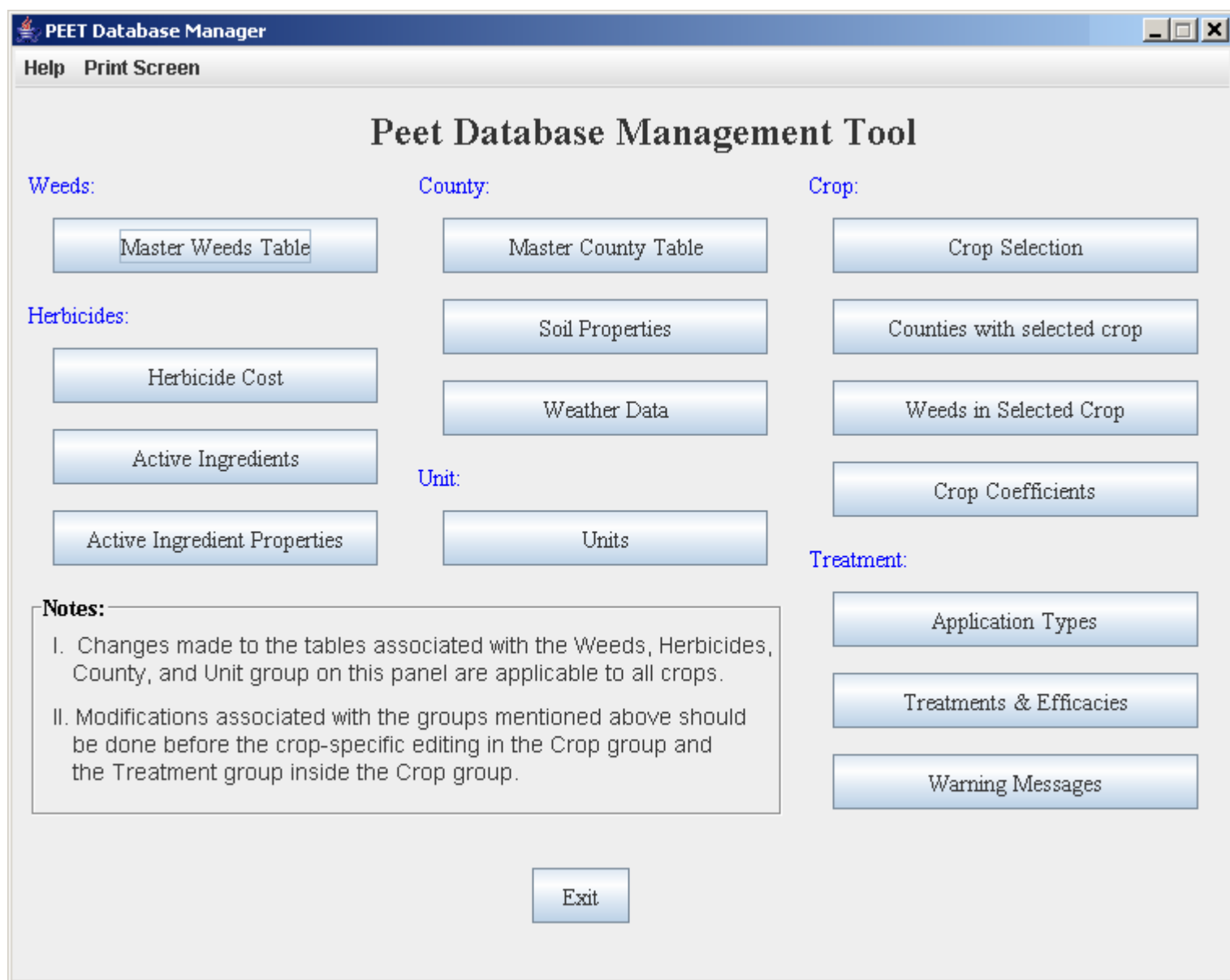
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PEET Database Manager

Opening Screen: This opening screen (shown below) contains buttons for managing different types of data. Selecting one of these buttons will display a new screen for entering and edit that type of data. The table on the following page provides a brief explanation of the use of each button.

Menus at top of each screen:

- **File:** This contains an option for final verification of a data set before converting it to the flat files for use in PEET and another option to convert the verified data.
- **Help Menu:** This contains options for obtaining extra documentation for each screen and information about the software itself.
- **Print Screen Menu:** This menu is used to print the contents displayed on the screen. This may be convenient for reviewing data and storing hard copy records of the data.



Description of data entered for each button on the Main Screen. If an entry has a data dependency specified, that data must be entered before the data for the specified button can be entered. Items listed in red include values used in all crops, but a specific crop may use only a subset of these data.

Button	Data Description	Data Dependencies
Master Weeds Table	List of all weeds expected in any crop	
Master County Table	List of all counties where crops are grown	
Herbicide Costs	List of all herbicides used in all crops and default purchase prices	<ul style="list-style-type: none"> • Units
Active Ingredients	Active ingredients present in each herbicide and amount of active ingredient per unit of product	<ul style="list-style-type: none"> • Herbicide tradenames entered in Herbicide Costs table
Active Ingredient Properties	Chemical properties of each active ingredient	<ul style="list-style-type: none"> • Active Ingredients table
Soil Properties	Names and soil properties of each soil on which crops are grown in each county	<ul style="list-style-type: none"> • Master County table
Weather Data	Source of daily infiltration and evapotranspiration data for each county	<ul style="list-style-type: none"> • Master County table
Units	Conversion factors for different units of area, volume, and weight or mass	
Crop Selection	Add a new crop or select and edit properties of an existing crop	
Counties with Selected Crop	List of counties in which a specific crop is grown	<ul style="list-style-type: none"> • Master County table • Crop Selection
Weeds in Selected Crop	List of weeds expected in a specific crop	<ul style="list-style-type: none"> • Master Weed table • Crop Selection
Crop Coefficients	Coefficients to calculate evapotranspiration for a specific crop from values of evapotranspiration for a reference crop	<ul style="list-style-type: none"> • Crop Selection
Application Types	Types of herbicide treatments used in this crop	
Treatments and Efficacies	Define herbicides, application rates, application depth and type, and efficacy for each treatment on each weed in a specific crop	<ul style="list-style-type: none"> • Herbicides tradenames entered in the Herbicide Cost option • Application types • Weeds in Selected Crop • Units
Warning Messages	Enter warnings to be displayed to user and specify the treatments for which the warning should be displayed	<ul style="list-style-type: none"> • Treatments defined in the Treatments and Efficacies option

PEET Database Manager

Master Weed Option: This screen is used to select a weed group and enter the name and weed code for any weed expected to be present in any crop for which PEET will be used. Weed names and codes in the table can be edited or deleted.

- **Add Button:** Opens a window allowing the user to select a weed group. A new row is then added to the table for that weed group with blanks for weed name and weed code. **It is essential that a unique weed code be entered for each weed name.**
- **Sort Button:** Sorts the weeds alphabetically by Weed Group and by Weed Name within a group.
- **Save Button:** Stores and additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire master weeds table on a printer

PEET Database Manager

Help Print Screen

Weeds Already in Database

Weed Group	Weed Name	Weed Code
annual broadleaf	velvetleaf	ABUTH
annual broadleaf	hophornbeam copperleaf	ACCOS
annual broadleaf	pigweed, smooth	AMACH
annual broadleaf	Palmer amaranth	AMAPA
annual broadleaf	redroot pigweed	AMARE
annual broadleaf	tall waterhemp	AMATU
annual broadleaf	common ragweed	AMBEL
perennial broadleaf	honeyvine milkweed	AMPAL
annual grass	broadleaf signalgrass	BRAPP
annual broadleaf	sicklepod	CASOB
annual grass	field sandbur	CCHIN
annual broadleaf	common lambsquarters	CHEAL
annual broadleaf	tropic croton	CVNGS
perennial grass	bermudagrass	CYNDA
sedges	yellow nutsedge	CYPES
sedges	purple nutsedge	CYPRO
annual broadleaf	jimsonweed	DATST
annual grass	large crabgrass	DIGSA
annual grass	barnyardgrass	ECHCG
annual grass	junglerice	ECHCO
annual broadleaf	eclipta	ECLAL
annual grass	goosegrass	ELEIN
annual broadleaf	prostrate spurge	EPHHT
annual grass	prairie cupgrass	ERBCO
annual broadleaf	common sunflower	HELAN
annual broadleaf	prairie sunflower	HELPE

Add

Sort

Save

Print

Delete a weed from Database

Return to Main Panel

PEET Database Manager

Master County Option: This screen is used to enter a county name for any county in which PEET will be used.

- **Adding a County:** The last row in the table has a county index but no name. When a name is added, a new row and County Index will be added to the table.
- **Sort Button:** Sorts the counties alphabetically by county name.
- **Save Button:** Stores any additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire master county table on a printer

County Index	County Name
1	Adair
3	Alfalfa
5	Atoka
7	Beaver
9	Beckham
11	Blaine
13	Bryan
15	Caddo
17	Canadian
19	Carter
21	Cherokee
23	Choctaw
25	Cimarron
27	Cleveland
29	Coal
31	Comanche
33	Cotton
35	Craig
37	Creek
39	Custer
41	Deleware

PEET Database Manager

Herbicide Cost Option: This screen is used to enter and edit herbicide trade names, and estimates of their cost per purchase unit. These products may be used in any crop. Purchase units are selected from a pull down list and must be present in the Units table before they are used here.

- **Add Button:** Opens a window allowing the user to select a purchase unit. A new row is then added to the table with blanks for trade name and purchase price.
- **Delete Button:** If a row in the table is selected and highlighted, pressing this button deletes the product from the database. It will no longer be usable in any crop.
- **Save Button:** Stores and additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire herbicides table on a printer

PEET Database Manager
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Help Print Screen

Enter Default Price for Each Herbicide:

Trade Name	Purchase Price	Purchase Unit
Aim	8.30	oz
Assure II	133.00	gal
Basagran	81.00	gal
Buctril	111.00	gal
Butyrac	31.00	gal
Cadre	180.00	14.4 oz
Caparol	30.00	gal
Cobra	130.00	gal
Command	70.00	gal
Cotoran/Meturon	40.00	gal
Dual II Magnum	106.00	gal
Frontier	96.00	gal
Fusilade DX	128.00	gal
Fusion 2.56 EC	133.00	gal
Goal	87.00	gal
Gramaxone Max	34.00	gal
Harvade	90.00	gal
Karmex 80DF	6.00	lb
MSMA 6.0	22.00	gal
Poast Plus	54.00	gal
Prowl	23.00	gal
Pursuit DG	10.50	oz
Roundup UltraMax	52.00	gal

Add
Delete
Save
Print
Return to Main Panel

PEET Database Manager

Active Ingredient Option: This screen is used to enter and edit the active ingredients present in each trade name and the weight of that active ingredient per pound of trade name product for dry materials or per gallon of product for liquids. This information allows the software to determine the quantities of active ingredients applied per acre of land for each product and any application rate.

- **Sort Button:** Sorts the table alphabetically by trade name
- **Add Button:** Opens a window allowing the user to select a trade name from the list entered in the Herbicide Cost option. A new row is then added to the table with blanks for active ingredient, amount of active ingredient per product unit, and product unit. If a product contains more than one active ingredient, a new row is added to this table for each active ingredient (as illustrated below for Fusion 2.56EC).

PEET Database Manager

Help Print Screen

Enter Active Ingredient(s) and Concentration(s) in Each Herbicide:

Trade Name	Active Ingredient	Amount of Active Ingredient (lb/product unit)	Product Unit
Aim	CARFENTRAZONE-ETHYL	0.4	LB
Assure II	QUIZALOFOP-ETHYL	0.88	GAL
Basagran	BENTAZON SODIUM SALT	4.0	GAL
Buctril	BROMOXYNIL OCTANOATE ESTER	4.0	GAL
Butyrac	2,4-DB DIMETHYLAMINE SALT	2.0	GAL
Cadre	IMAZAPIC	0.7	LB
Caparol	PROMETRYN	4.0	GAL
Cobra	LACTOFEN	2.0	GAL
Command	CLOMAZONE	3.0	GAL
Cotoran/Meturon	FLUOMETURON	4.0	GAL
Dual II Magnum	METOLACHLOR	7.64	GAL
Frontier	DIMETHENAMID	6.0	GAL
Fusilade DX	FLUAZIFOP-BUTYL	2.0	GAL
Fusion 2.56 EC	FENOXAPROP-P-ETHYL	0.56	GAL
Fusion 2.56 EC	FLUAZIFOP-P-BUTYL	2.0	GAL
Goal	OXYFLUORFEN	2.0	GAL
Gramaxone Max	PARAQUAT DICHLORIDE SALT	3.0	GAL
Harvade	DIMETHIPIN	4.9	GAL
Karmex 80DF	DIURON	0.8	LB
MSMA 6.0	METHANEARSONIC ACID SODIUM SALT	6.0	GAL
Poast Plus	SETHOXYDIM	1.0	GAL

Sort Add Delete Save Print Return to Main Panel

- **Delete Button:** If a row in the table is selected and highlighted, pressing this button deletes the information in that row from the database. If it is the only row for that particular trade name, the product will not be usable in any crop.
- **Save Button:** Stores and additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire table of active ingredients on a printer.

PEET Database Manager

Active Ingredient Properties Option: This screen is used to enter and edit properties of the active ingredients required in the model that estimates the amount of herbicide reaching groundwater and the health hazard posed by that amount. The meaning of each entry is explained on the following page.

When this option is selected, a row is placed in the table for each active ingredient specified in the Active Ingredient option. All rows of this table must be completed before a treatment with this herbicide can be used in the model.

- **Save Button:** Stores and additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire table of active ingredients and their properties on a printer.

PEET Database Manager

Help Print Screen

Enter Properties of Each Active Ingredient

Active Ingredient Common Name	Organic Carbon Partition Coefficient (ml/g OC)	Degradation Half-life (days)	Critical Concentration (ug/L)	Source of Data
2,4-DB DIMETHYLAMINE SALT	20.0	10.0	70.0	AGH
ACIFLUORFEN SODIUM SALT	113.0	14.0	1.0	AGH
BENTAZON SODIUM SALT	34.0	20.0	20.0	AGH
BROMOXYNIL OCTANOATE ESTER	10000.0	7.0	100.0	AGH
CARFENTRAZONE-ETHYL	10.0	10.0	1000.0	FMC DWLOC
CLETHODIM	5.0	3.0	70.0	AGH
CLOMAZONE	300.0	24.0	300.0	AGH
DICLOSULAM	78.0	53.0	1700.0	AGH
DIMETHENAMID	141.0	20.0	10.0	Guess
DIMETHIPIN	10.0	120.0	100.0	AGH
DIURON	480.0	90.0	10.0	AGH
ETHALFLURALIN	4000.0	60.0	300.0	AGH
FENOXAPROP-P-ETHYL	9490.0	10.0	17.5	AGH
FLUAZIFOP-BUTYL	5700.0	15.0	70.0	AGH
FLUAZIFOP-P-BUTYL	5700.0	15.0	70.0	AGH
FLUMIOXAZIN	700.0	15.0	70.0	AGH
FLUOMETURON	100.0	85.0	90.0	AGH
GLYPHOSATE AMINE SALT	24000.0	47.0	700.0	AGH
IMAZAPIC	2.0	120.0	4900.0	BASF DWLOC
IMAZETHAPYR	10.0	90.0	2000.0	AGH
LACTOFEN	10000.0	3.0	10.0	AGH

Save Print Return to Main Panel

Chemical Properties of Active Ingredients

Organic carbon partition coefficient (ml/g OC): At low concentrations, the concentration of pesticide adsorbed on the soil solids is proportional to the concentration in soil solution. That is

$$S = K_d C$$

where S is the concentration on the soil solids, C is the concentration in the soil solution, and the proportionality constant, K_d is the partition coefficient for the specific soil. Experimentally, scientists have found that the partition coefficient for many pesticides is approximately proportional to the organic carbon content of the soil. That is,

$$K_d = K_{OC} OC$$

where K_d is the partition coefficient for the chemical in a specific soil, OC is the organic carbon content of that soil, and K_{OC} is the organic carbon partition coefficient for the chemical. In PEET, the organic carbon partition coefficient for each active ingredient is used along with the organic carbon content of the soil of interest to obtain the partition coefficient for that pesticide in that soil. This then is used in the model to predict the movement of the pesticide. Hornsby, A. G., R.D. Wauchope, and A.E. Herner (1996. Pesticide Properties in the Environment. Springer. New York) is a good reference for these values.

Degradation Half-life (days): Pesticide degradation is usually estimated as a first-order process. That is the degradation rate is proportional to the concentration of the pesticide. First order degradation can also be expressed in terms of half-life which is the number of days required for the concentration of a pesticide in a solution to be reduced to one-half its original value. Values of these parameters for different chemicals are also available in Hornsby et al. (1996).

Critical Concentration ($\mu\text{g/L}$): The hazard posed to groundwater by each treatment is defined as the ratio of the concentration of the active ingredient in groundwater to a critical concentration of the active ingredient established for protecting consumers of the groundwater. That is

$$GWH = \frac{C_{\text{Active Ingredient}}}{C_{\text{Critical}}}$$

where GWH is the groundwater hazard, $C_{\text{Active Ingredient}}$ is the concentration of the active ingredient in the groundwater, and C_{Critical} is the concentration of the active ingredient that is considered to have negligible risk of harming human beings when consumed for an entire lifetime. Thus the groundwater hazard takes into account the toxicity of the chemical as well as the rate of movement to groundwater and the degradation rate. PEET ranks chemicals on the basis of groundwater hazard.

Source of Data: This is simply data for reference by the scientist to document the source of the data entered in this table.

PEET Database Manager

Soil Properties Option: PEET simulates the movement and degradation of pesticides in the soil of interest to estimate the quantity of pesticide reaching the aquifer. The CMLS model of Nofziger and Hornsby is used in this simulation. This model is a simplified management model utilizing readily available soil properties. The screen below is used to enter and edit soil properties for all soils in which crops supported by PEET will be grown. Entries on the screen are explained below.

Note: Only the properties of the soil horizons vary from one pedon to the next within a soil. The items above the properties table for each horizon refer to all pedons for this soil.

PEET Database Manager
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Help Print Screen

Enter Soil Names and Properties for each Soil on which a Crop is Grown:

County: Alfalfa ▼

Soil Name: ALBION SANDY LOAM

Pedon Index: 1 ▼ Organic Carbon Class: high ▼

Maximum Root Depth (mm): 1000.0 Texture Class: coarse ▼

Curve Number: 0.0

Horizon	Thickness (mm)	Organic Carbon (g/kg)	Bulk Density (Mg/m3)	Field Capacity (m3/m3)	Wilting Point (m3/m3)	Porosity (m3/m3)
1	203.0	8.7	1.43	0.29	0.1	0.46
2	254.0	4.7	1.52	0.29	0.1	0.42
3	356.0	2.1	1.52	0.24	0.1	0.42
4	187.0	1.0	1.57	0.18	0.06	0.41
5						

Previous Soil
Next Soil
New Soil
New Pedon
Delete Pedon
Save Soil
Return to Main Panel

County: Soils data are organized in the database by county. Any county in the Master County Table can be selected here.

Soil Name: This is the name of the soil that will be displayed to the PEET user.

Pedon Index: We often have soil properties from several sites that have been mapped as the same soil. We consider these to be different pedons of the same soil. This index is a simple way to identify these different sites. When a soil is selected in PEET, all pedons for that soil are used in the simulation. The PEET user selects the soil name but does not select specific pedons.

Maximum Root Depth: This is the maximum root depth of crops in this soil. If the root depth specified for the selected crop exceeds this value, this value is used. If the root depth for a crop is less than this maximum value, the root depth specified for the crop is used. Root depth as used in this software refers to the soil depth from which the plant uses water.

Curve Number: The SCS curve number method is used to estimate runoff from an area. The amount of water entering the soils is then estimated as the precipitation falling on the area on a specific day minus the amount of runoff. Curve numbers range from 0 to 100. Zero results in no runoff; 100 results in no infiltration. Using zero as the curve number will likely result in overestimating leaching in most soils. If a treatment is found to have a low risk when all of the precipitation enters the soil, that treatment is likely to have a low risk of degrading groundwater quality.

Organic Carbon Class: Efficacies for per-plant incorporated and pre-emergence treatments may depend upon the organic carbon content of the soil. Here the user identifies this soil pedon as having high, medium, or low organic carbon.

Texture Class: Efficacies for per-plant incorporated and pre-emergence treatments may depend upon the soil texture. Here the user identifies this soil pedon as having a coarse, medium or fine texture.

Soil Properties for each soil layer: The following properties are entered for each soil layer.

Horizon Number: These are consecutive integers referring to soil layers. Layer 1 is nearest the soil surface. The software supports up to 20 layers.

Thickness: This is the thickness of the soil layer in millimeters.

Organic Carbon Content: This is the organic carbon content of the soil layer in grams of organic carbon per kilogram of dry soil.

Bulk Density: This is the mass of dry soil per unit total volume of soil (that is the volume includes the volume of soil solids and soil pores). It has units of Mg/m^3 (or g/cm^3).

Field Capacity: This is the volume of water per unit total soil volume that exists in the soil when rapid drainage of the soil has ended.

Permanent Wilting Point: This is the volume of water per unit total soil volume when the soil is no longer able to support plant growth and permanent wilting occurs.

Porosity: This is the ratio of the volume of pores in the soil to the total volume of the soil.

Buttons

- **Previous Soil and Next Soil Buttons:** These buttons are used to move through the soils already stored in the PEET database.
- **New Soil Button:** Pressing this button opens up the screen with all fields editable and Pedon Index set to 1.
- **New Pedon Button:** Pressing this button opens a new screen with the pedon index set to its next value and the soil properties table for each horizon empty. All other values are the same as those for the preceding soil pedon.
- **Delete Pedon Button:** Pressing this button deletes the current pedon from the PEET database. If it is the only pedon defined for the soil, the entire soil is deleted from the database.
- **Save Soil Button.** Pressing this button will store the current soil pedon data in the PEET database.

PEET Database Manager

Weather Data Option: Movement of chemicals in soils depends to a large extent upon the movement of water in those soils. Weather (and supplemental irrigation) has a major impact upon soil water movement. So weather data are needed to simulate pesticide movement in PEET. Weather is highly variable from year to year. When making decisions about which, if any, herbicides to use, the future weather is unknown so the exact fate of the herbicide is unknown. PEET deals with that by simulating movement for many different application years at the same location and then determines the groundwater hazard that is exceeded with a user-specified probability.

Weather data can be supplied to the PEET software as historical weather, historical rainfall and evapotranspiration values, or stochastic parameters that can be used to generate weather using the WGEN weather generator. The screens for each of these types of data are illustrated on the following pages and are described below. If historical data are used, they should span at least 30 consecutive years.

Historical Weather: If historical weather is used, the model requires daily precipitation amounts and daily maximum and minimum temperatures in addition the name, elevation, latitude, and longitude of the weather station and their units of measure. Once those values are entered, the daily data can be entered into the table or read from an ASCII file.

The file structure is illustrated here.

Year	Month	Day	Rainfall	MinimumTemperature	MaximumTemperature
1948	1	1	88	14.0	28.0
1948	1	2	0.0	6.0	38.0
1948	1	3	0.0	10.0	46.0
1948	1	4	0.0	18.0	50.0
1948	1	5	0.0	25.0	55.0
1948	1	6	0.0	29.0	55.0
1948	1	7	0.0	28.0	57.0
1948	1	8	0.0	29.0	63.0
1948	1	9	0.0	33.0	63.0
1948	1	10	0.0	30.0	58.0
.
.
.
1948	1	30	0.0	9.0	31.0
1948	1	31	0.0	12.0	35.0
1948	2	1	0.0	21.0	41.0
1948	2	2	0.001	25.0	45.0

The first row in the file contains the header for each column as shown above. This header line must be in the file. Following lines contain data for each day. The columns are separated by <tab> keys.

Screen for defining a weather station using historical weather data.

PEET Database Manager Help Print Screen

Enter Weather Data:

County: **Caddo** **Data:** **Units:**

Station Name: **Fort Cobb, OK** Daily Rainfall and PET **Elevation** m ft

Elevation: **1260.0** Daily Rainfall and Maximum and Minimum Temperatures **Rainfall and PET** mm in

Latitude: **35.1** WGEN Parameters **Temperature** °C °F

Longitude: **-98.43**

Year	Month	Day	Rainfall	Minimum Temperature	Maximum Temperature
1948	1	1	88	14.0	28.0
1948	1	2	0.0	6.0	38.0
1948	1	3	0.0	10.0	46.0
1948	1	4	0.0	18.0	50.0
1948	1	5	0.0	25.0	55.0
1948	1	6	0.0	29.0	55.0
1948	1	7	0.0	28.0	57.0
1948	1	8	0.0	29.0	63.0
1948	1	9	0.0	33.0	63.0
1948	1	10	0.0	30.0	58.0
1948	1	11	0.0	34.0	54.0
1948	1	12	0.04	39.0	53.0

Historical Daily Rainfall and Potential Evapotranspiration (PET): This data is similar to the historical weather except that daily potential evapotranspiration amounts are provided instead of maximum and minimum temperatures. The tab delimited file for this option is follows the screen image. Once again the first row with the header information is required.

PEET Database Manager

Help Print Screen

Enter Weather Data:

County: **Caddo**

Station Name: **Fort Cobb, OK**

Elevation: **384.0**

Latitude: **35.1**

Longitude: **-98.43**

Data:

Daily Rainfall and PET

Daily Rainfall and Maximum and Minimum Temperatures

WGEN Parameters

Units:

Elevation m ft

Rainfall and PET mm in

Temperature °C °F

Year	Month	Day	Rainfall	PET
1972	1	1	1.2	6.3
1972	1	2	0	3.3
1972	1	3	0	5.7
1972	1	4	0	5.6
1972	1	5	0	4
1972	1	6	1.2	1.5
1972	1	7	27.5	2.4
1972	1	8	9.9	3.5
1972	1	9	0	3.9
1972	1	10	0	4.6
1972	1	11	0	0.8
1972	1	12	1	4.5

Illustration of file format for daily rainfall and potential evapotranspiration.

Year	Month	Day	Rainfall	PET
1972	1	1	1.2	6.3
1972	1	2	0	3.3
1972	1	3	0	5.7
1972	1	4	0	5.6
.
.
.
1972	1	30	0	4.3
1972	1	31	0	4.6
1972	2	1	18.3	3.5
1972	2	2	2.1	3.6

WGEN Parameters for Weather Data: Scientists have studied the characteristics of weather and have developed weather generators that generate daily weather sequences with statistical parameters matching those of the real weather. These are especially useful in Monte Carlo simulations where many simulations are carried out with different input parameters. That is done in PEET so utilizing the weather generator is a convenient way to deal with weather inputs. The WGEN weather generator of Richardson and Wright (1984) is built into the PEET decision support system. The screen below is used to enter the stochastic parameters needed by WGEN for a particular weather station. These parameters can be obtained from daily historical weather data using a program provided by Richardson and Wright. They also provide many sets of parameters for a wide range of weather stations in the software manual. The manual is available at <http://soilphysics.okstate.edu/software/cmls/WGEN.pdf>.

PEET Database Manager

Help Print Screen

Enter Weather Data:

County: **Caddo** Data: Units:

Station Name: **Fort Cobb, OK** Daily Rainfall and PET Elevation m ft

Elevation: **1260.0** Daily Rainfall and Maximum and Minimum Temperatures Rainfall and PET mm in

Latitude: **35.1** WGEN Parameters Temperature °C °F

Longitude: **-98.43**

Site Parameter	Value	Month	PWW	PWD	ALPHA	BETA
MeanTmaxDry	76.036964	1	0.409091	0.153179	0.324357	0.442812
AmpTmax	21.877216	2	0.467005	0.183986	0.340742	0.470576
MeanCVTmax	0.125157	3	0.409524	0.18693	0.365041	0.588176
AmpCVTmax	-0.076647	4	0.423913	0.167683	0.444659	0.742441
MeanTmaxWet	69.8256	5	0.477193	0.246998	0.402377	1.163035
MeanTmin	48.341244	6	0.440816	0.235294	0.391554	1.108837
AmpTmin	22.346968	7	0.411765	0.164464	0.373781	1.180033
MeanCVTmin	0.196495	8	0.335079	0.180207	0.379064	0.879246
AmpCVTmin	-0.14403	9	0.378109	0.194053	0.394694	1.213369
MeanRDry	460.0	10	0.4375	0.127119	0.35608	1.156289
AmpR	198.0	11	0.379085	0.135371	0.337475	0.803611
MeanRWet	300.0	12	0.438596	0.139168	0.318023	0.5483

PEET Database Manager

Units Option: This screen is used to enter new units of measure and the factor needed to convert quantities in those units to a standard unit.

- **Add Button:** This button introduces a new window in which the type of unit is selected. The system then inserts that unit into a new row on the table and allows the user to enter the new Unit of Interest and the number of the standard units in the new unit of interest as the Conversion Factor.
- **Delete Button:** Deletes the selected row from the database. This will not be permitted if the unit has been used.
- **Save Button:** Stores any additions and changes to the data in the PEET database.
- **Print Button:** Prints the entire units table on a printer.

Type of Units	Unit of Interest	Standard Unit	Conversion Factor
Area	HA	ACRE	2.47
Area	ACRE	ACRE	1.0
Mass/Weight	GRAM	LB	0.0022
Mass/Weight	14.4 OZ	LB	0.9
Mass/Weight	OZ	LB	0.0625
Mass/Weight	LB	LB	1.0
Mass/Weight	KG	LB	2.205
Mass/Weight	TON	LB	2000.0
Mass/Weight	40 LB	LB	40.0
Mass/Weight	12.5 LB	LB	12.5
Mass/Weight	50 LB	LB	50.0
Volume	2.5 GAL	FL OZ	320.0
Volume	FL OZ	FL OZ	1.0
Volume	GALLON	FL OZ	128.0
Volume	PT	FL OZ	16.0
Volume	QT	FL OZ	32.0
Volume	GAL	FL OZ	128.0

Conversion Factor is the number of "Standard Units" in the "Unit of Interest"

Add New Unit Delete Save Print Return to Main Panel

PEET Database Manager

Crop Selection Option: This screen is used to select a crop whose data will be entered or modified in other options and to enter parameters for a new crop. When the program begins, no crop is selected. To select an existing crop, simply click on the name of the crop. Then press the appropriate button to edit those parameters or to return to the main screen and select another option.

- **Add a Crop Button:** This button enables a user to define a new crop and the required parameters for it. The screen used is the same as the one used to edit a crop except the entries are blank.
- **Edit a Crop Button:** This button causes the screen on the following page to be displayed. The parameters for the crop can then be modified and saved in the database.

PEET Database Manager

Help Print Screen

Select a crop of interest:

Cotton, BXN

Cotton, Conventional

Cotton, Roundup Ready

Peanuts

Add a crop Edit a crop Return to main panel

Editing Crop Parameters: Explanations for the parameters are below this screen.

PEET Database Manager

Help Print Screen

Enter or Edit Crop Details

Crop Name:

Area Units: Yield Unit: Market Units:

Default Dryland Yield (lb/acre) low: Normal: High:

Default irrigated Yield (lb/acre) low: Normal: High:

Default Planting Date:

Root Depth (mm)

Default Market Price (\$/lb)

Herbicide Application Cost (\$/acre)

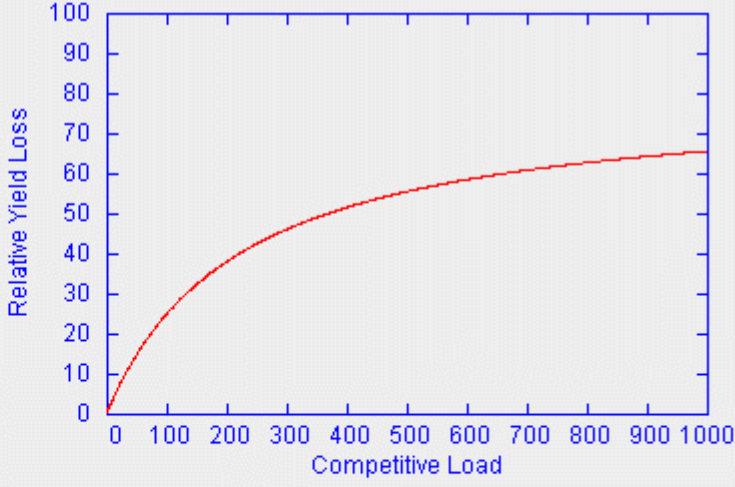
Scouting Cost (\$/acre)

Yield Loss Model Parameters

Maximum Yield Loss (%):

Loss Per Competitive Load (%/CL)

Critical Competitive Load (CL):



Crop Name: This is the crop name that will be displayed to the PEET user.

Area Units: This is the unit of area used when entering yields and herbicide application rates.

Yield Units: This is the unit in which yields are measured.

Market Units: This is the unit used when specifying the market price of the crop.

Default Yields for Dryland and Irrigated Conditions: Economics of herbicide use depends upon the expected yield of the crop. Since we do not know that yield at the time of treatment, PEET allows the user to enter three yields and to observe the economics for each yield. Thus the decision made can incorporate this broader knowledge. To facilitate this calculation, the system presents default yield values for each crop under dryland and irrigated management systems. Those values are entered here. The PEET user can modify these easily for their field and management area.

Default Planting Date and Root Depth: The pesticide transport model in PEET utilizes daily water balance calculations to predict the depth of the pesticide as a function of time after application. This water balance depends upon infiltration and evapotranspiration. The planting date is used to estimate changing evapotranspiration during the growth cycle of the crop. The root depth determines the soil depth from which water is removed by the crop.

Default Market Price: This is the default market price for the crop. It can be modified by the PEET user.

Herbicide Application Cost: This is the default cost of applying any herbicide. It does not include the cost of the herbicide. This value can be changed by the PEET user.

Scouting Cost: This is the portion of the scouting cost that is to be incorporated into the economics of weed control. This value can be modified by the user.

Parameters for Predicting Yield Loss: The loss in yield due to the weeds must be calculated in the PEET decision-support system. Coble and Mortensen , (Harold D. and David A. Mortensen. 1992. The threshold concept and its application to weed science. Weed Technology 6:191-195) published a model that has been used extensively for this. A basic concept involved is the total competitive load due to weeds. This is a method of calculating the total impact of a mixture of weeds by multiplying the density of each weed species by a weighting factor called the competitive index. The competitive index reflects the relative impact of a single weed of that weed species upon yield loss. The total competitive load D, is given by

$$D = \sum_{j=1}^n c_j d_j$$

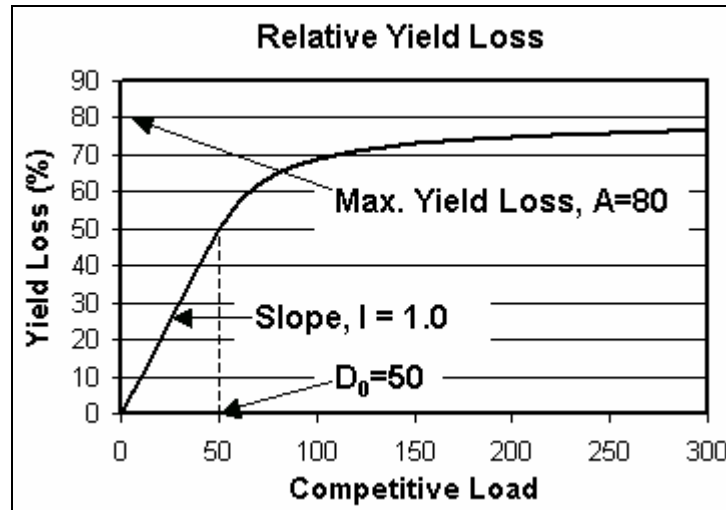
where c_j represents the competitive index of weed j , d_j represents the density of weed j , and n represents the number of different weed species in the field. The following table illustrates this calculation for weeds.

Index j	Weed Name	Competitive Index, c_j	Weed Density, d_j	Competitive Load, $c_j d_j$
1	Cocklebur	10.0	5	50
2	Crownbeard	3.0	4	12
3	Pigweed	2.8	5	14
4	Crabgrass	0.7	30	21
Total Competitive Load, $D = 50 + 12 + 14 + 21 = 97$				

The total competitive load is used to compute the yield loss, Y_{Loss} , using the equation

$$\frac{Y_{Loss}}{Y_0} = \begin{cases} ID & \text{for } D \leq D_0 \\ ID_0 + \frac{(A - ID_0)(D - D_0)I}{(A - ID_0) + I(D - D_0)} & \text{for } D > D_0 \end{cases}$$

where Y_0 is the expected weed-free yield, D is the total competitive load, I is the slope of the relative yield loss curve for competitive loads less than the threshold value D_0 , and A is the maximum relative yield loss at very high values of competitive load. This equation is illustrated below for values of $I = 1.0$, $A = 80$, and $D_0 = 50$.

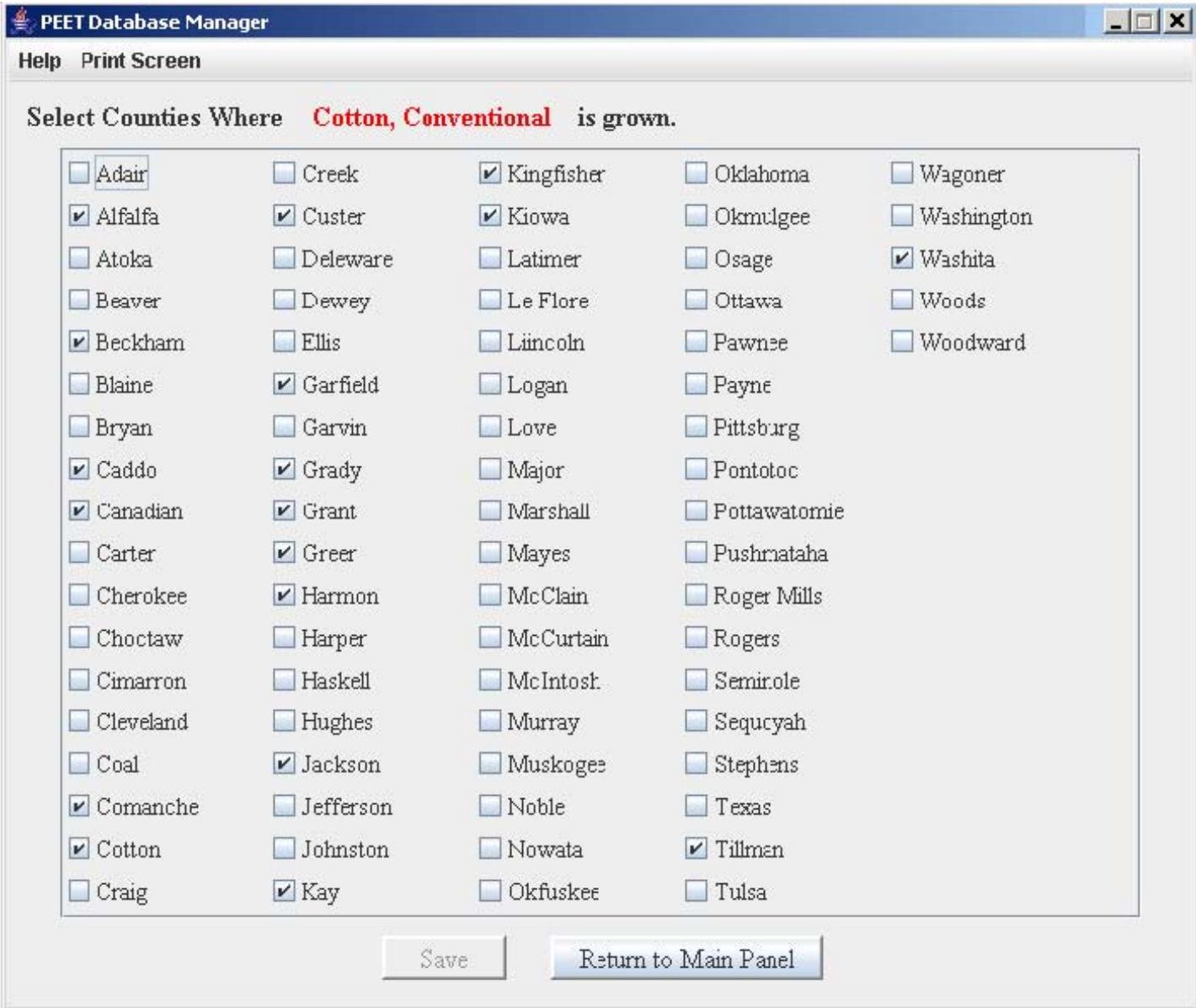


The Maximum Yield Loss requested in the crop editing screen is the value of A in the equation above. The Loss per Competitive Load is the value of the slope I at very low competitive loads, and the Critical Competitive Load is the value of D_0 in the equation. The graph in the lower right corner of the screen shows the relative yield loss as a function of competitive load for the parameters entered.

When all of the parameters have been entered, the **Save** button can be used to store the data for this crop in the database.

PEET Database Manager

Counties with Selected Crop Option: The screen below illustrates the screen for selecting counties in which a selected crop is grown. All of the counties in the Master County table are listed. Placing a check mark in the box by the county indicates that the selected crop is grown in this county. Once these selections have been made, the **Save** button at the bottom of the screen is pressed to store the data in the PEET database.



PEET Database Manager

Weeds in Selected Crop Option: The screen below illustrates the screen for selecting weeds expected in the selected crop. All of the weeds in the Master Weed table are listed. Placing a check mark in the box by the weed indicates that the weed may be present in the selected crop. The weed group, weed name, and weed code are automatically placed in each row. The remaining columns are explained on the page following the screen image.

PEET Database Manager

Select the Weeds Expected in Cotton, Conventional

Select	Display Order	Weed Group	Weed Name	Weed Code	Competitive Index	Low Density	Medium Density	High Density
<input checked="" type="checkbox"/>	1	annual grass	barnyardgrass	ECHCG	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	2	annual grass	broadleaf si...	BRAPP	3.0	25.0	50.0	100.0
<input checked="" type="checkbox"/>	3	annual grass	fall panicum	PANDI	2.0	25.0	50.0	100.0
<input checked="" type="checkbox"/>	4	annual grass	Texas panic...	PANTE	3.0	25.0	50.0	100.0
<input checked="" type="checkbox"/>	5	annual grass	field sandbur	CCHIN	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	6	annual grass	goosegrass	ELEIN	0.3	25.0	50.0	100.0
<input checked="" type="checkbox"/>	7	annual grass	green foxtail	SETVI	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	8	annual grass	yellow foxtail	SETLU	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	9	annual grass	junglerice	ECHCO	1.5	25.0	50.0	100.0
<input checked="" type="checkbox"/>	10	annual grass	large crabgr...	DIGSA	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	11	annual grass	prairie cupgr...	ERBCO	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	12	annual grass	red sprangle...	LEFFI	1.4	25.0	50.0	100.0
<input checked="" type="checkbox"/>	13	perennial gr...	bermudagra...	CYNDA	2.0	10.0	20.0	30.0
<input checked="" type="checkbox"/>	14	perennial gr...	johnsongras...	SORHA-r	6.0	10.0	25.0	50.0
<input checked="" type="checkbox"/>	15	perennial gr...	johnsongras...	SORHA-s	5.0	10.0	25.0	50.0
<input checked="" type="checkbox"/>	16	annual broa...	buffalobur	SOLCU	3.0	10.0	20.0	30.0
<input checked="" type="checkbox"/>	17	annual broa...	carpetweed	MOLVE	0.1	25.0	50.0	100.0
<input checked="" type="checkbox"/>	18	annual broa...	common coc...	XANST	10.0	5.0	15.0	25.0
<input checked="" type="checkbox"/>	19	annual broa...	common la...	CHEAL	4.0	10.0	20.0	30.0
<input checked="" type="checkbox"/>	20	annual broa...	common pur...	POROL	0.8	25.0	50.0	100.0
<input checked="" type="checkbox"/>	21	annual broa...	common rag...	AMBEL	2.5	10.0	30.0	50.0
<input checked="" type="checkbox"/>	22	annual broa...	common su...	HELAN	7.0	5.0	15.0	25.0
<input checked="" type="checkbox"/>	23	annual broa...	cutleaf groun...	PHYAN	3.5	10.0	20.0	30.0
<input checked="" type="checkbox"/>	24	annual broa...	crownbeard	VEEEN	1.0	10.0	30.0	50.0

Additional data to be entered:

Display Order: The numbers in this column control the order in which the weeds will appear on the weed density screen in the PEET decision-support system. They can be rearranged by changing the numbers in this column and then pressing the **Sort** button. For example, the table above has buffalobur at position 16 and carpetweed at 17. If I want buffalobur to appear after carpetweed I can change the display order value for buffalobur to 17.5. When I press the Sort button, the table is rearranged so the display order values are increasing so it places buffalobur after carpetweed. It then rennumbers the display order using whole numbers.

Competitive Index: The loss in yield due to the weeds must be calculated in the PEET decision-support system. Coble and Mortensen , (Harold D. and David A. Mortensen. 1992. The threshold concept and its application to weed science. Weed Technology 6:191-195) published a model that has been used extensively for this. A basic concept involved is the total competitive load due to weeds. This is a method of calculating the total impact of a mixture of weeds by multiplying the density of each weed species by a weighting factor called the **competitive index**. The competitive index reflects the relative impact of a single weed of that weed species upon yield loss. It usually has a value between 0 and 10 with 10 being the most competitive weed. The total competitive load for a collection of weeds D, is given by

$$D = \sum_{j=1}^n c_j d_j$$

where c_j represents the competitive index of weed j , d_j represents the density of weed j , and n represents the number of different weed species in the field. The following table illustrates this calculation for weeds.

Index j	Weed Name	Competitive Index, c_j	Weed Density, d_j	Competitive Load, $c_j d_j$
1	Cocklebur	10.0	5	50
2	Crownbeard	3.0	4	12
3	Pigweed	2.8	5	14
4	Crabgrass	0.7	30	21
Total Competitive Load, D =				50 + 12 + 14 + 21 = 97

The competitive index for each weed in a crop must be entered in the Competitive Index column of the table.

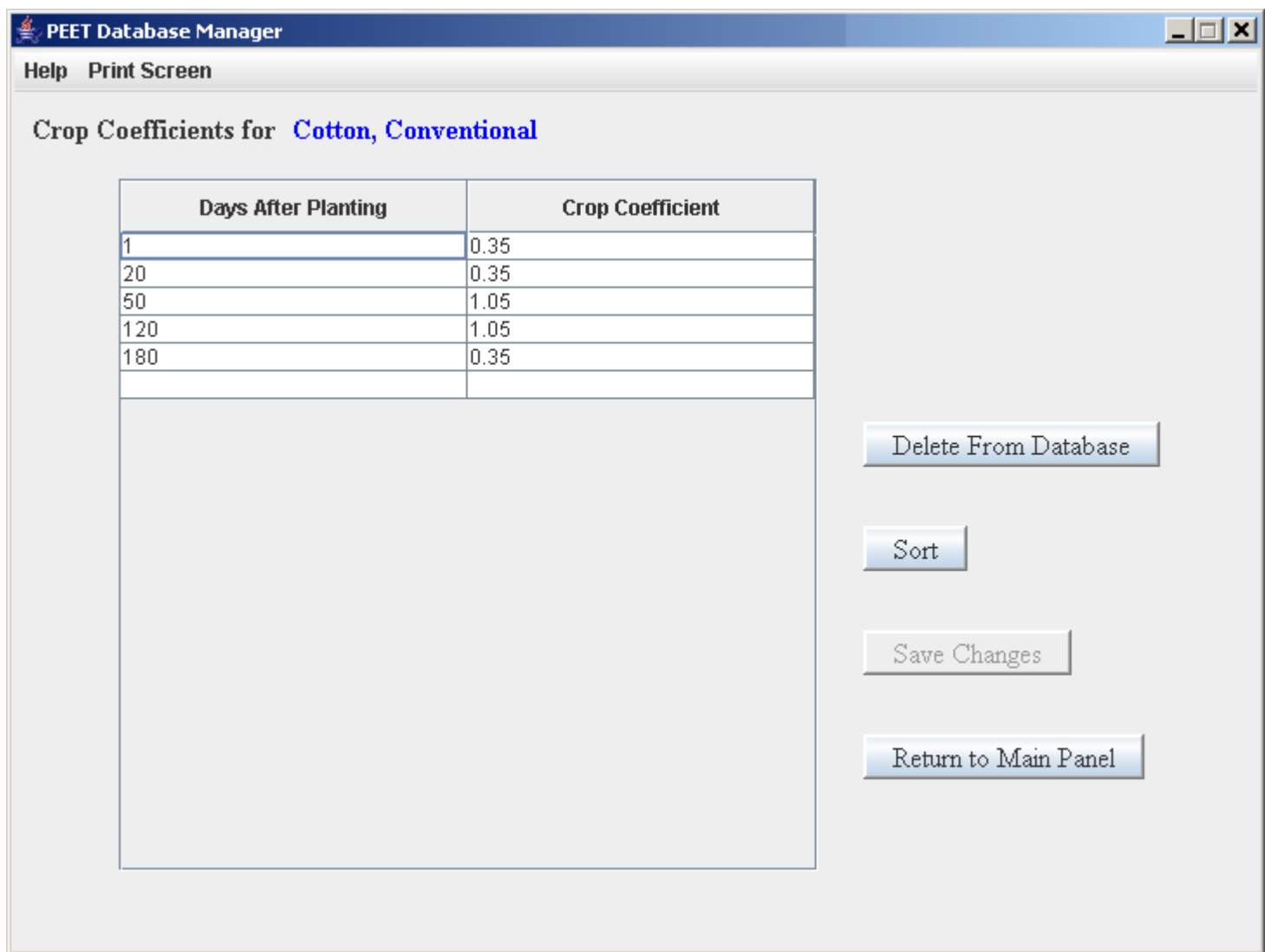
Low, Medium, and High Density Columns: As shown above, the weed density of each weed species is needed to calculate the total competitive load. For pre-emergence and pre-plant applications, the weeds cannot be counted so estimates of these populations must be made from experience in previous years. Thus, PEET asks the user to select "low", "medium", or "high" as densities for these types of application. The columns in this table contain estimates of the weed density that correspond to these descriptive words. In the example above, high density for barnyard grass was taken to be 100 plants per 100 square feet while high density for crownbeard was only 30 plants per 100 sq. ft.

PEET Database Manager

Crop Coefficient Option: The basic concept with all of the ET estimators used in calculating the water balance in the root zone and the movement of the chemical is to determine a reference crop evapotranspiration value, ET_0 , and to relate ET_0 to ET for the crop of interest by means of time dependent crop coefficients, $k_{CROP}(t)$. That is

$$ET(t) = k_{crop}(t)ET_0(t)$$

Values of $k_{CROP}(t)$ are obtained by linear interpolation between tabulated $k_{CROP}(t')$ values where t' is time measured from the date of planting. The following screen is used to enter, edit, sort, save or delete the crop coefficients for different days after planting. Values at other day are obtained by linear interpolation.



The screenshot shows a window titled "PEET Database Manager" with a menu bar containing "Help" and "Print Screen". The main content area is titled "Crop Coefficients for Cotton, Conventional". It features a table with two columns: "Days After Planting" and "Crop Coefficient". The table contains five rows of data. To the right of the table are four buttons: "Delete From Database", "Sort", "Save Changes", and "Return to Main Panel".

Days After Planting	Crop Coefficient
1	0.35
20	0.35
50	1.05
120	1.05
180	0.35

PEET Database Manager

Treatments and Efficacies Option: This option is used to define herbicides, application rates, application types, and application depths for different treatments for the selected crop. In addition, the screen is used to define efficacy values for each weed in this crop in different soil and application conditions. In the cases of preplant incorporated (PPI) and pre-emergence (PRE) application types, these application conditions refer to different soil textures and organic carbon levels (as shown in the first screen below). In the cases of post emergence (POST) and post-directed spray (PDS) application types, the application conditions refer to the soil moisture level and weed size (see the screen on the next page).

PEET Database Manager
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Help Print Screen

Enter Herbicide(s) for One Treatment for the selected crop: **Cotton, Conventional**

Display Order	Trade Name	Application Rate	Application Units
1	Command	1.5	fl oz
2			

Application Type:

 Application Depth (mm):

Weed Name	High OC Coarse Texture	High OC Medium Texture	High OC Fine Texture	Med. OC Coarse Texture	Med. OC Medium Texture	Med. OC Fine Texture	Low OC Coarse Texture	Low OC Medium Texture	Low OC Fine Texture
barnyardgrass	90.0	80.0	75.0	90.0	80.0	75.0	90.0	90.0	75.0
broadleaf signalgrass	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
fall panicum	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Texas panicum	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
field sandbur	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
goosegrass	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
green foxtail	90.0	80.0	75.0	90.0	80.0	75.0	90.0	90.0	75.0
yellow foxtail	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
jungerice	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
large crabgrass	90.0	80.0	75.0	90.0	80.0	75.0	90.0	90.0	75.0
prairie cupgrass	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
red sprangletop	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
bermudagrass	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
johnsongrass /bizo	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

PEET Database Manager

Help Print Screen

Enter Herbicide(s) for One Treatment for the selected crop: **Cotton, Conventional**

Display Order	Trade Name	Application Rate	Application Units
1	Assure II	8.0	fl oz
2			

Application Type: **POST**

Application Depth (mm): **0.0**

Delete Herbicide

First Treatment Next Treatment Previous Treatment Last Treatment New Treatment

Weed Name	Moist Soil			Dry Soil		
	Large Weeds	Medium Weeds	Small Weeds	Large Weeds	Medium Weeds	Small Weeds
barnyardgrass	60.0	70.0	80.0		50.0	65.0
broadleaf signalgrass	60.0	70.0	80.0		50.0	65.0
fall panicum	93.0	95.0	95.0		80.0	85.0
Texas panicum	60.0	70.0	80.0		60.0	70.0
field sandbur	93.0	95.0	95.0		80.0	85.0
goosegrass	93.0	95.0	95.0		85.0	85.0
green foxtail	93.0	95.0	95.0		85.0	85.0
yellow foxtail	93.0	95.0	95.0		85.0	85.0
junglerice	93.0	95.0	95.0		80.0	85.0
large crabgrass	60.0	70.0	80.0		50.0	65.0
prairie cupgrass	60.0	70.0	80.0		60.0	70.0
red sprangletop	60.0	70.0	80.0		65.0	70.0
bermudagrass	40.0	50.0	40.0		30.0	50.0
labeopanax (bize)	60.0	75.0	80.0		50.0	60.0

Save Delete Treatment Print Return to Main Panel

Treatment Definitions: Clicking on the “Trade Names” column produces a list of products that can be used to define a treatment. This list is taken from the Herbicide Cost table so if a herbicide of interest is not included in this list, it must be added to the Herbicide Costs table before it is available here. The application rate is entered in the second column and units of measure in the third. When the New Treatment button is pressed, a blank screen is presented with the application type editable.

Tank mixes of several herbicides are define by entering each herbicide and its application rate on different lines.

Efficacies: The efficacy of a treatment as used here is the percent of the weeds that are controlled by the treatment. Thus an efficacy of 90 for a treatment means that the original weed density would be reduced by 90% by the use of this treatment. An efficacy value must be entered for each weed species and each application condition in which the treatment can be used. If and entire column in the efficacy table is left blank,

the PEET software interprets that to mean that this treatment cannot be used under that application condition. For example, Assure II at an application rate of 8.0 fl oz/acre cannot be applied to a dry soil with large weeds as shown in the screen on the previous page.

- **Print Button:** Pressing this button causes the entire efficacy table to be printed.
- **Save Button:** Stores edited values and new treatments in the PEET Database.
- **Delete Treatment Button:** Deletes the defined treatment and efficacy table in the PEET Database
- **Delete Herbicide Button:** Deletes the selected herbicide from the PEET Database. This is used only when the treatment involves more than 1 herbicide. Deleting the last herbicide in a treatment is the same as deleting a treatment so the delete Treatment button must be used for that.
- **Buttons for moving through defined treatments:** The “Previous”, “Next”, “First” and “Last” Treatment buttons are used to move through the treatments already stored in the PEET database. This facilitates editing of the values already stored.
- **New Treatment Button:** This is used to define a totally new treatment and associated efficacy values.

PEET Database Manager

Warning Messages Option: PEET is capable of displaying warning messages to users for specific treatments. This screen is used to enter and edit the warning messages and to specify for which treatments they should be displayed.

PEET Database Manager
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Help Print Screen

Warning Messages and their association with Treatments of a Crop: Cotton, Conventional

Warning Index	Warning Messages
101	Tank mixing of Assure II, Fusilade DX , Poast Plus, Select, or any combination of graminicides with postemergence broadleaf herbicide may result in reduction in control of some grass species. For best results, apply the graminicide alone or in sequence with a broadleaf herbicide(s). Apply only under conditions of active growth. Consult the label for recommended tank mixes or application instructions.

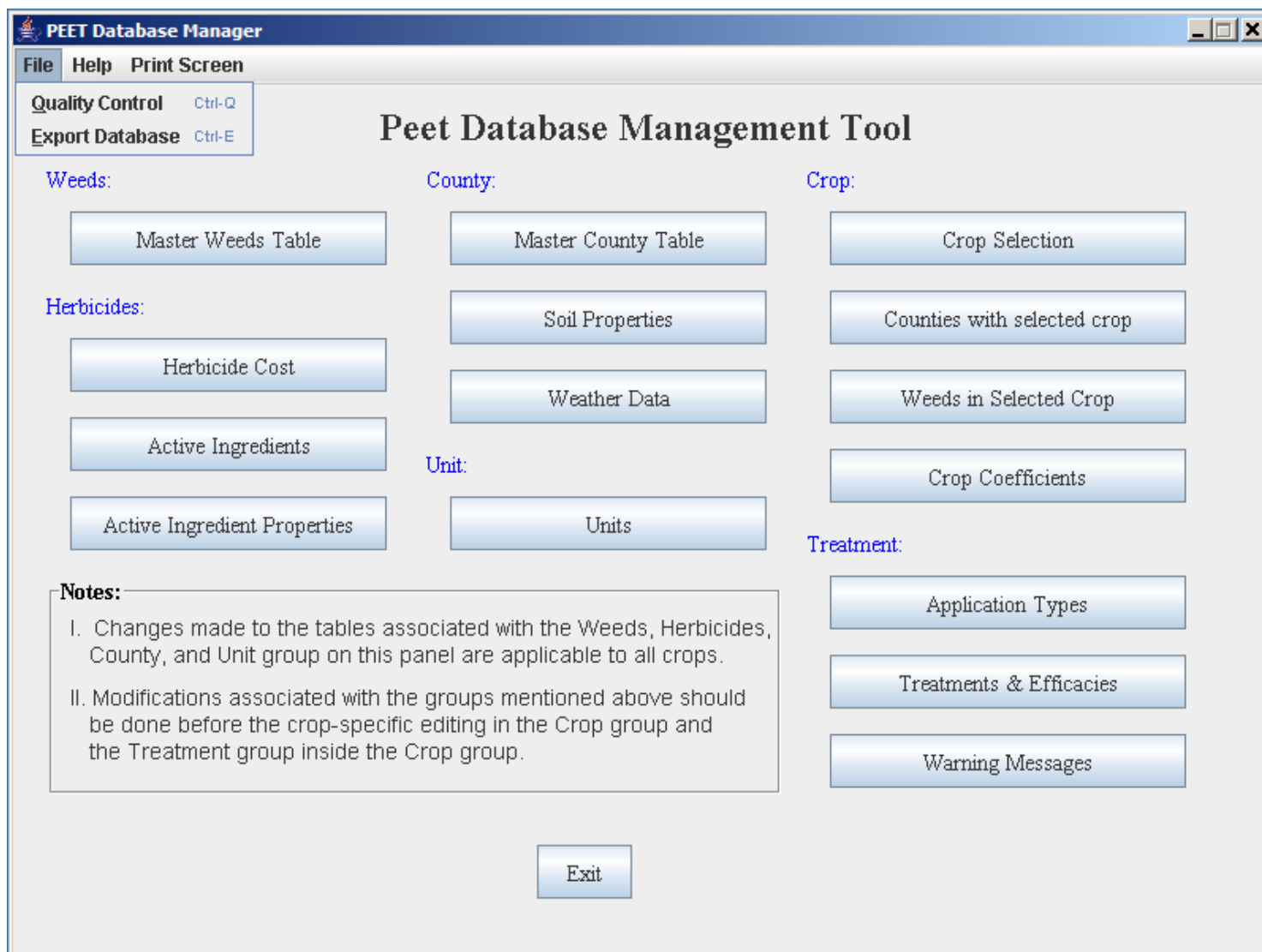
Treatment Index	Treatment Type	Herbicides and Rates	Display Above Warning with this Treatment
1107	POST	Select 2EC 8.0 fl oz	<input type="checkbox"/>
1108	POST	Select 2EC 12.0 fl oz	<input type="checkbox"/>
1109	POST	Select 2EC 16.0 fl oz	<input type="checkbox"/>
1110	POST	Staple 0.6 oz	<input type="checkbox"/>
1111	POST	Staple 1.2 oz	<input type="checkbox"/>
1112	POST	Staple 0.6 oz + Assure II 8.0 fl oz	<input checked="" type="checkbox"/>
1113	POST	Staple 0.6 oz + Assure II 10.0 fl oz	<input checked="" type="checkbox"/>
1114	POST	Staple 0.6 oz + Assure II 12.0 fl oz	<input checked="" type="checkbox"/>
1115	POST	Staple 1.2 oz + Assure II 8.0 fl oz	<input checked="" type="checkbox"/>
1116	POST	Staple 1.2 oz + Assure II 10.0 fl oz	<input checked="" type="checkbox"/>
1117	POST	Staple 1.2 oz + Assure II 12.0 fl oz	<input checked="" type="checkbox"/>

Previous Message
Next Message
New Message
Save
Print
Return to Main Panel

PEET Database Manager

Quality Control and Exporting Data: When the data for the crops and areas of interest have been entered, these options enable the scientist to make a final check on the completeness of the data and to export the data from the database manager and place it in a file used by PEET itself. Selecting the Quality Control option in the File menu opens a window and performs 35 queries on the database to detect inconsistencies and omissions in the data. If any problems are detected, they are listed in the text window so they can be fixed.

When no more errors exist, the scientist selects the Export Database option to create a file called *database.jar* that contains all of the data needed for the selected crops and areas. This file is stored in the same directory as the PEET Database Manager. The *database.jar* file is then placed on the web server in the same directory as the PEET software. When a user runs the software while connected to the internet, this database file is loaded onto their computer and used in the PEET software.



PEET Database Manager

Computer Configuration: The PEET Database Manager has been developed and tested on computers running the Microsoft Windows XP and Windows 2000 operating systems. We recommend that the computer have at least 512 MB of random access memory and 40 MB fixed disk.

The Java Run Time Environment, (Version 5.0 or later) must be installed on the computer to run PEET or the PEET Database Manager. This can be downloaded free of charge from Sun Microsystems at <http://java.sun.com>. It needs to be installed only one time for any number of Java programs.

The database to be accessed by the software is a Microsoft Access database. The Access database is connected to the PEET Database Manager software by means of ODBC which is included in the Windows operating systems. Before running the PEET Database Manager, the ODBC connection to the access database must be defined. The default ODBC name of the database is PEETRealTime.

Normally the Access database will not need to be modified from within Access. If a user chooses to use Access to enter or delete data, care must be taken to maintain consistency. No table structures or queries in the database should be modified or deleted.

The PEET Database Manager, Access database, and documentation are distributed in a file named PEETtools.exe. This self-extracting zip file should be stored in a directory of your choice and the files extracted by running the program. The database manager is stored in a file called PEETDatabaseManager.jar. It can be executed by opening the file. If you prefer, you can make a shortcut to this file and place it on the desktop. The program can then be executed by double clicking on the icon.