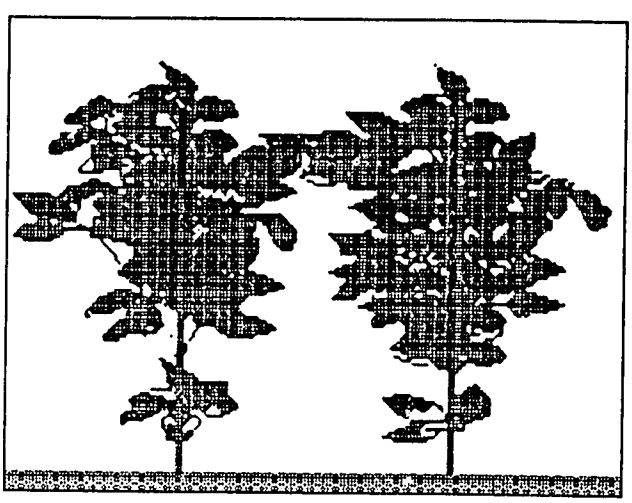
SOYGRO V5.42

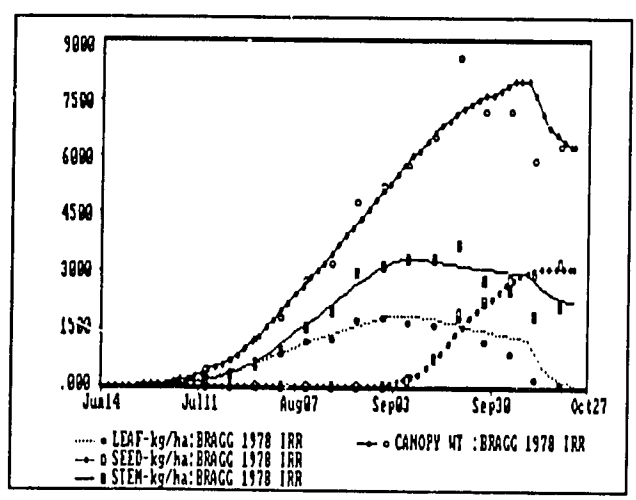
SOYBEAN CROP GROWTH SIMULATION MODEL

USER'S GUIDE

J. W. Jones, K. J. Boote, G. Hoogenboom,

S. S. Jagtap, and G. G. Wilkerson





May 1989

University of Florida

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International Benchmark Sites Network for Agrotechnology Transfer

Florida Agricultural Experiment Station Journal No. 8304

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Chapter 1
INTRODUCTION

SOYGRO Version 5.42 is a process-oriented soybean (*Glycine max* [L.] Merr.) crop growth model developed at the University of Florida by an interdisciplinary research team. The present version was developed by making numerous changes to earlier versions of SOYGRO. The original version of SOYGRO was developed from 1980 to 1983 and published by Wilkerson et al. (1983a). That version was coupled to a soil water balance model developed by Jones and Smajstrla (1980) and documented as SOYGRO V4.2 (Wilkerson et al. 1983b). This model was tested for two cultivars (Bragg and Cobb) grown in Florida on sandy soils and under various irrigation regimes. It was subsequently used to study the economic risks of irrigation management in Florida (Swaney et al. 1983; Boggess et al. 1983; and Boggess and Amerling 1983). The soybean model SOYGRO also served as the crop component in an integrated pest management model called SICM (Soybean Integrated Crop Management model, Wilkerson et al., 1983b, Mishoe et al., 1984, Jones et al., 1986).

In 1983, a cooperative effort between the UF team and the IBSNAT[1] (International Benchmark Sites Network for Agrotechnology Transfer) Project was initiated. A major goal of this work was to make the model more robust for use in other regions of the world where soils and climate differed from those in Florida. The first step in this process was to adapt a more general soil water model developed by Ritchie (1985). In addition a preliminary phenology model developed by J. W. Mishoe (unpublished) which predicts development of vegetative and reproductive stages of soybean in areas with diverse photoperiods and temperatures was included in the model. A new version, SOYGRO V5.0, was documented and released (Wilkerson et al., 1985).

Over time, we discovered problems in applying SOYGRO V5.0 to diverse environments and recognized the need to make a number of important changes in the model to improve its performance over a range of soils and environments. Concurrently the IBSNAT project had defined standard input and output formats for climate and soil in an attempt to make all the models in this project more useful with minimal incompatibilities. Thus, the soybean model was again revised to fit this standard format. This standardization allowed the various crop models to be integrated into an overall Decision Support System for Agrotechnology Transfer or DSSAT (Jones, 1986; IBSNAT, 1989). Several other important changes were made in the model to improve its performance over a range of soils and environments.

---

[1] IBSNAT is a program of the Agency of International Development, implemented by the University of Hawaii under the Cooperative Agreement No. AID/DAN-4054-A-00-7081-00.

SOYGRO V5.42

The Version 5.4 of SOYGRO (Jones et al., 1988) included the many improvements and enhancements. The coefficients for the phenology model were re-solved using the night temperature effects of Parker and Borthwick (1939) (Jones et al., 1989b). More genetic coefficients were developed for a range of cultivars. Cohorts of flowers, pods, and seeds are now maintained through reproductive growth. Also improvements were made in several other submodels including those for soil water and photosynthesis. SOYGRO Version 5.41 released in February, 1988 was created to correct some errors in the soil water balance that were found in Version 5.40. At the same time other corrections were made in the code. SOYGRO Version 5.42 was developed to fit within the Decision Support System for Agrotechnology Transfer of the IBSNAT Project. A new graphics feature will now allow the user to graph simulated and measured soil water content data in the same graph, similar to the crop data graphics option. Details of SOYGRO V5.42 are described in the Technical Documentation (Jones et al., 1989a).

Currently legume crop growth simulation models are also available for peanut (*Arachis hypogea* L.), PNUTGRO Version 1.02, (Boote et al., 1989a) and dry bean or common bean (*Phaseolus vulgaris* L.), BEANGRO Version 1.0, (Hoogenboom et al., 1989). Within the IBSNAT Project simulation models have been developed for corn (*Zea mays* L.), CERES-Maize Version 2.10 (Ritchie et al., 1989), and wheat (*Triticum aestivum* L.), CERES-Wheat Version 2.1 (Godwin et al., 1989). Crop models for sorghum, rice, millet, barley, and potato are currently being developed.

The purpose of this guide is to provide users with information on how to implement and operate the model on their own microcomputers.

Chapter 2
MODEL DESCRIPTION

SOYGRO V5.42 predicts dry matter growth, LAI, crop development, and final yield of soybean depending on daily weather data (precipitation, solar radiation, photoperiod, maximum and minimum temperatures) for specific soils. Soil parameters describe the ability of the soil to store water and to supply water to plant roots based on processes of runoff, percolation, and redistribution of water in a one-dimensional profile. Thus, soil characteristics and weather data are required inputs. The model also is sensitive to cultivar choice, planting date, row and plant spacings, and irrigation management options.

This version of SOYGRO was designed as a research tool. Users can input their own soil, weather, and management data as well as their own measured crop growth data from experiments or from farmer fields for testing or validating the model for their own conditions. Experiments can be simulated with the model and compared in tabular and graphical forms with measured data. Scientists can easily conduct sensitivity analyses by interactively selecting combinations of soils, weather, cultivar and management factors. And finally, users can conduct risk analysis studies by simulating many cropping seasons over time and space by varying weather and soil inputs.

Pests are not included in the current model, although efforts with cooperators are underway to include various types of insect damage on plants and pods. Also there are other factors, particularly in the soil, that are not included in the present version of the model (such as various plant nutrients). Therefore results from the model should be viewed as potential yields under the specified regimes of weather and soil condition. Other factors could be limiting and further reduce yields.

Chapter 3
SYSTEM REQUIREMENTS

SOYGRO V5.42 and earlier versions 5.4 and 5.41 were developed using an IBM AT microcomputer, DOS 3.3, Microsoft[2] Fortran V4.1 and Microsoft Quick Basic V4.0. The model runs fastest on machines with a math coprocessor, a clock speed of 20 MHz or faster, and with all input and output files and executable code located on a hard-disk drive. SOYGRO will also run on a basic two-floppy disk drive microcomputer with a minimum memory requirement of 256K. However, this setup has some limitations.

Both the Fortran and Basic section of the SOYGRO model require DOS version 2.0 or higher. To display graphical results, your PC must have a graphics adapter (IBM Color Graphics Adapter [CGA] or Enhanced Graphics Adapter [EGA] or equivalent) and a color or monochrome graphics monitor with either a CGA or EGA screen resolution. The graphics section of the model will not operate with a Hercules graphics card.

A 256K system has enough memory for approximately 5 runs per session. If you run out of memory, the system will come to a halt in the graphics portion while reading the output files generated by the model. If the system aborts because the computer ran out of memory you must reboot the system.

On a two-floppy disk system, you are limited by the amount of storage space on your diskettes. You must allow room on your drive B: (Data Disk) for the output files created by the model and a work file for graphics display, which is approximately half the size of the OUT2.SB file. The size of the files depends upon the number of runs and the total number of simulated days in the output files. The number of days per run file can be reduced if you ask for less frequent output in option no. 2, "**Select Simulation Output Options,**" after you have selected your experiment and treatment case study. Use a maximum of six runs per session if you have a two-floppy system and write the results to an output file every two days (default output frequency). If you exceed the amount of space available on the diskette, the graphics program will give you an error "*NOT ENOUGH SPACE FOR RANDOM WORK FILE.*"

The SOYGRO model will run on all IBM PC's, XT's, AT's and true compatibles. Unfortunately we do not have unlimited access to hardware. We have successfully run SOYGRO on the IBM PS/2, IBM PC, IBM XT, IBM AT, Fountain PC and AT, Zenith PC and AT, COMPAQ, Toshiba, Telex, AT&T, AST, and Olivetti microcomputers that meet the minimum requirements described above.

In a benchmark comparison, the model took 6.5 s on a AST Premium/386 (20 Mhz), 8.4 s on a Compaq Desk Pro-386 (16 Mhz), 21 s on an IBM PS/2-60 (12 Mhz), 33 s on an IBM AT (8

---

[2] Microsoft Corporation, 10700 Northup Way, Bellevue, WA 98004.

Mhz), 1:11 min on an IBM PC (4 Mhz) with a math coprocessor and 15:31 min on an IBM PC (4 Mhz) without a math coprocessor.

Chapter 4
GETTING STARTED

SOYGRO V5.42 is supplied on four floppy diskettes: 1) Program, 2) Data, 3) Graphics, and 4) Source Code diskettes. A directory of each of these diskettes is contained in Tables 5, 6, 7, and 8, respectively (Appendix A). Before proceeding further, insert the diskettes, one by one, into drive A: and obtain a directory. If all the directories match the ones in Table 5-8, you may proceed. If there are differences, such as missing files, please contact the suppliers of the model before continuing.

A back-up copy of each diskette should be made before trying to run SOYGRO. All diskettes are supplied to you with write-protect tabs so that the model will not run with the disks you received. This will protect your original copies in case your execution copies are lost or damaged in some way. Please label your copied diskettes the same as the original ones. If you plan to run SOYGRO from the diskettes, then the Program (No. 1) and Graphics (No. 3) diskettes must contain the system file COMMAND.COM. If you run SOYGRO from your hard-disk, then you will not have to create these system diskettes. The step-by-step procedure for installing SOYGRO to run on diskettes and on hard-disk systems are given in Chapters 5 and 6, respectively.

When your microcomputer is booted (first turned on or when DOS is loaded) a file called CONFIG.SYS is used to establish the characteristics of the computer. To run SOYGRO, you must create the file CONFIG.SYS (or edit it if it is already on your disk) and add the following 3 lines:

```
DEVICE = ANSI.SYS
FILES = 20
BREAK = ON
```

This is an important file and SOYGRO will not run unless it is on your system disk (floppy or hard-disk). Please follow the instructions in Chapter 5 or Chapter 6, depending on your hardware, to create this file.

Chapter 5
RUNNING SOYGRO ON A TWO-DISKETTE SYSTEM

Installation

To run SOYGRO on a two-diskette system, you must format two of the four diskettes with the /S option, that is they must be formatted as system diskettes. Then, copy COMMAND.COM, ANSI.SYS, and GRAPHICS.COM from your DOS diskette to each of these two diskettes (No. 1 and 3). In addition, you must edit CONFIG.SYS file and add the following three statements:

```
DEVICE = ANSI.SYS
FILES = 20
BREAK = ON
```

You need a total of 4 blank diskettes. The following list describes the step-by-step procedure for creating your diskettes to run SOYGRO.

1. Insert your DOS system diskette (Version 2.0 or higher) into drive A:
   Turn on the power to start the system.

2. Insert a blank diskette into drive B:

3. Enter:

   FORMAT B:/S
   N (In response to "*Format another (Y/N)*"
   COPY A:GRAPHICS.COM B:
   COPY A:ANSI.SYS B:

4. Remove the DOS system diskette from drive A:

5. Insert the distribution SOYGRO Program diskette (No. 1) into drive A:

6. Enter:

   COPY A:*.* B:

   The computer should terminate with "*3 files copied.*"

7. Use your editor to create the file CONFIG.SYS described above and save it to your B: diskette.

8. You now have your Program disk ready, and your computer will boot on this drive. Remove the diskettes from both drives.

9. Label the new diskette from drive B: "**1. PROGRAM SOYGRO V5.42.**"

10. Insert the DOS system diskette into drive A: again.

11. Insert a blank diskette into drive B:

12. Enter:

    FORMAT B:/S
    N (In response to "*Format another (Y/N)?*"
    COPY A:GRAPHICS.COM B:
    COPY A:ANSI.SYS B:

13. Remove the DOS diskette from drive A:

14. Insert the Graphics SOYGRO diskette (No. 3) into drive A:

15. Enter:

    COPY A:*.* B:

    The computer should terminate with "*17 files copied.*"

16. Remove diskettes from both drives.

17. Label the diskette from drive B: "**3. GRAPHICS SOYGRO V5.42.**"

18. Insert DOS diskette into drive A:

19. Enter:

    DISKCOPY A: B:

20. Remove the system diskette from A:

21. Insert the SOYGRO Data diskette (No. 2) into A: and a blank diskette into drive B:. *Press any key to make the copy.*

22. Remove both diskettes and label the one from drive B: "**2. Data SOYGRO V5.42.**"

23. Enter Y in response to the prompt, "*Do you want to make another copy?*"

24. Insert the Source Code diskette (No. 4) into A: and a blank diskette into drive B:. *Press any key to make the copy.*

25. This will create a backup of the Source Code diskette. Note that this diskette is not required for running the model. It is required only if programming changes are to be made.

26. Remove the diskettes and label the one from drive B: as "**4. SOURCE CODE, SOYGRO V5.42.**"

Execution

To run SOYGRO on your two-diskette system use the following steps:

1. Insert Program diskette (No. 1) into drive A: and the Data diskette (No. 2) into drive B:

2. Turn on the power to the computer or reboot the system by depressing and holding the <CTRL> and <ALT> keys, then pressing the <DEL> key and releasing them all.

3. Enter:

   GRAPHICS

   to set up the computer to print out graphs of your results (if you wish to have graphs printed using the <Shift-PrtSc> or <Print-Screen> screen dump command).

4. Enter:

   SGRO

   to start the SOYGRO program.

5. After the simulation is finished you will be prompted to replace the Program disk (No. 1) with the Graphics disk (No. 3) to run the graphics section of the model. *Press any key to continue.*

You will be prompted to select items from screen menus to simulate soybean growth and yield. An example run is included later in this User's Guide (Chapter 9).

Chapter 6
RUNNING SOYGRO ON A HARD-DISK SYSTEM

Installation

1. Start the system. If the system power is off, turn on the power. When the system is on, press and hold the <Ctrl> and <Alt> keys, then press the <Del> key, and then release them all to re-boot the system.

2. Create or edit the file CONFIG.SYS in the root directory, by entering:

   DEVICE = ANSI.SYS
   FILES = 20
   BREAK = ON

   Save the new or modified file CONFIG.SYS.

3. Create a subdirectory by entering:

   MD SOYGRO

4. Go into the new subdirectory by entering:

   CD SOYGRO

5. Copy SOYGRO Program, Data, and Graphics diskettes (No. 1, 2, and 3) into the subdirectory using the following steps:

   a. Insert SOYGRO program diskette (No. 1) into drive A:

   b. Enter:

      COPY A:*.* C:\SOYGRO

   The computer should terminate with "*3 files copied.*"

   c. Remove SOYGRO Program diskette from drive A:

   d. Insert SOYGRO Data diskette (No.2) into drive A:

   e. Enter:

      COPY A:*.* C:\SOYGRO

   The computer should terminate with "*49 files copied.*"

f. Remove Data diskette from drive A:

g. Insert Graphics diskette (No. 3) into drive A:

h. Enter:

```
COPY A:*.* C:\SOYGRO
```

The computer should terminate with "*17 files copied.*"

i. Remove the Graphics diskette

The following section is optional.

j. Insert Source Code diskette (No. 4) into drive A:

k. Enter:

```
COPY A:*.* C:\SOYGRO
```

The computer should terminate with "*45 files copied.*"

l. Remove the Source Code diskette

Execution

After installing the model in subdirectory SOYGRO, you are ready to run the model by simply entering SOYGRO. Thereafter, whenever you start the computer to run the model, use the following steps:

1. Turn on the computer.
2. Enter:

```
GRAPHICS
```

3. Enter:

```
CD SOYGRO
```

4. Enter:

```
SOYGRO
```

You will be prompted to select items from screen menus to simulate soybean growth and yield. An example run is included later in this User's Guide in Chapter 9. Note that the command to

start the model from the hard-disk is different from that used on the floppy-diskette system. Also note that you may wish to copy the source code from diskette No. 4 into the SOYGRO subdirectory on your hard-disk. However, you need to do this only if you want to make programming changes in the FORTRAN code.

Chapter 7
SYSTEM SETUP FOR SOYGRO GRAPHICS

The SOYGRO graphics program is designed to allow users to plot simulated and observed data after they visually evaluate the ability of the model to mimic experimental results. Users can select crop variables (such as leaf area index, seed weight, etc.) or weather/soil data. When more than one SOYGRO simulation is performed in a session, the user can also select the run number for graphical analysis. For example, users could choose to plot seed weight for two different simulations, irrigated and rainfed. Or users could select to view leaf weight, seed weight, and total canopy weights for a single run. Up to six variables at one time per graphics display can be selected for viewing, from various run and variable combinations. There is a restriction, however. Because the graph has only one vertical axis, users should not select variables of different scales for viewing on the same graph (i.e., LAI and seed weight in kg/ha). After a graph is displayed on the screen, the user can press the <Shift> <PrtSc> or <Print-Screen> keys to print the graph on a printer (if printer is available).

When SOYGRO graphics are run for the first time, the system will prompt you for the system setup with the following questions:

1) *Type drive and path of graphics program*

   If you are on a two-disk drive system enter: B:

   If you are on a hard-disk drive system enter: C:\SOYGRO or the appropriate drive and directory where you installed SOYGRO.

2) *Which data drive contains the selected data?*

   If you are on a two disk drive system enter: B:

   If you are on a hard-disk drive system enter: C: or the appropriate drive.

3) The following section describes how to set your monitor type and graphics-adapter card.

   NOTE: The graphics section of SOYGRO V5.42 will not work on a system with a <u>HERCULES</u> graphics card[3].

---

[3] Currently there are utilities available which can emulate CGA graphics for a Hercules monochrome graphics card. One of these utilities, SIMCGA, can be obtained from the authors, although we do not guarantee that it will work for all Hercules or Hercules compatible cards.

Graphics Options Available
[1] - CGA-LOW - 320 x 200 pixels, 3 color graph
[2] - CGA-HIGH - 640 x 200 pixels, monochrome graph (HERCULES NOT AVAILABLE)
[3] - EGA-LOW - 640 x 200 pixels, 6 color graph, requires EGA
[4] - EGA-MED - 640 x 350 pixels, 3 color graph, requires EGA
[5] - EGA-HIGH - 640 x 350 pixels, 6 color graph, requires EGA & 128 video memory
Enter graphics option ?

Enter the Graphics Option appropriate to your setup and preferences. The greater the number of pixels, the higher the resolution on the screen (CGA is Color Graphics Adapter or regular color graphics; EGA is Enhanced Graphics Adapter or higher resolution graphics). If you enter the wrong option for your graphics setup, the program will abort. You can reset your graphics definitions by deleting file "**SETUP.FLE**" from either the graphics disk (No. 3) or your hard-disk (see next section).

4) *Would you like to save disk drive and graphics option for future runs ? Y/N*

If you answer **Y** to this prompt, you will not be asked the system setup questions again and a file, "**SETUP.FLE**," will be created. If you answer **N**, the system will repeat the system setup question each time the graphics option is run. To change the system setup after you have answered **Y** to the setup question, delete the file "**SETUP.FLE**."

Chapter 8
PROBLEMS

Many types of microcomputers currently are available on the market. Therefore, we have been unable to test the simulation model SOYGRO V5.42 on all possible systems. If the model does not work after you have created your floppies or hard-disk files, please check the instructions given in Chapters 5, 6, and 7. A check list of some common problems follows.

1. The original disks will not run on your system because they do not include the required system files.

2. Make sure that both your "Program disk" and "Graphics disk" have a COMMAND.COM file.

3. Make sure that you have at least 256K of memory available and that you do not have any resident programs which uses additional memory.

4. Go through the copying process once more to check that you followed all the instructions correctly.

5. If problems persist and your system is "IBM compatible," please inform the authors about your problems. Make a copy of your error message and clearly describe what type of system you have: brand name, model type, amount of memory, video display, graphics card, printer, type and version of operating system and other information which can help determine the reason for your problems.

If the model executes, but aborts during the real-time running process, reboot the system and start again. If the same error occurs, try to choose a different experiment and treatment for the next run. If the model continues to abort, please make a screen dump of the error message, follow the instructions in No. 5 above and contact the authors of the model.

If the model operates correctly, but the graphics section does not work, check if you have a graphics board in your system. To be able to plot the results to the screen, a color graphics or monochrome (not **HERCULES**) graphics board is needed. Follow the instructions given in No. 5 above if the problem continues and contact the authors.

Specific Errors

In summary, possible errors which could occur are:

1. Wrong operating system.

2. Your machine is not a true "IBM compatible" microcomputer.

3. Not enough memory to execute the model section of SOYGRO.

4. No CONFIG.SYS file defined in your system.

5. Not enough disk space on either your floppy disk or your hard-disk to run the model.

6. Not enough memory to execute the graphics section of SOYGRO.

7. No graphics card present in your microcomputer.

8. You have a Hercules graphics card.

9. You used the wrong setup when you first defined your system in the graphics section of the model (see previous instructions).

10. You used the wrong batch file to run the model: SGRO is the command to run the model for a floppy disk system and SOYGRO is the command to run the model on a hard-disk system.

11. Your program disk is not placed in disk drive A: and your data disk is not placed in disk drive B:.

12. Some files are missing on your disks; in this case check your original copies or request another set of original copies from the authors.

Chapter 9
EXAMPLE RUN

An example run is provided below to demonstrate the model's operation and to provide users with data to compare with their results. There are various types of output from the model. The screen output is shown in the example below. Also, output data files are created on the floppy- or hard-disk to store screen output (OUT1.SB), simulated plant variables (OUT2.SB), weather and soil variables (OUT3.SB), and end of season summary results such as yield and season length, for each season simulated (OUT5.SB). The last section in this report contains documentation on IBSNAT crop model input (Appendix B and C) and output files (Appendix D), including descriptions of files OUT1.SB, OUT2.SB, and OUT3.SB (Appendix F). File OUT5.SB was created after IBSNAT Technical Report 5 (IBSNAT, 1986c) was published, and therefore is not described in that report. In addition, some new variables were added to OUT2.SB and OUT3.SB to allow graphical display of more variables (Appendix E and F).

Before proceeding, users should follow the instructions given in this example run to confirm that their outputs are the same as those reported for the example. The example run was made by selecting from the "Case Study Experiments," the first experiment (1978 Irrigated Bragg) and the first treatment in that experiment. Remember to enter GRAPHICS before running SOYGRO so that graphs which are displayed on the screen can be printed to your printer.

Simulation Model

To run the model on a floppy-diskette system, type SGRO (see Chapter 5 for detailed installation instructions and placement of disks in the disk drives). To run the model on a hard-disk system, type SOYGRO (see Chapter 6 for detailed installation instructions).

The following is an example of the output as it appears on the screen during the simulation and the different selections you can make as a user.

```
SOYGRO V5.42

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SOYGRO is a process oriented soybean growth and yield model
originally developed at the University of Florida to study irrigation
and pest management decisions. The model has been revised and adopted
for use in the International Benchmark Site Network for Agrotechnology
Transfer (IBSNAT) project, a US AID research program administered by the
University of Hawaii. This version has input and output data structure
compatible with the Decision Support System of IBSNAT which establishes
a linkage between the model, experimental data, and other crop model
applications now under development. Users can simulate specific
experiments for validation and also change model inputs for sensitivity
analysis in adapting it for their own uses.

                                    Press < ENTER > key to continue
```

Press Enter or Return

```
   CASE STUDY EXPERIMENTS                          INST.  SITE  EXPT.
   ----------------------------------              ID     ID    NO    YEAR
                                                   ----   ----  ----  ----
1)  BRAGG, IRRIGATED & NON-IRRIGATED               UF     GA    01    1978
2)  BRAGG, IRRIGATED & NON-IRRIGATED               UF     GA    01    1979
3)  BRAGG, WELL IRRIGATED                          UF     QU    01    1979
4)  COBB, IRRIGATED, VEG. & REPROD. STRESS         UF     GA    01    1981
5)  COBB, IRRIGATED & NON-IRRIGATED                UF     GA    01    1985
6)  WAYNE, IRRIGATED & NON-IRRIGATED               IU     CA    01    1979

1]  <=== CASE STUDY SELECTED
    <--- NEW SELECTION?
```

Type: 1 and press Enter or Return

```
TRT                                          INST.  SITE  EXPT.
NO.  BRAGG, IRRIGATED & NON-IRRIGATED         ID     ID    NO    YEAR
---  ---------------------------------------- ----   ----  ----
 1)  IRRIGATED                                UF     GA    01    1978
 2)  NON - IRRIGATED                          UF     GA    01    1978

 1]  <=== TREATMENT SELECTED
     <--- NEW SELECTION?
```

Type: 1 and press Enter or Return

```
WHAT WOULD YOU LIKE TO DO ?

0)   RUN SIMULATION.
1)   SELECT SENSITIVITY ANALYSIS OPTIONS.
2)   SELECT SIMULATION OUTPUT OPTIONS.

<=== CHOICE? < DEFAULT = 0 >
```

Type: 0 and press Enter or Return

```
                <=== RUN   1 IDENTIFIER ?
```

Type: BRAGG 1978 IRR (Use a 5 character string for CGA display and a maximum of 14 characters for all other displays).

```
INPUT SUMMARY      RUN NO.   1        SIMULATION BEGINS : JUN 15

INST_ID: UF  SITE_ID: GA  EXPT_NO: 01  YEAR: 1978  TRT_NO:  1
EXPERIMENT   : BRAGG, IRRIGATED & NON-IRRIGATED
TREATMENT    : IRRIGATED
WEATHER SET  : GAINESVILLE (29.6N,82.4W), FLORIDA 1978
VARIETY      : BRAGG              MATURITY GROUP :  7
IRRIGATION   : ACCORDING TO THE FIELD SCHEDULE
PLANTING DATE: JUN 15 PLANTS/M2: 29.90 ROW SPACING: .914m
                          PLANT SPACING:.037m

SOIL PROFILE DATA  Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
SOIL ALBEDO  :  .18  U: 5.0  SWCON:  .50  CURVE NO.: 66.0  PHFAC3: .84
  DEPTH-m      LL     DUL    SAT   EXTR   INIT   ROOT   KSAT
  .00-  .05  .023    .086   .230   .063   .086  1.000  7.400
  .05-  .15  .023    .086   .230   .063   .086  1.000  7.400
  .15-  .30  .023    .086   .230   .063   .086   .498 15.800
  .30-  .45  .023    .086   .230   .063   .086   .294 28.000
  .45-  .60  .023    .086   .230   .063   .086   .294 28.000
  .60-  .90  .021    .076   .230   .055   .076   .380 27.600
  .90- 1.20  .020    .076   .230   .056   .076   .133 17.500
 1.20- 1.50  .027    .130   .230   .103   .130   .062   .300
 1.50- 1.80  .070    .258   .360   .188   .258   .031   .100
           ---------------------------------
    SUM mm   55.2   213.6  453.0  158.4  213.6
                                        Press < ENTER > key to continue
```

Press Enter or Return

RUN NO. 1 SIMULATION OUTPUT

UF GA 1978 BRAGG 1978 IRR

DATE	CROP AGE	GROWTH STAGE	BIOMASS KG/HA	LAI	V-STAGE	WATER BALANCE COMPONENTS ES mm	EP mm	ET mm	RAIN mm	IRRIG mm	DROUGHT STRESS PHOTO	TURGOR
JUN 15	0	SOWING	0.	.00	.0	4.	0.	4.	0.	0.	.000	.000
JUN 21	6	EMERGENCE	19.	.03	.2	6.	0.	6.	2.	0.	.000	.000
JUN 26	11	UNIFOLIOL.	34.	.07	1.2	14.	1.	15.	10.	0.	.000	.000
JUN 26	11	END JUVEN.	34.	.07	1.2	14.	1.	15.	10.	0.	.000	.000
JUL 13	28	FLOWER IND	361.	.79	5.9	47.	19.	67.	127.	13.	.000	.028
AUG 1	47	FLOWERING	1691.	2.96	11.1	82.	67.	149.	299.	13.	.000	.000
AUG 20	66	FIRST POD	3775.	5.26	16.4	98.	138.	236.	518.	26.	.000	.000
AUG 26	72	END LEAF	4488.	5.30	18.1	101.	165.	267.	518.	52.	.000	.000
AUG 27	73	FULL POD	4606.	5.30	18.1	102.	171.	273.	518.	52.	.000	.000
SEP 26	103	END POD	7462.	4.11	18.1	120.	290.	410.	524.	157.	.025	.072
OCT 11	118	PHYS. MAT	7936.	3.23	18.1	129.	324.	454.	534.	180.	.139	.244
OCT 23	130	HARV. MAT	6223.	.21	18.1	136.	336.	472.	534.	190.	.327	.488

Press < ENTER > key to continue

Press Enter or Return

RUN NO. 1

UF GA 1978 BRAGG 1978 IRR

	PREDICTED	MEASURED
FLOWERING DATE	213	211
FIRST POD	232	233
FULL POD	239	233
PHYSIOL. MATURITY	284	282
POD YLD (KG/HA)	3948.00	4009.00
SEED YLD (KG/HA)	3088.00	3041.00
SHELLING PERCENTAGE	78.22	75.85
WT. PER SEED (G)	.144	.144
SEED NUMBER (SEED/M2)	2150.00	2223.00
SEEDS/POD	2.05	1.96
MAXIMUM LAI	5.31	4.67
BIOMASS (KG/HA) AT R8	6223.00	6068.00
STALK (KG/HA) AT R8	2198.00	1958.00
HARVEST INDEX	.496	.501

Press < ENTER > key to continue

Press Enter or Return

```
          Irrigation Summary
          ==================

19 IRRIGATION APPLICATIONS @   .75 EFFICIENCY.

CROP AGE    15   64   69   71   74   76   78   80   84   87   90   93   96
AMOUNT,mm   13.  13.  13.  13.  11.  11.  11.  11.  11.  11.   8.   8.   8.

CROP AGE    99  103  106  113  117  128
AMOUNT,mm    8.   7.   8.   7.   8.  10.

         SOYBEAN YIELD :  3088.3 KG/HA [   46.0 BU/ACRE ]


 MORE SIMULATIONS ?
 <===  Y OR N? <DEFAULT "Y">
```

Type: N and press Enter or Return

```
Stop - Program terminated.
```

Graphics Display

When you are running SOYGRO on a floppy-diskette system you will now have to replace the Program disk (No. 1) with the Graphics disk (No. 3). On a hard-disk system the program will immediately proceed with the graphics section of the model.

```
Type Drive and path of graphics program ?
```

Type: B: if you are using a floppy-drive system, or enter the drive and path, e.g., C:\SOYGRO, if you are using a hard-disk system, and press Enter or Return

```
Which data drive contains the selected data?
```

Type: B: if you are using a floppy drive system, or enter the drive name, e.g., C:, if you are using a hard-disk system, and press Enter or Return

```
Graphics Options Available
[1] - CGA-LOW  - 320 x 200 pixels, 3 color graph
[2] - CGA-HIGH - 640 x 200 pixels, monochrome graph (HERCULES NOT AVAILABLE)
[3] - EGA-LOW  - 640 x 200 pixels, 6 color graph, requires EGA
[4] - EGA-MED  - 640 x 350 pixels, 3 color graph, requires EGA
[5] - EGA-HIGH - 640 x 350 pixels, 6 color graph, requires EGA
                 & 128k video memory

Enter graphics option  ?
```

Type: 1 or any other number which represents your system and press Enter or Return

```
would you like to save disk drive and graphics option for future runs?
```

Type: Y if you want to save your setup on your floppy- or hard-disk system (or N) and press Enter or Return

```
SELECT GRAPH TYPE

1. Crop variables
2. Weather and soil variables
3. Nitrogen variables [CERES models only]
4. Harvest variables
5. Graphical display of plant [Soybean only]
0. Exit graph

Option (0,1,2,3,4 or 5)?
```

Type: 1 and press Enter or Return

```
READING DATA ... PLEASE WAIT!


FILE              RUN POINTS DOY
B:                 1    67   296
Do you want to plot field sample data points (Y/N)?
```

Type: Y (for this example) and press Enter or Return

```
VARIABLES AVAILABLE FOR GRAPHING ARE:     RUN# AVAILABLE FOR SELECTION ARE:
 1. Vegetative Growth Stage                  1. BRAGG 1978 IRR
 2. Leaf Area Index
 3. Number of Pods #/m2
 4. Stem Dry Weight (kg/ha)
 5. Seed Dry Weight (kg/ha)
 6. Leaf Dry Weight (kg/ha)
 7. Canopy Dry Weight (kg/ha)
 8. Pod Dry Weight (kg/ha)
 9. Shell Dry Weight (kg/ha)
10. Root Dry Weight (kg/ha)
11. Number of Seeds #/m2
12. Harvest Index (Seed/Top)
13. Shelling % (Seed/Pod*100)
14. Specific Leaf Area (cm2/g)
15. Seed Size (mg/seed)
| use PAGE UP or PAGE DOWN to see more SELECTIONS |
16. Nitrogen % in Canopy
17. Relative Drought Stress Indicator
18. Root Length Density Level 1 cm/cm3
19. Root Length Density Level 2 cm/cm3
20. Root Length Density Level 3 cm/cm3
21. Root Length Density Level 4 cm/cm3
22. Root Length Density Level 5 cm/cm3
23. Root Length Density Level 6 cm/cm3
24. Root Length Density Level 7 cm/cm3
25. Root Length Density Level 8 cm/cm3

You may plot 1 to 6 lines with any combination of variables and run#
How many lines do you want to plot ?
```

Type: 4 (for this example) and press Enter or Return

```
LINE# 1 : ENTER VARIABLE#,RUN#
LINE# 2 : ENTER VARIABLE#,RUN#
LINE# 3 : ENTER VARIABLE#,RUN#
LINE# 4 : ENTER VARIABLE#,PUN#
```

Type: 4,1 and press Enter or Return
Type: 5,1 and press Enter or Return
Type: 6,1 and press Enter or Return
Type: 7,1 and press Enter or Return

```
Do you want to change X-axis, Y-axis or graphics display (Y/N)?
```

Type: N (for this example). This option allows you to change type of graphics display, scale of the X-axis and Y-axis and to switch between Day of the Year and Days After Planting for the X-axis.

An example of a SOYGRO output graph is displayed in Figure 1. If you would like a hard copy of the graph and have a printer available, press the <Shift>-<PrtSc> or <Print- Screen>. Remember to enter the GRAPHICS command before you start to run the simulation model. IF

the screen is copied to your printer without the plotted lines, you forgot to enter the GRAPHICS command while in DOS. <Shift>-<PrtSc> or <Print- Screen> does not work in Enhanced Graphics Mode. In this case, change the type of graphics display and select option 2, CGA-HIGH, by responding with Y to the prompt :"Do you want to change the X-axis, Y-axis or graphics display" after selecting the variables (see previous page).

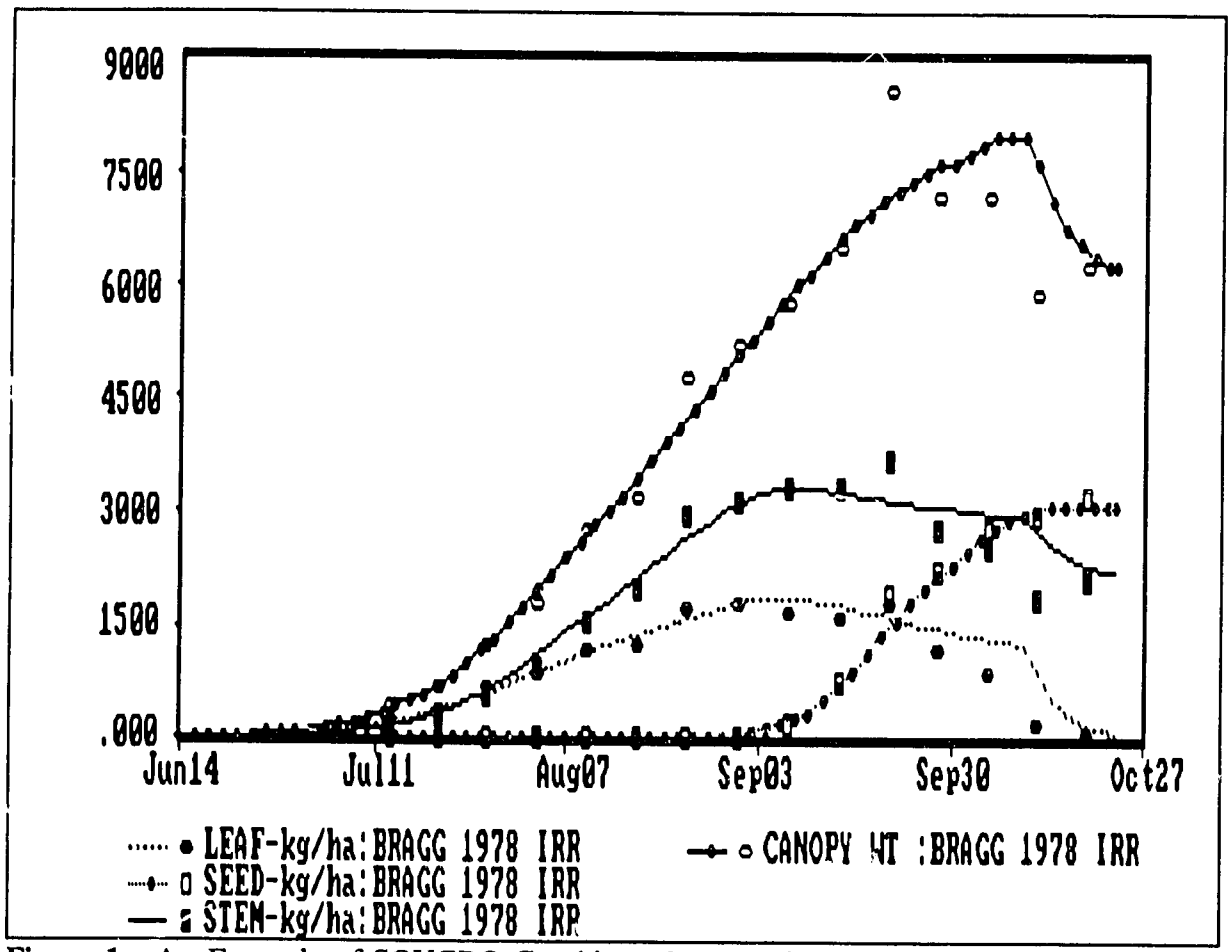

Figure 1. An Example of SOYGRO Graphics. Stem Weight, Seed Weight, Leaf Weight, and Canopy Weight as a Function of Day of the Year or Date.

```
More Graph Y/N?
```

Type: N (for this example) and press Enter or Return

```
SELECT GRAPH TYPE

1. Crop variables
2. Weather and soil variables
3. Nitrogen variables [CERES models only]
4. Harvest variables
5. Graphical display of plant [Soybean only]
0. Exit graph

Option (0,1,2,3,4 or 5)?
```

Type: 0 (to exit the graphics program) and press Enter or Return

Chapter 10
SENSITIVITY ANALYSIS

Besides running *case study experiments* or your own field experiments, there is also an option on the display to run *sensitivity analysis studies* with the model. After you have selected a particular experiment and treatment case study, enter option 1 when the computer prompts with:

```
WHAT WOULD YOU LIKE TO DO ?

0)  RUN SIMULATION.
1)  SELECT SENSITIVITY ANALYSIS OPTIONS.
2)  SELECT SIMULATION OUTPUT OPTIONS.
<=== CHOICE? [ DEFAULT = 0 ]
```

The model will inform you that any time you change a particular parameter in the sensitivity analysis section, the model predictions will not correspond to the measured field data.

```
                    MANAGEMENT / SENSITIVITY ANALYSIS
                    =================================

The following options are initially assigned values according
to the case study and treatment selected.  With these
default values you will be able to validate the simulation
results.  Change the default values to evaluate alter-
nate management strategies or make tactical decisions.
If you choose not to change any of the current selections,
Press <—┘ in response to questions.  NOTE: THIS MESSAGE
WILL NOT BE REPEATED
```

The following options can currently be changed in the management or sensitivity analysis section of the model :

1. Cultivar
2. Simulation date :
   a. planting date
   b. start of soil water balance simulation.
3. Planting density :
   a. row spacing
   b. plant spacing
4. Irrigation strategy :
   a. rainfed
   b. field or treatment schedule
   c. stage specific auto irrigation
   d. no water stress
5. Soil series or type
6. Weather data:
   a. year
   b. site

More detailed examples of sensitivity analysis runs with the model SOYGRO V5.42 are given in the Technical Documentation (Jones et al., 1989a).

Chapter 11
PROCEDURES TO ADD NEW EXPERIMENTS FOR SIMULATION

Data Base Management System

There are two ways that input data files can be created for running SOYGRO V5.42. The files can be created manually using a file editor on the PC, or they can be created directly from the IBSNAT minimum data set after the experimental data have been entered on the forms supplied with IBSNAT Technical Report 1, 2nd edition (IBSNAT, 1986a) or 3rd edition (IBSNAT, 1988). Programs have been developed to enter the data into DSSAT Data Base Management System (DBMS) and retrieve the data into the proper IBSNAT file format (IBSNAT, 1986b, 1989). All these programs are part of DSSAT. Contact IBSNAT[4] directly to order a copy of DSSAT or the software for minimum data set entry and data retrieval for the crop simulation models. The formats for all input and output files (FILE1 through FILE9 and FILEA and FILEB) are documented in Technical Report 5 (IBSNAT, 1986c)

Manual Creation of Files.

In creating each of the files indicated below, refer to IBSNAT Technical Report 5 (IBSNAT, 1986c) for the formats. The new files must use these formats or they will not work correctly.

1. Add a 3-line entry to file SBEXP.DIR to indicate to SOYGRO that a new experiment is available for simulation (See Table 9 where an example is highlighted).

2. If the experiment was performed during a new weather year or at a new site, create a new weather data file (i.e., UFGA0112.W78, see Table 11) and add one entry to file WTH.DIR to indicate its availability (See Table 10 where an example of a new entry is highlighted). Check if weather data are available for the whole range of days for which you want to run your simulation because the model requires daily weather data. The model checks for missing and negative data entries (solar radiation and rainfall only) and will give the user a warning if the data do not match the required input formats.

3. If you want to use a soil type not found in the model's data base, add a new set of data to file SPROFILE.SB2 (Table 12). If the data for the soil at the experiment site is already in SPROFILE.SB2, then there is no need to add the soil again. Every soil should have a unique number in the file. IBSNAT has developed a special soil data entry program to generate the parameters required for a particular soil type and this program

---

[4] IBSNAT Project, Department of Agronomy and Soil Science, College of Tropical Agriculture and Human Resources, University of Hawaii, 2500 Dole Street, Krauss Hall 22, Honolulu, Hawaii 96822.

is part of the DSSAT system (IBSNAT, 1989). The minimum characteristics needed are : soil series name; soil family name or soil taxonomy name; percentage sand, silt, clay, organic carbon, stoniness or rocks; and wet bulk density for each horizon. The pH value, percentage aluminum saturation, and nitrate and ammonia concentration are needed for future soil fertility aspects of the model. Some of these data can be obtained from the Soil Conservation Service (SCS) database in Lincoln, Nebraska (contact the authors of the model or IBSNAT to check if your particular soil type is available), your local or state SCS representative, or your local soil physics laboratory.

4. Create file _____.SB8 with a 2-line entry for management variables for each treatment. If there are 5 treatments, then there are 10 lines in this file. The file name designated by _____ should have 8 characters and be named according to Technical Report 5 (IBSNAT, 1986c), i.e., UFGA7801.SB8 is FILE 8 for institute UF, site GA, year 78, and experiment 01 (Table 15).

5. Create file _____.SB6 with all irrigation events for each treatment (Table 14). The last entry for each treatment is -1 for Julian day and -1.0 for irrigation amount.

6. Create file _____.SB5 with initial soil water condition data for each treatment (Table 13). Note, if a sensitivity analysis is run and soil type is changed during simulation, the initial condition values will need to come from the soil profile data, not from FILE 5. The number of soil layers and their thicknesses must be exactly the same as those in the soil data file SPROFILE.SB2, for that soil; otherwise the model will abort and will give you an error message.

7. If there is a new cultivar, determine genetic coefficient data and input into GENETICS.SB9 (Table 16). In diskette No. 2, the GENETICS.SB9 data file contains coefficients for many cultivars, ranging in adaptation from the tropics to temperate latitudes and climates. If you have a cultivar that is not included in the list, you can choose one from the list using maturity group (MG) as an indication of adaption. The higher maturity groups (MG 7 to 10) are more adapted to latitudes below 30 and are highly sensitive to photoperiod. Lower maturity groups are less sensitive to photoperiod, with MG 00 being almost insensitive. These low MG cultivars are better adapted to higher latitudes where photoperiods vary more widely. A detailed procedure to determine genetic coefficients for a new cultivars is described in Chapter 12.

8. For field comparisons, put treatment final yield data (averages) in file _____.SBA, 2 lines per treatment (Table 18). The following field measured variables are defined in file _____.SBA : seed dry yield (kg/ha), weight per seed (g/seed), number of seeds per m^2 (#/m^2), number of seeds per pod (#/pod), maximum LAI measured during the growing season (m^2/m^2), total above ground biomass at harvest (kg/ha), stem dry weight at harvest (kg/ha), flowering date (Julian day of the year), physiological maturity date (Julian day of year), first pod date (Julian day of the year), full pod date (Julian day of

the year), and pod dry yield (shells and seeds, kg/ha). Follow the format of the example shown in Table 18 to enter the data.

9. For graphical time-series analysis of simulated and measured crop growth and biomass data, put seasonal replicated growth and other measurements in file _____.SBB. An example of this file is on the data disk, No. 2, in file UFGA7801.SBB (Table 19). The order and the type of variables for file _____.SBB are given in the GLABEL.DAT file (Table 21). The first line defines the ID codes for institute, site, experiment number, year, and treatment. The explanation of these codes is given in Technical Report 5 (IBSNAT, 1986c). The second line of each treatment defines which growth variables are present in the file. The numbers used in file _____.SBB should correspond to the numbers of the variables as defined in file GLABEL.DAT (Table 21). The first number on this second line defines the total number of field measured variables defined in file _____.SBB, excluding the first column which is the Julian day of the year. This variable is fixed, while the other variables can vary dependent upon the type of data collected during the growth-analysis experiment. The following lines contain the experimental data, starting with the Julian day in the first column. Always keep at least two spaces between each column and align the data below the first input line. After you have entered all experimental data for a particular treatment, enter a -1 on the next line. Repeat the same setup for the other treatments of your experiment. More information is given in Technical Report 5 (IBSNAT, 1986c).

10. For graphical time-series analysis of simulated and measured soil water content, evapotranspiration, and weather data, put seasonal replicated measured data in file _____.SBC. An example of this file is on the data disk, No. 2, in file UFGA7801.SBC (Table 20). Unfortunately no soil water content data were taken during the 1978 soybean experiment, and therefore maximum and minimum air temperature and solar radiation are shown as an example. The order and the type of variables for file _____.SBC are given in the GLABEL2.DAT file (Table 22). The first line defines the ID codes for institute, site, experiment number, year, and treatment. The explanation of these codes is given in Technical Report 5 (IBSNAT, 1986c). The second line of each treatment defines which growth variables are present in the file. The numbers used in file _____.SBC should correspond to the numbers of the variables as defined in file GLABEL2.DAT (Table 22). The first number on this second line defines the total number of field measured variables defined in file _____.SBC, excluding the first column which is the Julian day of the year. This variable is fixed, while the other variables can vary dependent upon the type of data collected during the growth analysis experiment. The following lines contain the observed data, starting with the Julian day in the first column. Always keep at least two spaces between each column and align the data below the first input line. After you have entered all measured data for a particular treatment, enter a -1 on the next line. Repeat the same setup for the other treatments of your experiment. Because of memory limitations, the graphics program can only handle a maximum of 50 dates per treatment.

11. Crop-specific parameters are defined in file CROPPARM.SB0 (Table 17). The values of these parameters have been derived from the literature or carefully calibrated and, therefore, should not be changed.

After the files have been created properly, you can run SOYGRO for your experiment. The experiment, treatments, weather, soil, and cultivars will appear as choices in selecting simulation conditions for running both the case studies and the sensitivity-analysis section.

Sometimes the simulation model will be unable to predict your field-measured data and the graphics representation will show a poor fit to the data points. This might be caused by using a different cultivar which is not defined in file GENETICS.SB9, a soil type which is not defined in file SPROFILE.SB2, an experiment or set of treatments which cannot be simulated by the model because the options, i.e. fertility effects, are not available, or various other reasons. In most cases you can calibrate the model to your experiment data and carefully change a few parameters one at a time to properly fit your data. A detailed explanation of this calibration process is given in the Technical Documentation of SOYGRO V5.42 (Jones et al., 1989a).

If you are trying to simulate two treatments which differ in fertility or pH or other aspects to which the model is not presently sensitive, you may wish to consider FORTRAN code changes to make the model sensitive to the desired feature. If you successfully make and validate such coding changes, we would appreciate receiving copies to check out and for possible inclusion in future model versions.

Chapter 12
ESTIMATING GENETIC COEFFICIENTS FOR A NEW SOYBEAN VARIETY

Genetic coefficients are defined in the cultivar input file GENETICS.SB9 (Table 16) and are used to simulate the response of various cultivars to weather and management conditions. These coefficients allow the same soybean crop growth model to predict differences in development, growth, and yield among cultivars when planted in the same environment as well as the differences in the behavior of a single cultivar when planted in different environments (Boote et al., 1989b). The genetic coefficients can be divided into those that relate to development, to vegetative growth, and to reproductive growth. Each cultivar is described in the GENETICS.SB9 file by five lines of coefficients. We have found that many of these coefficients are reasonably constant among the cultivars with which we have worked, whereas others vary considerably. The SOYGRO model requires these coefficients and when they have not been previously defined for a cultivar they must be estimated. Table 1 lists the genetic coefficients that must be estimated for each new cultivar and provides definitions of each. A set of procedures has been developed to allow users of the model to obtain estimates of these coefficients (Table 1) using experiment data collected for soybean under field conditions.

Table 1. Description of the Genetic Coefficients that Need to Be Estimated for a New Cultivar.

VARNO	Shortest night length in which the time taken for floral induction is still at a minimum.
VARTH	Days at optimum temperatures from the end of the juvenile period to floral initiation under long day conditions divided by the duration of the same period under short days.
VARTHR(4)	Duration (days at optimum temperatures) of the induction phase, i.e., the period from full expansion of the first true leaf (i.e., a unifoliate leaf) to the stage when the plant has induced a flower.
VARTHR(6)	Duration (days at optimum temperatures) of the period from first flower appearance to the start of pod growth, pods ≥ 0.5 cm.
VARTHR(8)	Duration (days at optimum temperatures) of the period from first flower appearance to the end of expansion of the last leaf.
VARTHR(10)	Duration (days at optimum temperatures) of the total reproductive period from first flower appearance to physiological maturity.
TRIFOL	Number of trifoliates produced per day at optimum temperatures.
SIZELF	Area of normal leaf at nodes 8 to 10.
PODVAR	Number of pods produced per day with plants growing under short days and at optimum temperatures.
FLVAR	Number of flowers produced per day with plants growing under short days and optimum temperatures (= 2*PODVAR).
SHVAR	Rate of dry matter accumulation at optimum temperatures of pods from the stage when they are about half of their maximum size, to full size, but before seed growth starts.
SDPDVR	Mean number of seed per pod.
SDVAR	Kernel or seed filling rate during the linear filling stage and under optimum conditions.

Experimental Conditions and Measurements

Ideally, the experimental conditions for estimating genetic coefficients should be for optimal growth, i.e., no water, nutrient, or pest stresses. Also, the experiment should include several planting dates so that the data will include information or response under different daylengths, temperatures, and solar radiation levels. Currently, there are no genetic coefficients in the model that relate to differences among cultivars to define responses to pest or nutrient stresses. When the experiment includes pest, nutrient, or water stresses, the procedures outlined below can still be used to estimate the coefficients, but the uncertainty in their values increases considerably. Similarly, if only one planting date is available, the ability to estimate the sensitivity of the cultivar to daylength is poor.

The measurements that are needed to estimate the genetic coefficients are described in detail in IBSNAT Technical Report 1 (IBSNAT, 1988) and are referred to as the Minimum Data Set

Table 2. Summary of Minimum Data Requirements for Estimating the Genetic and Cultivar-specific Coefficients of SOYGRO V5.42.

A. Weather

1. Daily Air Temperature; Maximum and Minimum, °C
2. Daily Rainfall, mm/day
3. Daily Solar Radiation, MJ/(m^2 day)

B. Management Data

(a) planting date
(b) row spacing, m
(c) plant population, pl/m^2
(d) cultivar name (and maturity group, if known).

C. Crop

1. Dates of:

(a) first true leaf, V-1
(b) 50% of plants with flower, anywhere on plant
(c) 50% of plants with pods just starting to expand, $\geq$ 0.5 cm in length, anywhere on plant.
(d) 50% of plants with last leaf expanded
(e) 50% of plants at physiological maturity (R-7 as defined by Fehr et al. (1971)).

2. Growth Analysis Data (at four or more dates in the season)

(a) total dry weight, g/m^2
(b) leaf biomass, g/m^2
(c) seed biomass, g/m^2
(d) number of pods/m^2
(e) leaf area index (LAI).

3. Final Harvest Data

(a) number of pods/m^2
(b) number of seeds/m^2
(c) above ground dry weight, g/m^2
(d) pod weight, g/m^2 (or seed weight, or both).

(MDS). Daily weather data are required. Soil properties are required for allowing the model to simulate daily availability and distribution of water in the soil. Data on vegetative and reproductive development and growth are also required. These data are summarized in Table 2.

General Procedures

Approximate values of each of these genetic coefficients for a genotype that is not present in the genetics file (GENETICS.SB9), but for which experimental data are available, can be obtained by trial and error. The general sequence of steps in applying this method is as follows :

1. Select initial genetic coefficient values for the genotype in question. Do this by identifying in Table 3 or Table 16 a genotype which is in the same maturity group or grows in an area of adaptation similar to that of the genotype in question.

2. Enter the name of the genotype in question, and the selected initial coefficient values, in the genetics file. Do this by using any file editor, but be cautious to avoid entering tabs when the file is stored. In some cases this may involve using a NOTABS option.

3. Run the model for one location/treatment combination for which data are available.

Table 3. Sample Genetic Coefficients for Soybean Genotypes Adapted to Different Environments.

MATURITY GROUP	APPROXIMATE LATITUDE OF ADAPTATION	GENETIC COEFFICIENTS †												
		VARNO	VARTH	VARTHR (4)	VARTHR (6)	VARTHR (8)	VARTHR (10)	TRIFOL	SIZELF	SLAVAR	PODVAR	SHVAR	SDPDVR	DVAR
00	>45	9.5	1.5	5.88	6.1	20.3	43.16	0.35	172.	360.	130.	9.5	2.1	6.0
0	43-45	9.5	1.5	5.88	6.1	20.3	43.16	0.35	172.	360.	130.	9.5	2.1	6.0
1	42-49	10.0	2.0	5.88	6.1	20.3	43.16	0.35	172.	360.	130.	9.5	2.1	6.0
2	40-43	10.5	3.5	5.88	6.1	20.3	43.16	0.35	172.	350.	130.	10.5	2.1	6.0
3	38-41	11.2	4.0	5.88	6.1	20.3	43.16	0.35	172.	350.	130.	11.5	2.1	6.0
4	36-40	12.0	4.5	5.88	6.1	20.3	43.16	0.35	172.	350.	130.	11.5	2.1	6.0
5	33-38	12.0	5.0	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0
6	30-36	12.0	8.0	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0
7	26-35	12.0	9.0	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0
8	20-33	12.0	17.6	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0
9	10-30	12.0	21.0	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0
10	0-25	12.0	31.0	5.88	6.1	9.9	43.16	0.35	172.	350.	200.	11.5	2.1	6.0

† The values given here are based a number of different experiments; thus they may change as more data are acquired, and they are provided for guidance only.

4. Examine and note the goodness-of-fit between the predicted and measured variable and decrease (or increase) the coefficient, as described below, until the fit between the predicted and measured variable is good.

5. If more treatments/location combinations are available, note the values estimated for the first treatment/location combination and then repeat for all other combinations. Calculate means when all runs are complete and enter these into the genetic coefficient FILE 9 GENETICS.SB9 (Table 16).

Estimating Phenology Genetic Coefficients

The relative increase in duration of a reproductive growth phase as daylength increases is important to estimate. The slope (relative delay) per increase in daylength (or decrease in night length) is set by the values of VARTH (the relative increase in phase duration) at 5 hour night lengths (or 19 hour daylength). In actuality, the slope is estimated from data whose night length is not 5 hours, but is often 0 to 3 hours shorter than the critical night length (VARN0, the length of the dark period above which the reproductive development rate is maximum). The two coefficients, VARN0 and VARTH, define the photoperiod sensitivity of a cultivar. These coefficients have been shown to vary with maturity group (MG) in the data that we have analyzed to date, Fig. 2 and 3. Therefore, if maturity group is known, initial estimates of these coefficients can be obtained from the default coefficients provided in Table 3. If maturity group is not known, the magnitude of uncertainty increases, but estimates may be made using these procedures.

The variable VARTHR(4) is the threshold of photothermal days from the V-1 stage (or end of juvenile stage) to floral induction, which appears to vary mostly between 3.50 and 8.80, with an average of 5.88 (Table 4). In the "test" genetic coefficient data, VARTHR(4) should be set to 5.88 (the mean value) and either VARTH or VARNO should be varied until time to first flower is accurately predicted. If MG is known, and MG is 4 or higher, then VARNO should be set to 12.0 and VARTH varied according to Table 3 and Fig. 2. If MG is below 4, then VARTH should be set according to Table 3 and Fig. 2 and VARNO should be varied until flowering date matches. The ranges that VARTH and VARNO should be allowed to vary are given in Table 4. If either of these coefficients reach the limit for a particular MG, then the other coefficient should be varied. VARTHR(4) should not be varied at this point, but may require adjustment after estimating the photothermal days from flowering to physiological maturity VARTHR(10) (see below). Note that Fig. 2 and 3 define a relationship between VARTH and VARNO for the maturity groups, and this general relationship must be maintained after estimating the coefficients, regardless of whether MG was known or not.

For the remainder of the calibration process, keeping the same VARTH and VARNO that were determined from the flowering date, but vary other thresholds to match other observed dates. These should be varied according to the sequence listed in Table 4. VARTHR(6) should be adjusted until the simulated time of first pod of 0.5 cm or longer anywhere on the plant matches the observed time (or approximately at R3)

When adjusting VARTHR(10) to fit physiological maturity, it should be varied only between the limits indicated (39.1 to 47.5). If VARTHR(10) is changed to the highest value (47.5) and physiological maturity is still predicted too early, then the photoperiod sensitivity should be increased and the process of fitting flowering and other dates (including physiological maturity) should be repeated. Photoperiod sensitivity is increased by increasing VARTH or VARNO or both. Generally speaking, these should be increased together by selecting values near the next higher MG in Table 3, although ranges of $\pm$ 0.5 h on VARNO and $\pm$ 4.0 on VARTH may be selected, with VARTH $\geq$ 1.0. With these new values, the VARTHR(·) values should still

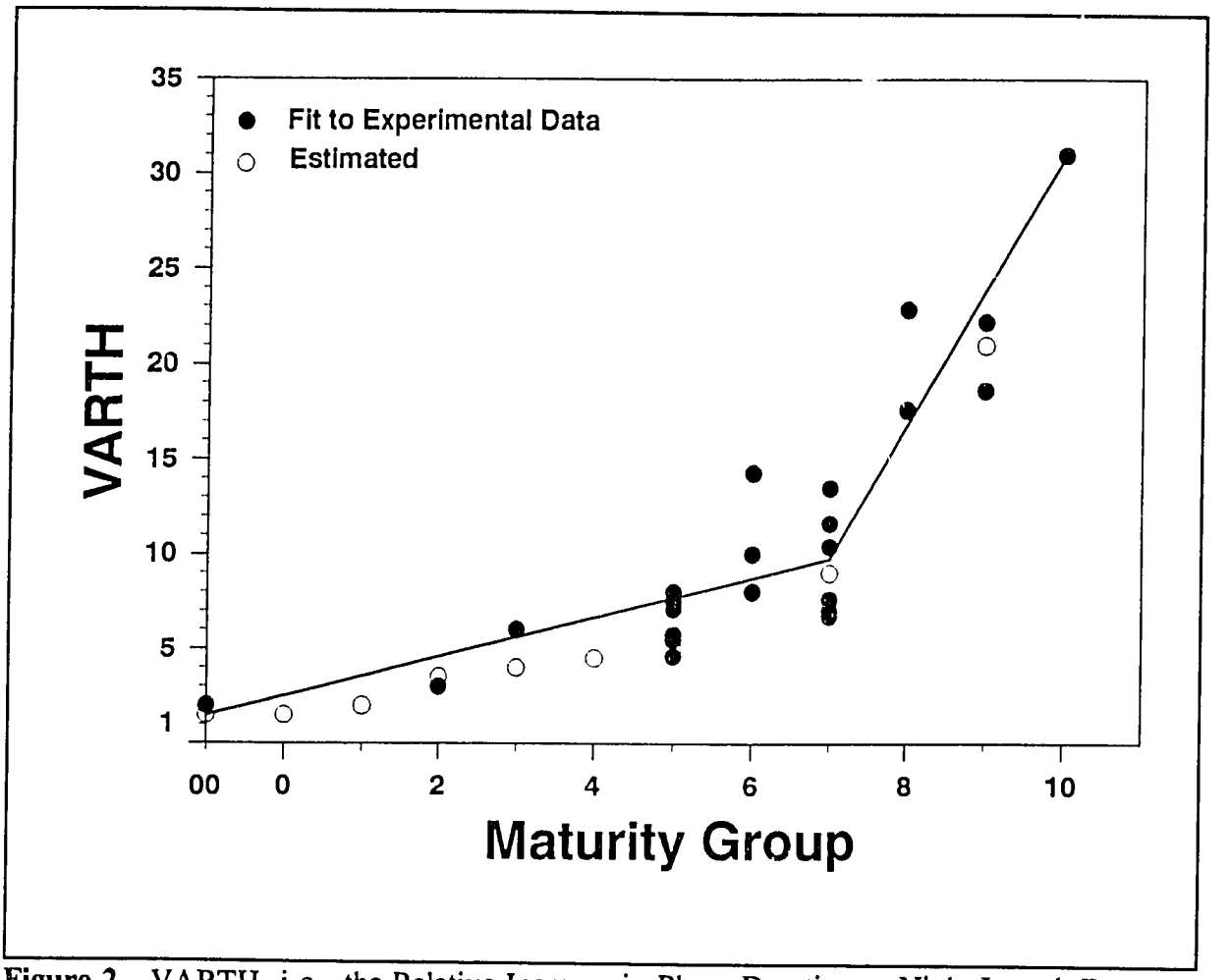

Figure 2. VARTH, i.e., the Relative Increase in Phase Duration as Night Length Decrease Below its Critical Value, as a Function of Maturity Group for Cultivars Described in File GENETICS.SB9.

come out within the ranges specified in Table 4, or the adjustment was too severe.

When fitting VARTHR(10), if it reaches its lowest value (39.1) and the predicted physiological maturity is still later than observed, then the sensitivity to photoperiod is too high and VARTH or VARNO or both should be decreased and the VARTHR(·) values must be estimated again.

Estimating Vegetative Growth Coefficients

TRIFOL should be varied until V-stage vs. time is predicted, and SIZELF can be varied within the limits given in Table 4 to fit leaf area vs. time during early vegetative growth (until V-6 occurs). Alternatively, if the area of the largest leaf is measured, in cm^2, then this value can be used, provided that no stress occurred.

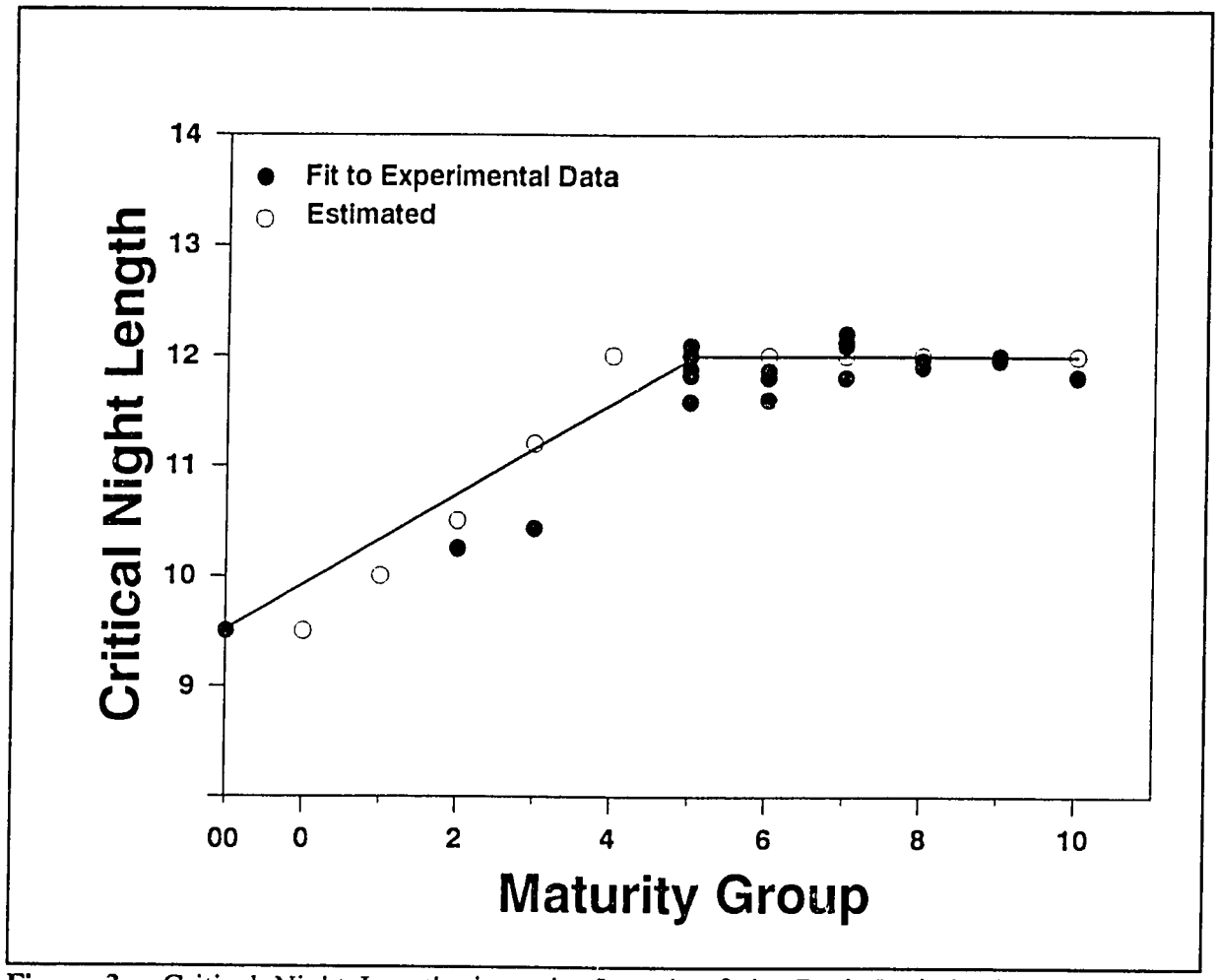

Figure 3. Critical Night Length, i.e., the Length of the Dark Period Above which the Development Rate is Maximum, as a Function of Maturity Group for Cultivars Described in File GENETICS.SB9.

Reproductive Growth Coefficients

These coefficients are important in defining the ability of the cultivar to develop a seed load. Seeds per pod (SDPDVR) can be computed directly using harvest maturity data, provided no stress occurred, whereas the other coefficients (PODVAR, SHVAR, and SDVAR) are varied to fit pod numbers, shell weight, and seed weight vs. time curves, respectively. If pod numbers vs. time are too low, then PODVAR is increased until the rate of pod addition matches observed data, and vice versa. Then, simulated shell and seed weights are compared with observed data. If simulated shell weight is too low, then SHVAR is increased until observed and simulated shell weights agree and vice versa. In this case SDVAR should be increased if simulated seed weight is lower than observed seed weight. Changes in either SHVAR or SDVAR will affect both simulated shell and seed growth because of the carbohydrate supply/demand relationships in the model. One may have to adjust these coefficients iteratively until both shell and seed weights

match observed data. Generally, the ratio of SDVAR to SHVAR should be about 0.5. Limits on these coefficients are given in Table 4 also.

Other Genetic Coefficients in GENETICS.SB9

The other coefficients should simply be copied from another cultivar, which assumes that these really vary only slightly among cultivars, or computed as defined in Table 4 for FLVAR and VARTHR(7).

Biomass Growth Rate

In some cases, we have found that the simulated top growth is significantly lower than observed top dry weight early in the season, even under no water stress conditions. We have concluded that factors in the field are causing reductions in photosynthesis or changes in partitioning, or

Table 4. Mean and Range of Genetic Coefficients during Calibration.

OBSERVED VARIABLE	COEFFICIENT	MEAN	RANGES	
			MG Known	MG Unknown
Reproductive Development				
Date of First Flowering	VARTH	†	$\bar{x} \pm 4.0$	0.0-35.0
Date of First Flowering	VARNO	‡	$\bar{x} \pm 0.5$	3.0-12.5
Date of First Flowering	VARTHR(4)	5.88	3.50-8.80	3.50-20.0
Date of First Pod	VARTHR(6)	6.10	5.40-8.50	5.40-8.50
Date of Full Pod	VARTHR(7)	VARTHR(6)*1.70	-	-
Time of Last Leaf Expansion	VARTHR(8)	9.90 (MG $\geq$ 5)	5.5-12.50	5.5-26.0
		20.30 (MG $<$ 5)	17.0-26.0	-
Time of Physiological Maturity	VARTHR(10)	43.16	39.1-47.5	39.1-47.5
Vegetative Growth				
V-Stage vs. Time	TRIFOL	0.35	0.30-0.42	0.30-0.42
LAI vs. Time, Prior to V-6	SIZELF	172	150-200	150-200
Reproductive Growth				
# Seeds / # Pods at Harvest	SDPDVR	2.1	1.8-30	1.8-30
# Pods/m^2 vs. Time	PODVAR	200 (MG $\geq$ 5)	180-250	120-250
		130 (MG $<$ 5)	120-160	-
# Flowers/m^2 vs. Time	FLVAR	2*PODVAR	-	
Shell Weight, g/m^2 vs. Time	SHVAR §	11.5	9.5-22	9.5-22.0
Seed Weight, g/m^2 vs. Time	SDVAR §	6.0	5.5-11.0	5.5-11.0

† Mean ($\bar{x}$) varies with maturity group, see Fig. 2
‡ Mean ($\bar{x}$) varies with maturity group, see Fig. 3
§ SDVAR should be about 0.5 of SHVAR. Most cultivars have SHVAR in the range of 9.5-11.6, but large seeded cultivars (such as Kaohsiung 8) may have a SHVAR of 22.0.

both. This could be caused by low soil nutrition or soil pests, such as nematodes. In the soil profile defined for the site SPROFILE.SB2 (Table 12), we have a coefficient (PHFAC3) that can be adjusted to fit early season biomass growth rates (prior to start of seed growth) to reflect a reduced assimilation of carbon by the plant tops. This should be considered only after estimation of genetic coefficients above, and even then, one will not know why the change had to be made. We have seen values ranging from 1.0 for Iowa, Illinois and other soils to 0.84 for sandy soil in Florida. We found this to go as low as 0.5 to 0.6 for soils in India. If this soil "stress" factor is varied, it should only be done for well-watered experiments and subsequent tests should be run on that soil to determine the stability of this value. Currently, an effort is being made to include soil nutrients explicitly in SOYGRO to account for some of this uncertainty.

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Appendix A
DIRECTORY LISTING OF DISTRIBUTION DISKETTES

Program Disk

Table 5. Directory of SOYGRO V5.42 disk 1: "*Program Disk.*"

SOYGRO	BAT	13	5-01-89	8:00a
SGRO	BAT	68	5-01-89	8:00a
GRO	EXE	136494	5-01-89	8:00a

Table 6. Directory of SOYGRO V5.42 disk 2: "*Data Disk.*"

UFGA7801	SB5	627	5-01-89	8:01a
UFGA7801	SB6	258	5-01-89	8:01a
UFGA7801	SB8	261	5-01-89	8:01a
UFGA7801	SBA	175	5-01-89	8:01a
UFGA7801	SBB	303[illegible]	5-01-89	8:01a
UFGA7801	SBC	1447	5-01-89	8:01a
UFGA7901	SB5	627	5-01-89	8:01a
UFGA7901	SB6	148	5-01-89	8:01a
UFGA7901	SB8	261	5-01-89	8:01a
UFGA7901	SBA	175	5-01-89	8:01a
UFGA7901	SBB	3811	5-01-89	8:01a
UFGA8101	SB5	937	5-01-89	8:01a
UFGA8101	SB6	590	5-01-89	8:01a
UFGA8101	SB8	391	5-01-89	8:01a
UFGA8101	SBA	262	5-01-89	8:01a
UFGA8101	SBB	9072	5-01-89	8:01a
UFGA8501	SB6	227	5-01-89	8:01a
UFGA8501	SBA	175	5-01-89	8:01a
UFGA8501	SBB	2943	5-01-89	8:01a
UFGA8501	SB5	663	5-01-89	8:01a
UFGA8501	SB8	261	5-01-89	8:01a
UFQU7901	SB5	374	5-01-89	8:01a
UFQU7901	SB6	25	5-01-89	8:01a
UFQU7901	SB8	131	5-01-89	8:02a
UFQU7901	SBA	88	5-01-89	8:02a
UFQU7901	SBB	1178	5-01-89	8:02a
IUCA7901	SB5	1253	5-01-89	8:02a
IUCA7901	SB6	97	5-01-89	8:02a
IUCA7901	SB8	521	5-01-89	8:02a
IUCA7901	SBA	349	5-01-89	8:02a
IUCA7901	SBB	16412	5-01-89	8:02a
SBEXP	DIR	1339	5-01-89	8:02a
WTH	DIR	463	5-01-89	8:02a
INTRO	DAT	1914	5-01-89	8:02a
GENETICS	SB9	13778	5-01-89	8:02a
CROPPARM	SB0	2945	5-01-89	8:02a
SPROFILE	SB2	23359	5-01-89	8:02a
UFGA0112	W78	16130	5-01-89	8:02a
UFGA0112	W79	16130	5-01-89	8:02a
UFGA0112	W81	16131	5-01-89	8:02a
UFGA0112	W85	16131	5-01-89	8:02a
UFQU0112	W79	16131	5-01-89	8:02a
IUCA0109	W79	12082	5-01-89	8:02a
SIM	DIR	112	5-01-89	8:02a
OUT1	SB	4083	5-01-89	8:02a
OUT2	SB	12163	5-01-89	8:02a
OUT3	SB	8375	5-01-89	8:02a
OUT4	SB	3	5-01-89	8:02a
OUT5	SB	517	5-01-89	8:02a

Graphics Disk

Table 7. Directory of SOYGRO V5.42 disk 3: "*Graphics Disk.*"

GLABEL4	DAT	498	5-01-89	8:05a
GLABEL2	DAT	784	5-01-89	8:05a
GLABEL	DAT	1069	5-01-89	8:05a
GRAPH	BAT	27	5-01-89	8:05a
SGRO	BAT	68	5-01-89	8:05a
SOYGRO	BAT	13	5-01-89	8:05a
N2	PLT	607	5-01-89	8:05a
N4	PLT	700	5-01-89	8:05a
SOYV2	PLT	3732	5-01-89	8:05a
LL1	LEV	909	5-01-89	8:05a
LLB	LEV	1037	5-01-89	8:05a
RLB	LEV	1040	5-01-89	8:05a
BRUN40	EXE	76816	5-01-89	8:03a
HVGRF	EXE	17215	5-01-89	8:04a
MAIN	EXE	11721	5-01-89	8:04a
NEWPLT	EXE	93712	5-01-89	8:04a
GRPH	EXE	51623	5-01-89	8:05a

Source Code

Table 8. Directory of SOYGRO V5.42 disk 4: "*Source Code.*"

OPHARV	FOR	7283	5-01-89	8:06a
IPSENS	FOR	10049	5-01-89	8:06a
CLEAR	FOR	159	5-01-89	8:06a
CROP	FOR	8307	5-01-89	8:06a
FREEZE	FOR	1127	5-01-89	8:06a
GPHEN	FOR	6704	5-01-89	8:06a
IDWTH	FOR	2179	5-01-89	8:06a
INTRO	FOR	359	5-01-89	8:06a
IPCROP	FOR	4446	5-01-89	8:06a
IPEXP	FOR	6102	5-01-89	8:06a
IPFREQ	FOR	2524	5-01-89	8:06a
IPSOIL	FOR	7220	5-01-89	8:06a
IPTRT	FOR	2958	5-01-89	8:06a
IPVAR	FOR	3231	5-01-89	8:06a
IRRIG	FOR	3075	5-01-89	8:06a
JULIAN	FOR	861	5-01-89	8:06a
NAILUJ	FOR	449	5-01-89	8:06a
OPECHO	FOR	4546	5-01-89	8:06a
OPSEAS	FOR	9453	5-01-89	8:06a
PHINIT	FOR	1076	5-01-89	8:06a
PHOTO	FOR	4198	5-01-89	8:06a
PHOTIN	FOR	747	5-01-89	8:06a
WATBAL	FOR	15476	5-01-89	8:06a
SENES	FOR	3109	5-01-89	8:06a
GROW	FOR	3301	5-01-89	8:06a
SUNRIS	FOR	1354	5-01-89	8:07a
TABEX	FOR	327	5-01-89	8:07a
VARTY	FOR	3046	5-01-89	8:07a
VEGGR	FOR	6654	5-01-89	8:07a
VERIFY	FOR	2183	5-01-89	8:07a
PODS	FOR	18179	5-01-89	8:07a
WCALC	FOR	1902	5-01-89	8:07a
ROOTS	FOR	1251	5-01-89	8:07a
IPWTH	FOR	3944	5-01-89	8:07a
COMSOI	DAT	652	5-01-89	8:07a
COMIO	DAT	1440	5-01-89	8:07a
COMGRO	DAT	3048	5-01-89	8:07a
GRPH	BAS	39043	5-01-89	8:07a
MAIN	BAS	6136	5-01-89	8:07a
HVGRF	BAS	11263	5-01-89	8:07a
NEWPLT	BAS	25106	5-01-89	8:07a
COMPILE	BAT	606	5-01-89	8:07a
GROLINK	BAT	60	5-01-89	8:07a
GROOBJ		232	5-01-89	8:07a
GRO	FOR	5076	5-01-89	8:07a

Appendix B
INPUT FILES

Experiment File Directory

Table 9. File "*SBEXP.DIR.*"

```
UFGA7801 BRAGG, IRRIGATED & NON-IRRIGATED          UFGA0112.W78 SPROFILE.SB2
UFGA7801.SB4 UFGA7801.SB5 UFGA7801.SB6 UFGA7801.SB7 UFGA7801.SB8 GENETICS.SB9
UFGA7801.SBA UFGA7801.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
UFGA7901 BRAGG, IRRIGATED & NON-IRRIGATED          UFGA0112.W79 SPROFILE.SB2
UFGA7901.SB4 UFGA7901.SB5 UFGA7901.SB6 UFGA7901.SB7 UFGA7901.SB8 GENETICS.SB9
UFGA7901.SBA UFGA7901.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
UFQU7901 BRAGG, WELL IRRIGATED                     UFQU0112.W79 SPROFILE.SB2
UFQU7901.SB4 UFQU7901.SB5 UFQU7901.SB6 UFQU7901.SB7 UFQU7901.SB8 GENETICS.SB9
UFQU7901.SBA UFQU7901.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
UFGA8101 COBB, IRRIGATED, VEG. & REPROD. STRESS    UFGA0112.W81 SPROFILE.SB2
UFGA8101.SB4 UFGA8101.SB5 UFGA8101.SB6 UFGA8101.SB7 UFGA8101.SBB GENETICS.SB9
UFGA8101.SBA UFGA8101.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
UFGA8501 COBB, IRRIGATED & NON-IRRIGATED           UFGA0112.W85 SPROFILE.SB2
UFGA8501.SB4 UFGA8501.SB5 UFGA8501.SB6 UFGA8501.SB7 UFGA8501.SB8 GENETICS.SB9
UFGA8501.SBA UFGA8501.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
IUCA7901 WAYNE, IRRIGATED & NON-IRRIGATED          IUCA0109.W79 SPROFILE.SB2
IUCA7901.SB4 IUCA7901.SB5 IUCA7901.SB6 IUCA7901.SB7 IUCA7901.SB8 GENETICS.SB9
IUCA7901.SBA IUCA7901.SBB OUT1.SB OUT2.SB OUT3.SB OUT4.SB OUT5.SB
```

Table 10. File "*WTH.DIR.*"

```
UFGA GAINESVILLE (29.6N,82.4W), FLORIDA 1978 01-01-78 12-31-78 UFGA0112.W78
UFGA GAINESVILLE (29.6N,82.4W), FLORIDA 1979 01-01-79 12-31-79 UFGA0112.W79
UFGA GAINESVILLE (29.6N,82.4W), FLORIDA 1981 01-01-81 12-31-81 UFGA0112.W81
UFGA GAINESVILLE (29.6N,82.4W), FLORIDA 1985 01-01-85 12-31-85 UFGA0112.W85
UFQU QUINCY      (30.6N,86.4W), FLORIDA 1979 01-01-79 12-31-79 UFQU0112.W79
IUCA CASTANA     (42.2N,93.7W), IOWA    1979 01-01-79 09-30-79 IUCA0109.W79
```

FILE1 - Daily Weather Data

Table 11. File "*UFGA0112.W78*" (Only the first 50 days of the file are shown.)

```
UFGA 029.63 082.37 11.90  1.00          XLAT, XLONG, PARFAC, PARDAT
UFGA 78   1  5.29  18.3  13.3   4.8  14.60
UFGA 78   2 11.09  18.3   8.3   0.0  21.30
UFGA 78   3 14.68  13.9   3.3   0.0  27.70
UFGA 78   4 14.38  19.4   0.0   0.0  25.90
UFGA 78   5 10.88  23.9   6.7   0.0  19.30
UFGA 78   6 10.78  25.6  11.1   0.0  22.10
UFGA 78   7  9.49  25.0   9.4   0.0  17.60
UFGA 78   8  3.10  23.9  15.6  10.4  11.70
UFGA 78   9 16.28  18.3   1.1  25.1  28.70
UFGA 78  10 15.68   8.9  -3.9   0.0  20.30
UFGA 78  11 15.38  11.7  -2.8   0.0  27.60
UFGA 78  12  7.19  19.4   1.7   0.0  14.70
UFGA 78  13 10.88  20.0  13.3  27.9  21.80
UFGA 78  14 11.38  14.4   3.3   0.0  21.50
UFGA 78  15 14.18   7.8  -3.3   0.0  26.10
UFGA 78  16 13.18  16.1  -3.9   0.0  25.30
UFGA 78  17 10.39  21.7   9.4   4.8  21.10
UFGA 78  18 14.98  21.7   6.7   0.0  29.70
UFGA 78  19  0.60  19.4   8.9  71.9   1.70
UFGA 78  20  4.29  16.7   7.2   6.9   9.20
UFGA 78  21 10.39  10.0   1.1   0.0  19.90
UFGA 78  22 13.38  16.7   1.1   0.0  26.00
UFGA 78  23  6.59  16.7   7.8   0.0  14.00
UFGA 78  24 10.68  23.3   5.6   0.0  21.70
UFGA 78  25  7.39  26.1  16.7   0.0  15.90
UFGA 78  26 17.08  25.6   6.1   5.6  32.10
UFGA 78  27  7.39  12.2   0.0   0.0  14.90
UFGA 78  28 15.88  11.1  -1.1   0.0  30.10
UFGA 78  29 17.38  10.6  -4.4   0.0  32.70
UFGA 78  30 16.18  12.2  -3.3   0.0  31.10
UFGA 78  31  3.80  12.2   4.4   0.0   8.50
UFGA 78  32  2.29   9.4   4.4   8.6   5.10
UFGA 78  33  2.90  16.1   8.9   9.7   6.60
UFGA 78  34  2.10  16.1   6.1   2.8   4.90
UFGA 78  35 14.48  11.7   3.3   0.0  27.40
UFGA 78  36 16.08  17.2   1.1   0.0  31.80
UFGA 78  37 17.87  16.7  -0.6   0.0  33.50
UFGA 78  38 14.08  10.0  -2.8   0.0  26.90
UFGA 78  39  2.70   8.9  -0.6   4.3   6.30
UFGA 78  40  4.59   9.4   4.4  28.2  10.00
UFGA 78  41 17.28  15.0   1.7   0.0  34.40
UFGA 78  42 17.28  17.8  -1.7   0.0  34.60
UFGA 78  43 17.38  21.7   0.0   0.0  35.80
UFGA 78  44 11.58  22.8   6.7   0.0  24.30
UFGA 78  45 18.17  21.1   9.4   0.0  35.80
UFGA 78  46 16.48  18.9   1.7   0.0  32.70
UFGA 78  47  5.99  19.4   8.3  31.2  13.20
UFGA 78  48  5.29  18.9  11.1   0.0  11.40
UFGA 78  49  6.49  18.9  10.6  38.9  14.00
UFGA 78  50  8.19  18.9  11.7   0.0  17.10
```

Table 12. File "*SPROFILE.SB2.*"

```
01                DEEP SILTY CLAY
  .11  6.00    .30  85.00   6.9  13.9 1.0  1.32E-03   32.5  6.67   .04 1.00
  10.   .513   .680   .760   .680  1.000  1.35  1.74  2.5  3.3  6.5  .00
  15.   .513   .679   .759   .679   .819  1.36  1.66  2.4  3.2  6.5  .00
  15.   .514   .679   .759   .679   .607  1.36  1.45  2.2  3.0  6.5  .00
  15.   .514   .679   .759   .679   .607  1.36  1.45  2.2  3.0  6.5  .00
  30.   .516   .677   .757   .677   .368  1.37  1.09  2.0  2.6  6.5  .00
  30.   .519   .675   .755   .675   .202  1.38   .65  1.7  2.2  6.5  .00
  30.   .521   .674   .754   .674   .111  1.38   .29  1.4  1.8  6.5  .00
  30.   .522   .673   .753   .673   .061  1.39   .09  1.1  1.3  6.5  .00
  30.   .522   .673   .753   .673   .033  1.39   .01   .8   .9  6.5  .00
  -1.   .00    .00    .00    .00    .00    .00    .00   .0   .0   .0  .00
02                MEDIUM SILTY CLAY
  .11  6.00    .20  87.00   6.9  13.9 1.0  1.32E-03   32.5  6.67   .04 1.00
  10.   .513   .680   .760   .680  1.000  1.35  1.74  2.5  3.3  6.5  .00
  15.   .513   .679   .759   .679   .819  1.36  1.66  2.4  3.2  6.5  .00
  15.   .514   .679   .759   .679   .607  1.36  1.45  2.2  3.0  6.5  .00
  15.   .516   .677   .757   .677   .407  1.37  1.12  2.0  2.7  6.5  .00
  15.   .516   .677   .757   .677   .407  1.37  1.12  2.0  2.7  6.5  .00
  30.   .518   .676   .756   .676   .247  1.37   .73  1.8  2.3  6.5  .00
  30.   .520   .674   .754   .674   .135  1.38   .37  1.5  1.9  6.5  .00
  -1.   .00    .00    .00    .00    .00    .00    .00   .0   .0   .0  .00
03                SHALLOW SILTY CLAY
  .11  6.00    .10  89.00   6.9  13.9 1.0  1.32E-03   32.5  6.67   .04 1.00
  10.   .513   .680   .760   .680  1.000  1.35  1.74  2.5  3.3  6.5  .00
  10.   .513   .679   .759   .679   .819  1.36  1.66  2.4  3.2  6.5  .00
  10.   .514   .679   .759   .679   .607  1.36  1.45  2.2  3.0  6.5  .00
  10.   .516   .677   .757   .677   .449  1.36  1.16  2.1  2.7  6.5  .00
  15.   .516   .677   .757   .677   .449  1.36  1.16  2.1  2.7  6.5  .00
  -1.   .00    .00    .00    .00    .00    .00    .00   .0   .0   .0  .00
04                DEEP SILT LOAM
  .12  6.00    .40  77.00   6.9  13.9 1.0  1.32E-03   93.1  6.67   .04 1.00
  10.   .106   .262   .362   .262  1.000  1.37  1.16  2.5  3.3  6.5  .00
  15.   .106   .262   .362   .262   .819  1.37  1.10  2.4  3.2  6.5  .00
  15.   .107   .262   .362   .262   .607  1.37   .97  2.2  3.0  6.5  .00
  15.   .107   .262   .362   .262   .607  1.37   .97  2.2  3.0  6.5  .00
  30.   .108   .261   .361   .261   .368  1.38   .72  2.0  2.6  6.5  .00
  30.   .110   .260   .360   .260   .202  1.38   .43  1.7  2.2  6.5  .00
  30.   .111   .259   .359   .259   .111  1.39   .20  1.4  1.8  6.5  .00
  30.   .112   .258   .358   .258   .061  1.39   .06  1.1  1.3  6.5  .00
  30.   .112   .258   .358   .258   .033  1.39   .01   .8   .9  6.5  .00
  -1.   .00    .00    .00    .00    .00    .00    .00   .0   .0   .0  .00
05                MEDIUM SILT LOAM
  .12  6.00    .30  79.00   6.9  13.9 1.0  1.32E-03   93.1  6.67   .04 1.00
  10.   .106   .262   .362   .262  1.000  1.37  1.16  2.5  3.3  6.5  .00
  15.   .106   .262   .362   .262   .819  1.37  1.10  2.4  3.2  6.5  .00
  15.   .107   .262   .362   .262   .607  1.37   .97  2.2  3.0  6.5  .00
  15.   .108   .261   .361   .261   .407  1.38   .75  2.0  2.7  6.5  .00
  15.   .108   .261   .361   .261   .407  1.38   .75  2.0  2.7  6.5  .00
  30.   .110   .260   .360   .260   .247  1.38   .49  1.8  2.3  6.5  .00
  30.   .111   .259   .359   .259   .135  1.39   .24  1.5  1.9  6.5  .00
  -1.   .00    .00    .00    .00    .00    .00    .00   .0   .0   .0  .00
```

Table 12 Continued. File "*SPROFILE.SB2.*"

```
06                SHALLOW SILT LOAM
  .12  6.00     .20  81.00   6.9  13.9 1.0  1.32E-03   93.3  6.67   .04 1.00
  10.   .106    .262   .362   .262  1.000  1.37  1.16  2.5  3.3  6.5  .00
  10.   .106    .262   .362   .262   .819  1.37  1.10  2.4  3.2  6.5  .00
  10.   .107    .262   .362   .262   .607  1.37   .97  2.2  3.0  6.5  .00
  10.   .108    .261   .361   .261   .449  1.38   .77  2.1  2.7  6.5  .00
  15.   .108    .261   .361   .261   .449  1.38   .77  2.1  2.7  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
07                DEEP SANDY LOAM
  .13  6.00     .50  68.00   6.9  13.9 1.0  1.32E-03   98.3  6.67   .04 1.00
  10.   .086    .220   .320   .220  1.000  1.61   .70  2.5  3.3  6.5  .00
  15.   .086    .220   .320   .220   .819  1.61   .66  2.4  3.2  6.5  .00
  15.   .086    .220   .320   .220   .607  1.61   .58  2.2  3.0  6.5  .00
  15.   .086    .220   .320   .220   .607  1.61   .58  2.2  3.0  6.5  .00
  30.   .087    .219   .319   .219   .368  1.61   .43  2.0  2.6  6.5  .00
  30.   .088    .218   .318   .218   .202  1.62   .26  1.7  2.2  6.5  .00
  30.   .089    .218   .318   .218   .111  1.62   .12  1.4  1.8  6.5  .00
  30.   .089    .218   .318   .218   .061  1.62   .04  1.1  1.3  6.5  .00
  30.   .089    .217   .317   .217   .033  1.62   .01   .8   .9  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
08                MEDIUM SANDY LOAM
  .13  6.00     .50  70.00   6.9  13.9 1.0  1.32E-03   98.3  6.67   .04 1.00
  10.   .086    .220   .320   .220  1.000  1.61   .70  2.5  3.3  6.5  .00
  15.   .086    .220   .320   .220   .819  1.61   .66  2.4  3.2  6.5  .00
  15.   .086    .220   .320   .220   .607  1.61   .58  2.2  3.0  6.5  .00
  15.   .087    .219   .319   .219   .407  1.61   .45  2.0  2.7  6.5  .00
  15.   .087    .219   .319   .219   .407  1.61   .45  2.0  2.7  6.5  .00
  30.   .088    .219   .319   .219   .247  1.62   .29  1.8  2.3  6.5  .00
  30.   .089    .218   .318   .218   .135  1.62   .15  1.5  1.9  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
09                SHALLOW SANDY LOAM
  .13  6.00     .40  74.00   6.9  13.9 1.0  1.32E-03   98.4  6.67   .04 1.00
  10.   .086    .220   .320   .220  1.000  1.61   .70  2.5  3.3  6.5  .00
  10.   .086    .220   .320   .220   .819  1.61   .66  2.4  3.2  6.5  .00
  10.   .086    .220   .320   .220   .607  1.61   .58  2.2  3.0  6.5  .00
  10.   .087    .219   .319   .219   .449  1.61   .46  2.1  2.7  6.5  .00
  15.   .087    .219   .319   .219   .449  1.61   .46  2.1  2.7  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
10                DEEP SAND
  .15  4.00     .60  65.00   6.9  13.9 1.0  1.32E-03  111.9  6.67   .04 1.00
  10.   .032    .107   .267   .107  1.000  1.66   .29  2.5  3.3  6.5  .00
  15.   .032    .107   .267   .107   .819  1.66   .28  2.4  3.2  6.5  .00
  15.   .032    .107   .267   .107   .607  1.66   .24  2.2  3.0  6.5  .00
  15.   .032    .107   .267   .107   .607  1.66   .24  2.2  3.0  6.5  .00
  30.   .032    .107   .267   .107   .368  1.66   .18  2.0  2.6  6.5  .00
  30.   .033    .106   .266   .106   .202  1.66   .11  1.7  2.2  6.5  .00
  30.   .033    .106   .266   .106   .111  1.66   .05  1.4  1.8  6.5  .00
  30.   .033    .106   .266   .106   .061  1.66   .01  1.1  1.3  6.5  .00
  30.   .033    .106   .266   .106   .033  1.66   .00   .8   .9  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
11                MEDIUM SAND
  .15  4.00     .50  70.00   6.9  13.9 1.0  1.32E-03  112.0  6.67   .04 1.00
  10.   .032    .107   .267   .107  1.000  1.66   .29  2.5  3.3  6.5  .00
  15.   .032    .107   .267   .107   .819  1.66   .28  2.4  3.2  6.5  .00
  15.   .032    .107   .267   .107   .607  1.66   .24  2.2  3.0  6.5  .00
  15.   .032    .107   .267   .107   .407  1.66   .19  2.0  2.7  6.5  .00
  15.   .032    .107   .267   .107   .407  1.66   .19  2.0  2.7  6.5  .00
  30.   .033    .106   .266   .106   .247  1.66   .12  1.8  2.3  6.5  .00
  30.   .034    .105   .265   .105   .135  1.66   .06  1.5  1.9  6.5  .00
  -1.   .00     .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
```

Table 12 Continued. File "*SPROFILE.SB2.*"

```
 12                SHALLOW SAND
   .15  4.00    .40  75.00   6.9  13.9 1.0  1.32E-03  112.0  6.67   .04 1.00
   10.   .032   .107   .267   .107  1.000  1.66   .29  2.5  3.3  6.5  .00
   10.   .032   .107   .267   .107   .819  1.66   .28  2.4  3.2  6.5  .00
   10.   .032   .107   .267   .107   .607  1.66   .24  2.2  3.0  6.5  .00
   10.   .032   .107   .267   .107   .449  1.66   .19  2.1  2.7  6.5  .00
   15.   .032   .107   .267   .107   .449  1.66   .19  2.1  2.7  6.5  .00
   -1.   .00    .00    .00    .00    .00    .00   .00   .0   .0   .0  .00
 13 Waipio, HI   Waipio (Clayey, kaolinitic, isohyperth, Tropeptic Eutrustox)
  0.14  5.00   0.60  60.00  22.0   7.0 1.0  1.32E-03   60.1  6.67  0.04 1.00
    5.  0.220  0.350  0.550  0.350  1.000  1.00  2.27   .0   .0  6.3  0.0
   10.  0.230  0.350  0.550  0.350  1.000  1.00  2.27   .0   .0  6.3  0.0
   15.  0.240  0.350  0.550  0.350  0.800  1.05  1.10   .0   .0  5.8  0.0
   20.  0.250  0.370  0.480  0.370  0.400  1.17  1.41   .0   .0  5.8  0.0
   20.  0.260  0.380  0.460  0.380  0.200  1.22  0.59   .0   .0  6.0  0.0
   20.  0.250  0.380  0.460  0.380  0.050  1.22  0.36   .0   .0  6.0  0.0
   20.  0.260  0.400  0.480  0.400  0.020  1.17  0.27   .0   .0  6.0  0.0
   -1.  0.000  0.000  0.000  0.000  0.000  0.00  0.00   .0   .0  0.0  0.0
 14 Gainesville  Millhopper Fine Sand (Loamy,silic,hyperth Arenic Paleudult)
  0.18 02.00  00.650  60.00  21.0  29.9 1.0  1.32E-03  114.2  6.67  0.04 0.84
    5.   .026   .096   .230   .096  1.000  1.30  2.00   .0   .0   .0   .00
   10.   .025   .086   .230   .086  1.000  1.30  1.00   .0   .0   .0   .00
   15.   .025   .086   .230   .086  0.498  1.40  1.00   .0   .0   .0   .00
   30.   .025   .086   .230   .086   .294  1.40  0.50   .0   .0   .0   .00
   30.   .028   .090   .230   .090   .380  1.45  0.10   .0   .0   .0   .00
   30.   .028   .090   .230   .090   .133  1.45  0.10   .0   .0   .0   .00
   30.   .029   .130   .230   .130   .062  1.45  0.04   .0   .0   .0   .00
   30.   .070   .258   .360   .258   .031  1.20  0.24   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0   0.0   .0   .0   .0   .00
 15 Gainesville  Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
000.18 05.00  00.50  66.00  21.0  29.9 1.0  1.32E-03  114.2  6.67  0.04 0.84
    5.   .023   .086   .230   .086  1.000   .00   .00   .0   .0   .0   7.4
   10.   .023   .086   .230   .086  1.000   .00   .00   .0   .0   .0   7.4
   15.   .023   .086   .230   .086  0.498   .00   .00   .0   .0   .0  15.8
   15.   .023   .086   .230   .086   .294   .00   .00   .0   .0   .0  28.0
   15.   .023   .086   .230   .086   .294   .00   .00   .0   .0   .0  28.0
   30.   .021   .076   .230   .076   .380   .00   .00   .0   .0   .0  27.6
   30.   .020   .076   .230   .076   .133   .00   .00   .0   .0   .0  17.5
   30.   .027   .130   .230   .130   .062   .00   .00   .0   .0   .0   0.3
   30.   .070   .258   .360   .258   .031   .00   .00   .0   .0   .0   .10
   -1.   .0     .0     .0     .0     .0     .0    .0   .0   .0   .0   .0
 16 Gainesville  Lake Fine Sand (Hyperthermic, coated Typic Quartzipsamments)
000.18 00.00  00.50  66.00  21.0  29.9 1.0  1.32E-03  114.4  6.67  0.04 0.84
    5.   .020   .089   .230   .089  1.000   .00   .00   .0   .0   .0   .00
   10.   .019   .068   .230   .068  1.000   .00   .00   .0   .0   .0   .00
   15.   .019   .068   .230   .068  0.498   .00   .00   .0   .0   .0   .00
   15.   .026   .075   .230   .075   .294   .00   .00   .0   .0   .0   .00
   15.   .026   .075   .230   .075   .294   .00   .00   .0   .0   .0   .00
   30.   .025   .073   .230   .073   .380   .00   .00   .0   .0   .0   .00
   30.   .022   .069   .230   .069   .133   .00   .00   .0   .0   .0   .00
   30.   .023   .072   .230   .072   .030   .00   .00   .0   .0   .0   .00
   30.   .035   .085   .230   .085   .010   .00   .00   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0   .0   .0   .0   .0
```

Table 12 Continued. File "*SPROFILE.SB2.*"

```
 17 Quincy, FL   Orangeburg Sandy Loam (F-loamy,silic,thermic Typ Paleudults)
   .13  9.00  0C.27  84.00  21.0  29.9 1.0  1.32E-03   85.1  6.67  0.04 0.95
    5.   .125   .198   .294   .198  1.000  1.49  1.73   .0   .0   .0   .00
   10.   .125   .198   .294   .198   .874  1.49  1.73   .0   .0   .0   .00
   10.   .125   .198   .294   .198   .874  1.49  1.73   .0   .0   .0   .00
   09.   .117   .226   .323   .226   .351  1.41   .40   .0   .0   .0   .00
   09.   .117   .226   .323   .226   .351  1.41   .40   .0   .0   .0   .00
   10.   .138   .250   .332   .250   .310  1.44   .20   .0   .0   .0   .00
   11.   .138   .250   .332   .250   .310  1.44   .20   .0   .0   .0   .00
   38.   .167   .281   .331   .281   .302  1.57   .14   .0   .0   .0   .00
   43.   .182   .291   .334   .291   .077  1.59   .16   .0   .0   .0   .00
   30.   .162   .272   .320   .272   .036  1.61   .09   .0   .0   .0   .00
   28.   .154   .263   .319   .263   .006  1.58   .03   .0   .0   .0   .00
   -1.    .0     .0     .0     .0     .0     .0    .0    .0   .0   .0    .0
 18 Manhattan,KS Haynie (Coarse-silty, mixed,calcareous,mesic Typ Udifluvent)
  0.14  5.00   0.60  60.00  12.0  32.0 1.0  1.32E-03   85.0  6.67  0.04 1.00
   15.  0.072  0.225  0.275  0.225  1.000  1.15  0.61   .0   .0   .0   .00
   15.  0.070  0.240  0.290  0.240  0.700  1.16  0.61   .0   .0   .0   .00
   30.  0.040  0.154  0.194  0.154  0.200  1.21  0.59   .0   .0   .0   .00
   30.  0.032  0.091  0.141  0.091  0.050  1.23  0.29   .0   .0   .0   .00
   30.  0.032  0.087  0.137  0.087  0.030  1.31  0.24   .0   .0   .0   .00
   30.  0.032  0.087  0.137  0.087  0.010  1.31  0.20   .0   .0   .0   .00
   30.  0.032  0.087  0.137  0.087  0.010  1.31  0.20   .0   .0   .0   .00
   -1.    .0     .0     .0     .0     .0     .0    .0    .0   .0   .0    .0
 19 Swift, CAN   Wood Mountain Loam (Orthic Brown Chernozem)
  0.12  8.00   0.50  60.00   2.2  36.2 1.0  1.32E-03   94.7  6.67  0.04 1.00
    5.  0.096  0.230  0.250  0.230  1.000  0.00  1.10   .0   .0   .0   .00
   10.  0.096  0.230  0.250  0.230  0.800  0.00  1.10   .0   .0   .0   .00
   15.  0.112  0.250  0.260  0.250  0.700  0.00  0.61   .0   .0   .0   .00
   15.  0.094  0.220  0.230  0.220  0.500  0.00  0.61   .0   .0   .0   .00
   15.  0.103  0.220  0.230  0.220  0.250  0.00  0.59   .0   .0   .0   .00
   15.  0.103  0.220  0.230  0.220  0.150  0.00  0.15   .0   .0   .0   .00
   15.  0.102  0.250  0.220  0.250  0.080  0.00  0.10   .0   .0   .0   .00
   30.  0.102  0.250  0.220  0.250  0.050  0.00  0.10   .0   .0   .0   .00
   30.  0.102  0.250  0.220  0.250  0.050  0.00  0.10   .0   .0   .0   .00
   -1.    .0     .0     .0     .0     .0     .0    .0    .0   .0   .0    .0
 20 Rothamsted   Rothamsted
  0.14  6.00   0.50  60.00  14.0  27.0 1.0  1.32E-03   73.8  6.67  0.04 1.00
   10.  0.110  0.280  0.330  0.280  1.000  1.10  1.16   .0   .0   .0   .00
   15.  0.150  0.320  0.420  0.320  0.900  1.20  1.00   .0   .0   .0   .00
   20.  0.220  0.370  0.420  0.370  0.700  1.25  0.68   .0   .0   .0   .00
   20.  0.220  0.370  0.420  0.370  0.500  1.25  0.26   .0   .0   .0   .00
   30.  0.220  0.370  0.420  0.370  0.200  1.25  0.25   .0   .0   .0   .00
   30.  0.220  0.370  0.420  0.370  0.100  1.25  0.20   .0   .0   .0   .00
   30.  0.220  0.370  0.420  0.370  0.050  1.25  0.20   .0   .0   .0   .00
   -1.    .0     .0     .0     .0     .0     .0    .0    .0   .0   .0    .0
 21 Aleppo, SYR  Tel Hadya (Palexerollic Chromoxerert; high AWC)
  0.14  6.00   0.50  72.00  16.4  11.5 1.0  1.32E-03   63.5  6.67  0.04 1.00
   10.  0.210  0.340  0.357  0.340  1.000  1.30  0.50   .0   .0   .0   .00
   15.  0.210  0.350  0.367  0.350  0.700  1.30  0.50   .0   .0   .0   .00
   25.  0.230  0.360  0.380  0.360  0.500  1.30  0.50   .0   .0   .0   .00
   25.  0.260  0.380  0.400  0.380  0.150  1.30  0.40   .0   .0   .0   .00
   25.  0.270  0.390  0.410  0.390  0.040  1.30  0.35   .0   .0   .0   .00
   25.  0.300  0.380  0.400  0.380  0.020  1.30  0.30   .0   .0   .0   .00
   25.  0.300  0.375  0.390  0.375  0.010  1.30  0.30   .0   .0   .0   .00
   30.  0.300  0.375  0.390  0.375  0.020  1.30  0.30   .0   .0   .0   .00
   20.  0.300  0.375  0.390  0.375  0.001  1.30  0.30   .0   .0   .0   .00
   -1.    .0     .0     .0     .0     .0     .0    .0    .0   .0   .0    .0
```

Table 12 Continued. File "*SPROFILE.SB2.*"

```
 22 Aleppo, SYR  Tel Hadya (Palexerollic Chromoxerert; low AWC)
  0.14  6.00   0.50  72.00  16.4  11.5 1.0  1.32E-03   63.5  6.67  0.04 1.00
   10.  0.210  0.280  0.357  0.280  1.000  1.30  0.50   .0   .0   .0   .00
   15.  0.210  0.280  0.367  0.280  0.700  1.30  0.50   .0   .0   .0   .00
   25.  0.230  0.290  0.380  0.290  0.500  1.30  0.50   .0   .0   .0   .00
   25.  0.260  0.350  0.400  0.350  0.150  1.30  0.40   .0   .0   .0   .00
   25.  0.270  0.350  0.410  0.350  0.040  1.30  0.35   .0   .0   .0   .00
   25.  0.300  0.350  0.400  0.350  0.020  1.30  0.30   .0   .0   .0   .00
   25.  0.300  0.350  0.390  0.350  0.010  1.30  0.30   .0   .0   .0   .00
   30.  0.300  0.350  0.390  0.350  0.020  1.30  0.30   .0   .0   .0   .00
   20.  0.300  0.350  0.390  0.350  0.001  1.30  0.30   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
 23 Florence, SC Norfolk Loamy Sand
  0.14  5.00   0.60  60.00  16.8  20.0 1.0  1.32E-03   88.2  6.67  0.04 1.00
   10.  0.075  0.210  0.250  0.210  1.000  1.55  0.30   .0   .0   .0   .00
   10.  0.075  0.210  0.250  0.210  1.000  1.55  0.30   .0   .0   .0   .00
   21.  0.100  0.240  0.290  0.240  0.800  1.67  0.17   .0   .0   .0   .00
   30.  0.210  0.310  0.350  0.310  0.400  1.54  0.01   .0   .0   .0   .00
   30.  0.210  0.320  0.360  0.320  0.100  1.54  0.01   .0   .0   .0   .00
   25.  0.180  0.280  0.320  0.280  0.100  1.68  0.01   .0   .0   .0   .00
   25.  0.180  0.280  0.320  0.280  0.100  1.74  0.01   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
 24 Marianna, FL Norfolk Sandy Loam  (F-loamy,silic,thermic Typ Paleudults)
   .18  6.00    .10  77.00  20.0  30.0 1.0  1.32E-03   90.9  6.67  0.04 0.84
    5.   .061   .145   .312   .145  1.000  1.38  1.29   .0   .0  5.5   .00
    5.   .061   .145   .312   .145  1.000  1.38  1.29   .0   .0  5.5   .00
   10.   .050   .141   .302   .141   .775  1.42   .47   .0   .0  5.5   .00
   18.   .056   .165   .270   .165   .448  1.52   .28   .0   .0  5.5   .00
   20.   .198   .304   .359   .304   .300  1.48   .25   .0   .0  5.1   .00
   21.   .198   .304   .359   .304   .300  1.48   .25   .0   .0  5.1   .00
   16.   .197   .305   .335   .305   .100  1.64   .12   .0   .0  5.1   .00
   17.   .197   .305   .335   .305   .100  1.64   .12   .0   .0  5.1   .00
   17.   .184   .292   .332   .292   .100  1.61   .06   .0   .0  5.0   .00
   18.   .184   .292   .332   .292   .100  1.61   .06   .0   .0  5.0   .00
   26.   .210   .318   .339   .318   .020  1.67   .05   .0   .0  5.0   .00
   28.   .227   .335   .350   .335   .000  1.66   .06   .0   .0  4.9   .00
   28.   .227   .335   .350   .335   .000  1.66   .06   .0   .0  4.9   .00
   -1.   .000   .000   .000   .000   .000   .00   .00   .0   .0   .0   .00
 25 Raleigh, NC  Norfolk Sandy Clay Loam (F-l,silic.,therm. Typ. Paleudults)
000.14 03.00  00.23  60.0  16.8  20.0 1.0  1.32E-03  106.9  6.67  0.04 0.95
    5.0 0.042  0.169  0.392  0.169  1.000   .00   .00   .0   .0   .0   .00
   10.0 0.042  0.169  0.392  0.169  1.000   .00   .00   .0   .0   .0   .00
   10.0 0.042  0.169  0.392  0.169   .779   .00   .00   .0   .0   .0   .00
   08.0 0.044  0.177  0.358  0.177   .349   .00   .00   .0   .0   .0   .00
   13.0 0.056  0.165  0.396  0.165   .209   .00   .00   .0   .0   .0   .00
   15.0 0.150  0.291  0.377  0.291   .070   .00   .00   .0   .0   .0   .00
   15.0 0.150  0.291  0.377  0.291   .070   .00   .00   .0   .0   .0   .00
   30.0 0.150  0.291  0.377  0.291   .017   .00   .00   .0   .0   .0   .00
   30.0 0.150  0.291  0.377  0.291   .000   .00   .00   .0   .0   .0   .00
   -1.0  .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
 26 Castana, IO  Ida Silt Loam
000.12 06.00  00.30  60.00  12.0  32.0 1.0  1.32E-03   89.4  6.67  0.04 1.00
    5.   .135   .290   .485   .290  1.000   .00   .00   .0   .0   .0   .00
   10.   .135   .290   .485   .290  1.000   .00   .00   .0   .0   .0   .00
   15.   .135   .290   .485   .290   .175   .00   .00   .0   .0   .0   .00
   15.   .106   .228   .514   .228   .138   .00   .00   .0   .0   .0   .00
   15.   .106   .228   .514   .228   .138   .00   .00   .0   .0   .0   .00
   30.   .105   .254   .517   .254   .188   .00   .00   .0   .0   .0   .00
   30.   .133   .290   .507   .290   .250   .00   .00   .0   .0   .0   .00
   30.   .108   .283   .505   .283   .213   .00   .00   .0   .0   .0   .00
   30.   .108   .291   .542   .291   .100   .00   .00   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
```

Table 12 Continued. File "*SPROFILE.SB2.*

```
 27 Sumatra, IND Sitiung ( no subsoil acidity, Ultisol )
  0.14  5.00   0.60  60.00  22.0   7.0 1.0  1.32E-03   32.5  6.67  0.04 1.00
    5.   .328   .448   .550   .448  1.000  1.00  2.27   .0   .0   .0   .00
   10    .353   .472   .550   .472  1.000  1.00  2.27   .0   .0   .0   .00
   15.   .377   .497   .550   .497  0.750  1.05  1.10   .0   .0   .0   .00
   20.   .349   .482   .520   .482  0.350  1.17  1.41   .0   .0   .0   .00
   20.   .349   .492   .520   .492  0.150  1.22  0.59   .0   .0   .0   .00
   30.   .328   .476   .490   .476  0.100  1.22  0.36   .0   .0   .0   .00
   30.   .328   .448   .490   .448  0.001  1.17  0.27   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
 28 Sumatra, IND Sitiung ( subsoil acidity, Ultisol )
  0.14  5.00   0.60  60.00  22.0   7.0 1.0  1.32E-03   33.3  6.67  0.04 1.00
    5.   .328   .448   .550   .448  1.000  1.00  2.27   .0   .0   .0   .00
   10    .353   .472   .550   .472  0.800  1.00  2.27   .0   .0   .0   .00
   15.   .377   .497   .550   .497  0.100  1.05  1.10   .0   .0   .0   .00
   20.   .349   .482   .520   .482  0.010  1.17  1.41   .0   .0   .0   .00
   20.   .349   .492   .520   .492  0.000  1.22  0.59   .0   .0   .0   .00
   30.   .328   .476   .490   .476  0.000  1.22  0.36   .0   .0   .0   .00
   30.   .328   .448   .490   .448  0.000  1.17  0.27   .0   .0   .0   .00
   -1.   .0     .0     .0     .0     .0     .0    .0    .0   .0   .0   .0
 29 Hyderabad,IN Patancheru (Alfisol Udic Rhodustalf)
000.14 03.00   0.50  80.0  30.0    8.0 1.0  1.32E-03   97.1  6.67  0.04 1.00
    5.0 0.060  0.200  0.430  0.200  1.000   .00   .00   .0   .0   .0   .00
   12.0 0.060  0.200  0.430  0.200  1.000   .00   .00   .0   .0   .0   .00
   08.0 0.060  0.200  0.430  0.200  0.515   .00   .00   .0   .0   .0   .00
   15.0 0.076  0.192  0.430  0.192  0.458   .00   .00   .0   .0   .0   .00
   15.0 0.124  0.220  0.430  0.220  0.400   .00   .00   .0   .0   .0   .00
   15.0 0.160  0.220  0.430  0.220  0.286   .00   .00   .0   .0   .0   .00
   15.0 0.160  0.200  0.430  0.200  0.172   .00   .00   .0   .0   .0   .00
   15.0 0.160  0.200  0.430  0.200  0.057   .00   .00   .0   .0   .0   .00
   15.0 0.160  0.200  0.430  0.200  0.057   .00   .00   .0   .0   .0   .00
   -1.0 0.000  0.000  0.000  0.000  0.000   .0    .0    .0   .0   .0   .0
```

Table 13. File "*UFGA7801.SB5.*"

```
01 UFGA7801
    5.  0.086  0.0  0.0  0.0
   10.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   30.  0.076  0.0  0.0  0.0
   30.  0.076  0.0  0.0  0.0
   30.  0.130  0.0  0.0  0.0
   30.  0.258  0.0  0.0  0.0
   -1. -1.     0.0  0.0  0.0
02 UFGA7801
    5.  0.086  0.0  0.0  0.0
   10.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   15.  0.086  0.0  0.0  0.0
   30.  0.076  0.0  0.0  0.0
   30.  0.076  0.0  0.0  0.0
   30.  0.130  0.0  0.0  0.0
   30.  0.258  0.0  0.0  0.0
   -1. -1.     0.0  0.0  0.0
```

FILE6 - Irrigation Management File

Table 14. File "*UFGA7801.SB6.*"

```
01 UFGA7801
 181  13.
 230  13.
 235  13.
 237  13.
 240  11.
 242  11.
 244  11.
 246  11.
 250  11.
 253  11.
 256   8.
 259   8.
 262   8.
 265   8.
 269   7.
 272   8.
 279   7.
 283   8.
 294  10.
  -1  -1.
02 UFGA7801
  -1  -1.
```

FILE8 - Treatment Management File

Table 15. File "*UFGA7801.SB8.*"

```
UFGA7801 01 IRRIGATED                                        15   01
 166 166  29.90  0.914  4.00  2 00   0.75 00.50   40.0  00.00  0
UFGA7801 02 NON - IRRIGATED                                  15   01
 166 166  29.90  0.914  4.00  1 00   0.75 00.50   40.0  00.00  0
```

Appendix C
CULTIVAR AND CROP COEFFICIENT FILES

FILE9 - Cultivar-Specific Coefficients

Table 16. File "*GENETICS.SB9.*"

```
 01 BRAGG            07                          VARIETY 1, MAT. GRP 7
  5.0 11.80 13.50 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  09.00 0.0 4.00 12.86 06.50 09.74 9.00 34.00  VARTHR(J),J=1,9
 47.50 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.05 200.0  450.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 02 COBB             08                          VARIETY 2, MAT. GRP 8
 5.00 11.956 17.625 1.0                          VARN1,VARNO,VARTH,VARDH
5.00 09.00 0.00 3.50  12.86 4.50 9.56 5.50 34.00  VARTHR(J),J=1,9
 47.50 12.00                                     VARTHR(J),J=10,11
11.0     5.5  2.00  250.0   600.0                SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 157.7 350.                                 TRIFOL,SIZELF,SLAVAR
 03 WAYNE            03                          VARIETY 3,MAT. GRP 3
  5.0 10.43 6.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.00 09.00 0.00 7.00 12.86 6.0 11.437 18.50 34.00 VARTHR(J),J=1,9
 40.50 12.00                                     VARTHR(J),J=10,11
 11.00   6.0   2.20 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.420 173.47 350.0                               TRIFOL,SIZELF,SLAVAR
 06 RANSOM           07                          VARIETY 6, MAT. GRP 7
  5.0 12.125 6.75  1.0                           VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 7.61 12.86 6.50 12.06 12.06 34.00  VARTHR(J),J=1,9
 46.18  12.00                                    VARTHR(J),J=10,11
 11.25   5.5   2.2  200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.360 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 08 FORREST          05                          VARIETY 8, MAT. GRP 5
  5.0 12.09 04.62 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 8.81 12.86 6.00 12.46 12.46 34.00  VARTHR(J),J=1,9
 42.91  12.00                                    VARTHR(J),J=10,11
 11.50   5.8   2.2  200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.360 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 09 WILLIAMS         03                          VARIETY 9,MAT. GRP 3
  5.0 10.43 6.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.00 09.00 0.00 7.40 12.86 6.0 11.437 17.00 34.00 VARTHR(J),J=1,9
 43.00 12.00                                     VARTHR(J),J=10,11
 11.00   6.0   2.20 120.0  240.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 188.37 350.0                               TRIFOL,SIZELF,SLAVAR
 10 WILLIAMS-82      03                          VARIETY 10,MAT. GRP 3
  5.0 10.43 6.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 7.40 12.86 6.0 11.437 17.00 34.00 VARTHR(J),J=1,9
 43.00 12.00                                     VARTHR(J),J=10,11
 11.00   6.0   2.20 120.0  240.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 188.37 350.0                               TRIFOL,SIZELF,SLAVAR
 11 EVANS            00                          VARIETY 11,MAT. GRP 00
  5.0 09.500 2.0  1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 3.50 12.86 7.0 10.67 25.50 34.00 VARTHR(J),J=1,9
 44.00  12.00                                    VARTHR(J),J=10,11
  9.50   6.00  2.20 160.0  320.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.380 173.47 360.0                               TRIFOL,SIZELF,SLAVAR
```

Table 16 Continued. File "*GENETICS.SB9.*"

```
 12 JUPITER          09                          VARIETY 12, MAT. GRP 9
 5.00 12.00 18.62 1.0                            VARN1,VARNO,VARTH,VARDH
5.00 09.00 5.00 5.50 12.86 8.50 9.50 9.50 34.00  VARTHR(J),J=1,9
 42.00 12.00                                     VARTHR(J),J=10,11
13.0     6.0  2.10  200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.338 173.7 350.                                 TRIFOL,SIZELF,SLAVAR
 15 KAOHSIUNG 8      05                          VARIETY 15,MAT. GRP5
  5.0 12.00 8.00  1.0                            VARN1,VARNO,VARTH,VARDH
5.00 09.00 0.0 4.80 12.86 6.10 10.50 10.50 34.0  VARTHR(J),J=1,9
 44.50 12.00                                     VARTHR(J),J=10,11
22.00  11.0  2.10  200.0  400.                   SHVAR,SDVAR,SDPDVR,PODVAR
0.350 173.47 350.0                               TRIFOL,SIZELF,SLAVAR
 20 HILL             05                          VARIETY 20, MAT. GRP 5
  5.0 11.58  5.75 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 11.24 12.86 6.56 11.31 11.31 34.00  VARTHR(J),J=1,9
 39.23 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 21 DAVIS            06                          VARIETY 21, MAT. GRP 5
  5.0 11.82  7.12 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 11.61 12.86 6.80 11.73 11.73 34.00  VARTHR(J),J=1,9
 45.98 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 22 TRACY            06                          VARIETY 22, MAT. GRP 6
  5.0 11.86  8.06 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0  6.36 12.86 6.41 11.05 11.05 34.00  VARTHR(J),J=1,9
 43.23 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 23 BRAXTON          07                          VARIETY 23, MAT. GRP 7
  5.0 12.13  11.62 1.0                           VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 5.24 12.86 5.63  9.70 9.70 34.00  VARTHR(J),J=1,9
 40.65 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 24 LEE-74           07                          VARIETY 24, MAT. GRP 7
  5.0 12.09  7.60 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 6.89 12.86 5.90 10.17 10.17 34.00  VARTHR(J),J=1,9
 41.65 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 25 GOVAN            07                          VARIETY 25, MAT. GRP 7
  5.0 12.20  10.40 1.0                           VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 6.01 12.86 5.45 9.40 9.40 34.00  VARTHR(J),J=1,9
 39.14 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 26 HARDEE           08                          VARIETY 26, MAT. GRP 8
  5.0 11.90  22.85 1.0                           VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 4.65 12.86 5.13 8.84 8.84 34.00  VARTHR(J),J=1,9
 42.98 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 27 VICOJA           10                          VARIETY 27, MAT. GRP 10
  5.0 11.81  31.00 1.0                           VARN1,VARNO,VARTH,VARDH
5.00  9.00 0.0 4.65 12.86 5.13 8.84 8.84 34.00  VARTHR(J),J=1,9
 42.98 12.00                                     VARTHR(J),J=10,11
 11.60   6.00  2.00 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
```

Table 16 Continued. File "*GENETICS.SB9.*"

```
 32 PK-7394          07                          VARIETY 32, MAT. GRP 7
  5.0 11.80  7.00 1.0                            VARN1,VARNO,VARTH,VARDH
5.00  09.00 0.0 4.00 12.86 06.50 09.74 7.00 34.00  VARTHR(J),J=1,9
 47.50 12.00                                     VARTHR(J),J=10,11
 13.00   6.00  2.05 150.0  300.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.330 171.4 350.0                                TRIFOL,SIZELF,SLAVAR
 33 PAPILLON         09                          VARIETY 33, MAT. GRP 9
 5.00 12.00 18.62 1.0                            VARN1,VARNO,VARTH,VARDH
5.00 09.00 5.00 5.50 12.86 8.50 9.50 9.50 34.00  VARTHR(J),J=1,9
 42.00 12.00                                     VARTHR(J),J=10,11
 15.00   7.5  2.10  150.0  300.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.338 173.7 350.                                 TRIFOL,SIZELF,SLAVAR
 38 MG-00 GENERAL    00                          VARIETY 38,MAT. GRP 00
  5.0 09.50 1.50 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
  9.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 360.0                               TRIFOL,SIZELF,SLAVAR
 39 MG-0  GENERAL     0                          VARIETY 39,MAT. GRP 0
  5.0 09.50 1.50 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
  9.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 360.0                               TRIFOL,SIZELF,SLAVAR
 40 MG-1  GENERAL     1                          VARIETY 40,MAT. GRP 1
  5.0 10.00 2.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
  9.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 360.0                               TRIFOL,SIZELF,SLAVAR
 41 MG-2  GENERAL     2                          VARIETY 41,MAT. GRP 2
  5.0 10.50 3.50 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 10.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 42 MG-3  GENERAL     3                          VARIETY 42,MAT. GRP 3
  5.0 11.20 4.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 43 MG-4  GENERAL     4                          VARIETY 43,MAT. GRP 4
  5.0 12.00 4.50 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51 20.30 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 130.0  260.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 44 MG-5  GENERAL     5                          VARIETY 44,MAT. GRP 5
  5.0 12.00 5.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 45 MG-6  GENERAL     6                          VARIETY 45,MAT. GRP 6
  5.0 12.00 8.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
```

Table 16 Continued. File "*GENETICS.SB9.*"

```
 46 MG-7  GENERAL     7                          VARIETY 46,MAT. GRP 7
  5.0 12.00 9.00 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 47 MG-8  GENERAL     8                          VARIETY 47,MAT. GRP 8
  5.0 12.00 17.6 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 48 MG-9  GENERAL     9                          VARIETY 48,MAT. GRP 9
  5.0 12.00 21.0 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
 49 MG-10 GENERAL    10                          VARIETY 49,MAT. GRP 10
  5.0 12.00 31.0 1.0                              VARN1,VARNO,VARTH,VARDH
5.000 09.00 0.00 5.88 12.86 6.1 10.51  9.90 34.00 VARTHR(J),J=1,9
 43.16  12.00                                    VARTHR(J),J=10,11
 11.50   6.00  2.10 200.0  400.0                 SHVAR,SDVAR,SDPDVR,PODVAR,FLWVAR
0.350 172.00 350.0                               TRIFOL,SIZELF,SLAVAR
```

Table 17. File "*CROPPARM.SB0.*"

```
48.27 40.30 1.67 -0.0173          PARMAX,PHTMAX,PHFAC1,PHFAC2
-1.599 1.132 -0.123               CNIT1,CNIT2,CNIT3
0.0 0.0 5.00 0.0 24.0 1.0 34.0 1.0 45.00 0.0 50.0 0.0  XPHOTO,YPHOTO
1.50 1.77 30                      PHPT1,PHPT2,NLITE
0.0 0.0 0.1 0.1243 0.2 0.1917 0.3 0.2564 0.4 0.3183 0.5 0.3773
0.6 0.4336 0.7 0.4870 0.8 0.5376 0.9 0.5855 1.0 0.6305 1.1 0.6728
1.2 0.7122 1.3 0.7488 1.4 0.7826 1.5 0.8137 1.6 0.8419 1.8 0.8899
2.0 0.9267 2.2 0.9523 2.4 0.9667 2.6 0.9717 2.8 0.9785 3.0 0.9837
3.5 0.9918 4.0 0.9959 4.5 0.9979 5.0 0.9989 7.5 1.0000 8.0 1.0000
3.5E-04 0.0040                    RE330C,R30C2
1.61 1.44 1.37 2.08 1.45 1.49     AGRLF,AGRSTM,AGRRT,AGRSD1,AGRSD2,AGRSH
0.68                              ALPHBR
0.294 0.125 0.128 0.035           PROLFI,PROLFF,PROSTI,PROSTF
0.092 0.056 0.196 0.056           PRORTI,PRORTF,PROSHI,PROSHF
1.00 0.20 0.05                    SENRTE,SENRT2,SENDAY
0.0 0.0 5.0 0.0 14.0 0.12 30.0 0.12          XSTAGE,SENPOR
3.0 0.0 5.0 0.2 10.0 0.6 30.0 0.6            XSENMX,SENMAX
0.48 0.22                         FRSTMF,FRLFF
1.00                              ATOP
7                                 NVSPT
0.0 .430 1.5 .430 3.3 .40 5.0 .350 7.8 .34 10.5 .31 30. .31   XLEAF, YLEAF
0.0 .090 1.5 .130 3.3 .23 5.0 .300 7.8 .36 10.5 .51 30. .51   XSTEM, YSTEM
180. 350. 171.4                   FINREF,SLAREF,SIZREF
0.3  950. 280.0  0.40             CONGR1,SLAMAX,SLAMIN,THICKN
5.0                               VSSINK
0.0 0.0 1.0 18.3 2.0 48.6 3.0 99.6 4.0 178.2 5.0 285.7   XVGROW,YVBRAG
25.0 7500 0.0006 0.1 0.01          RTDEPI,RFAC1,RTSEN,RLDSM,RTSDF
0.0 0.15 3.0 0.15 6.0 0.15 30.0 0.15   XRTFAC,YRTFAC
80.0 0.60 0.3 0.00                THRESH,SETMAX,SRMAX,RFLWAB
10 5  0.00 0.398                  LNGSH,LAGSD,SHTHIC,SDPRO
-0.4495 0.125 -0.00269            CONSD1,CONSD2,CONSD3
30.0 35.0 7.0 45.0                TOPT1,TOPT2,TPHMIN,TPHMAX
1 1 1 1 2 1 2 3 3 2 2 5           NTYACC(JJ),JJ=1,12
1 1 1 3 4 5 6 6 6 6 6 11          NPRIOR(JJ),JJ=1,12
0.12 0.50                         WTNEW,PORPT
3.6765E-5                         WTFAC
-2.22 -5.00                       FREEZ1,FREEZ2
14                                NBPDAT
-50.,0.,6.37,7.22,10.,12.78,15.55,21.11,26.67,32.22,37.78,40.56,40.91,80. BPTMP
0.,0.,0.,0.071,0.303,0.586,0.788,0.980,01.00,0.828,0.505,0.061,00.00,0.   BPPHP
10                                NXYTEM
-50. 00.00 '4.00 20.00 27.00 32.22 37.78 40.56 40.91  80.0   XTEMPD
 00. 00.00 00.00 01.00 01.00 0.828 0.505 0.061 0.000  00.0   YTEMPD
5                                 NXYSLA
-50.00 00.00 15.00 25.00 60.00  XSLA
 00.45 00.45 00.45 01.00 01.00  YSLA
12                                NPSLW
0.0     0.001  0.0015  0.002  0.0025  0.003
0.0035  0.004  0.005   0.006  0.008   0.010                  XPSLW
0.162  0.679  0.790  0.867  0.923  0.966
1.000  1.027  1.069  1.100  1.141  1.167                    YPSLW
05.00                             DAYMIN
01.50                             RWUEP1
```

Appendix D
FIELD MEASURED DATA FILES

FILEA - Measured Phenology and Growth Summary Data

Table 18. File "*UFGA7801.SBA.*"

```
UFGA7801  1   3041.   .1440  2223. 1.96  4.67  6068.  1958. 211 282
 233 233   4009.
UFGA7801  2   1178.   .1230   969. 1.85  4.50  3491.  1756. 211 282
 233 233   1602.
```

Table 19. File "*UFGA7801.SBB.*'

```
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1978  TRT_NO:  1
12 1 2 3 4 5 6 7 8 9 13 14 12
194.    .0   .89      .0  178.0      .0  266.0   444.0     0.0     0.0  0.00  334.6  0.0
201.    .0  1.28      .0  300.0      .0  366.0   667.0     0.0     0.0  0.00  349.7  0.0
208.    .0  1.91      .0  551.0      .0  656.0  1207.0     0.0     0.0  0.00  291.2  0.0
215.    .0  2.86      .0  943.0      .0  843.0  1786.0     0.0     0.0  0.00  339.3  0.0
222.    .0  4.17      .0 1561.0      .0 1187.0  2748.0     0.0     0.0  0.00  351.3  0.0
229.    .0  3.90      .0 1956.0      .0 1204.0  3160.0     0.0     0.0  0.00  323.9  0.0
236.    .0  4.66      .0 2947.0      .0 1723.0  4792.0   123.0   123.0  0.00  270.5  0.0
243.    .0  4.47      .0 3144.0      .0 1772.0  5224.0   308.0   308.0  0.00  252.3  0.0
250.    .0  4.44      .0 3303.0   182.0 1631.0  5740.0   805.0   623.0 22.60  272.2  0.030
257.    .0  3.99      .0 3326.0   754.0 1568.0  6507.0  1613.0   859.0 46.75  254.5  0.116
264.    .0  4.67      .0 3657.0  1912.0 1769.0  8586.0  3161.0  1249.0 60.49  264.0  0.222
271.    .0  2.83      .0 2732.0  2223.0 1180.0  7144.0  3232.0  1009.0 68.78  239.8  0.311
278.    .0  2.09      .0 2515.0  2730.0  858.0  7136.0  3763.0  1033.0 72.55  243.6  0.383
285.    .0   .47      .0 1851.0  2913.0  170.0  5866.0  3845.0   932.0 75.76  276.5  0.497
292.    .0   .09      .0 2064.0  3169.0   34.0  6270.0  4172.0  1003.0 75.96  264.7  0.505
-1
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1978  TRT_NO:  2
12 1 2 3 4 5 6 7 8 9 13 14 12
194.    .0   .75      .0  160.0      .0  244.0   405.0     0.0     0.0  0.00  307.4  0.0
201.    .0  1.08      .0  251.0      .0  311.0   563.0     0.0     0.0  0.00  347.3  0.0
208.    .0  1.81      .0  535.0      .0  626.0  1161.0     0.0     0.0  0.00  289.1  0.0
215.    .0  3.29      .0 1080.0      .0  974.0  2054.0     0.0     0.0  0.00  337.8  0.0
222.    .0  4.38      .0 1663.0      .0 1261.0  2923.0     0.0     0.0  0.00  347.3  0.0
229.    .0  4.30      .0 2083.0      .0 1392.0  3475.0     0.0     0.0  0.00  308.9  0.0
236.    .0  4.21      .0 2556.0      .0 1517.0  4184.0   112.0   112.0  0.00  277.5  0.0
243.    .0  4.50      .0 2673.0      .0 1439.0  4431.0   319.0   319.0  0.00  312.7  0.0
250.    .0  2.09      .0 1998.0    42.0  838.0  3104.0   268.0   226.0 15.67  249.4  0.014
257.    .0  3.24      .0 2650.0   253.0 1220.0  4530.0   661.0   408.0 38.28  265.6  0.056
264.    .0  2.30      .0 2609.0   471.0  931.0  4440.0   901.0   430.0 52.28  247.0  0.106
271.    .0  1.14      .0 2113.0   775.0  498.0  3812.0  1200.0   425.0 64.58  228.9  0.203
278.    .0   .85      .0 1905.0   782.0  371.0  3398.0  1122.0   340.0 69.70  229.1  0.230
285.    .0   .53      .0 1922.0  1149.0  236.0  3732.0  1574.0   425.0 73.00  224.5  0.308
292.    .0   .07      .0 1590.0  1206.0   30.0  3250.0  1630.0   424.0 73.99  233.3  0.371
-1
```

Table 20. File "*UFGA7801.SBC.*"

```
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1978  TRT_NO:  1
03 4 6 7
166 19.37  31.7  23.3
170 21.17  30.6  19.4
175 19.97  33.9  21.7
180 23.17  35.6  21.7
185 12.28  35.0  22.8
190 25.47  32.8  21.7
195 17.77  31.1  21.7
200 16.58  32.2  22.2
205 26.26  35.0  23.3
210 13.78  30.6  21.7
215 25.67  31.7  21.1
220 12.98  33.3  22.8
225 10.39  31.1  22.8
230 24.06  35.0  21.7
235 19.77  32.2  22.2
240 19.87  35.0  22.2
245 17.28  35.0  22.8
250 22.37  33.9  19.4
255 20.87  32.8  19.4
260 20.47  33.9  20.6
265 19.17  33.9  20.6
270 12.18  29.4  20.0
275 19.07  30.0  17.8
280 19.17  31.7  12.8
285 12.78  29.4  19.4
290 17.77  25.6   5.6
292 12.78  28.3  15.0
-1
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1978  TRT_NO:  2
03 4 6 7
166 19.37  31.7  23.3
170 21.17  30.6  19.4
175 19.97  33.9  21.7
180 23.17  35.6  21.7
185 12.28  35.0  22.8
190 25.47  32.8  21.7
195 17.77  31.1  21.7
200 16.58  32.2  22.2
205 26.26  35.0  23.3
210 13.78  30.6  21.7
215 25.67  31.7  21.1
220 12.98  33.3  22.8
225 10.39  31.1  22.8
230 24.06  35.0  21.7
235 19.77  32.2  22.2
240 19.87  35.0  22.2
245 17.28  35.0  22.8
250 22.37  33.9  19.4
255 20.87  32.8  19.4
```

Table 20 Continued. File "*UFGA7801.SBC.*"

```
260 20.47  33.9  20.6
263 20.17  33.3  17.2
264 15.88  33.9  21.7
265 19.17  33.9  20.6
270 12.18  29.4  20.0
275 19.07  30.0  17.8
280 19.17  31.7  12.8
285 12.78  29.4  19.4
290 17.77  25.6   5.6
292 12.78  28.3  15.0
-1
```

Appendix E
GRAPHICS LABEL FILES

Crop Data Labels

Table 21. File "*GLABEL.DAT.*'

```
1. Vegetative Growth Stage
V-STAGE
2. Leaf Area Index
LAI
3. Number of Pods #/m2
POD NO-M2
4. Stem Dry Weight (kg/ha)
STEM-kg/ha
5. Seed Dry Weight (kg/ha)
SEED-kg/ha
6. Leaf Dry Weight (kg/ha)
LEAF-kg/ha
7. Canopy Dry Weight (kg/ha)
CANOPY WT
8. Pod Dry Weight (kg/ha)
POD-kg/ha
9. Shell Dry Weight (kg/ha)
SHELL-kg/ha
10.Root Dry Weight (kg/ha)
ROOT-kg/ha
11.Number of Seeds #/m2
SEED no-m2
12.Harvest 'ndex (Seed/Top)
HARVEST IND
13.Shelling % (Seed/Pod*100)
SHELLING-%
14.Specific Leaf Area (cm2/g)
SLA cm2/g
15.Seed Size (mg/seed)
SEED SZ-mg
16.Nitrogen % in Canopy
NITROGEN-%
17.Relative Drought Stress Indicator
TURFAC
18.Root Length Density Level 1 cm/cm3
Root LD L1
19.Root Length Density Level 2 cm/cm3
Root LD L2
20.Root Length Density Level 3 cm/cm3
Root LD L3
21.Root Length Density Level 4 cm/cm3
Root LD L4
22.Root Length Density Level 5 cm/cm3
Root LD L5
23.Root Length Density Level 6 cm/cm3
Root LD L6
24.Root Length Density Level 7 cm/cm3
Root LD L7
25.Root Length Density Level 8 cm/cm3
Root LD L8
```

Soil Water and Weather Data Labels

Table 22. File "*GLABEL2.DAT.*"

```
1. Avg Transpiration (mm)
TRANSP mm
2. Avg Soil & Plant Evaporation (mm)
EVAP - mm
3. Avg Pot. Evapotranspiration (mm)
POT ET mm
4. Solar Radiation (MJ)
RAD - MJ
5. Daylength period (H)
DAYL - H
6. Maximum Temperature (C)
MAX T - C
7. Minimum Temperature (C)
MIN T - C
8. Period Rainfall (mm)
RAIN - mm
9. Period Irrigation (mm)
IRRIG - mm
10.Soil Water Content level 1 cm3/cm3
SWC L1
11.Soil Water Content level 2 cm3/cm3
SWC L2
12.Soil Water Content level 3 cm3/cm3
SWC L3
13.Soil Water Content level 4 cm3/cm3
SWC L4
14.Soil Water Content level 5 cm3/cm3
SWC L5
15.Soil Water Content level 6 cm3/cm3
SWC L6
16.Soil Water Content level 7 cm3/cm3
SWC L7
17.Soil Water Content level 8 cm3/cm3
SWC L8
18.Total extractable soil water (mm)
PESW - mm
```

Appendix F
OUTPUT FILES

OUT1 : Output Echo and Summary

Table 23. File "*OUT1.SB.*"

```
                              SOYGRO V5.42
                              ============


 INPUT SUMMARY      RUN NO.   1          SIMULATION BEGINS : JUN 15

 INST_ID: UF  SITE_ID: GA  EXPT_NO: 01  YEAR: 1978  TRT_NO:  1
 EXPERIMENT    : BRAGG, IRRIGATED & NON-IRRIGATED
 TREATMENT     : IRRIGATED
 WEATHER SET   : GAINESVILLE (29.6N,82.4W), FLORIDA 1978
 VARIETY       : BRAGG              MATURITY GROUP :  7
 IRRIGATION    : ACCORDING TO THE FIELD SCHEDULE
 PLANTING DATE: JUN 15 PLANTS/M2: 29.90 ROW SPACING: .914m PLANT SPACING: .037m

 SOIL PROFILE DATA  Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
 SOIL ALBEDO  :  .18  U: 5.0  SWCON:  .50  CURVE NO.: 66.0  PHFAC3: .84
   DEPTH-m       LL     DUL    SAT    EXTR   INIT   ROOT   KSAT
   .00-  .05   .023    .086   .230   .063   .086  1.000  7.400
   .05-  .15   .023    .086   .230   .063   .086  1.000  7.400
   .15-  .30   .023    .086   .230   .063   .086   .498 15.800
   .30-  .45   .023    .086   .230   .063   .086   .294 28.000
   .45-  .60   .023    .086   .230   .063   .086   .294 28.000
   .60-  .90   .021    .076   .230   .055   .076   .380 27.600
   .90- 1.20   .020    .076   .230   .056   .076   .133 17.500
  1.20- 1.50   .027    .130   .230   .103   .130   .062   .300
  1.50- 1.80   .070    .258   .360   .188   .258   .031   .100
             ---------------------------------
     SUM mm    55.2   213.6  453.0  158.4  213.6

   RUN NO.   1        SIMULATION OUTPUT

   UF  GA  1978       BRAGG 1978 IRR

                                                WATER BALANCE COMPONENTS     DROUGHT
   DATE CROP GROWTH   BIOMASS   LAI   V-  ES   EP   ET   RAIN IRRIG   STRESS
         AGE STAGE     KG/HA        STAGE mm   mm   mm    mm   mm  PHOTO TURGOR
-------------------------------------------------------------------------------------
JUN 15    0 SOWING       0.   .00    .0   4.   0.   4.    0.    0.  .000  .000
JUN 21    6 EMERGENCE   19.   .03    .2   6.   0.   6.    2.    0.  .000  .000
JUN 26   11 UNIFOLIOL.  34.   .07   1.2  14.   1.  15.   10.    0.  .000  .000
JUN 26   11 END JUVEN.  34.   .07   1.2  14.   1.  15.   10.    0.  .000  .000
JUL 13   28 FLOWER IND 361.   .79   5.9  47.  19.  67.  127.   13.  .000  .028
AUG  1   47 FLOWERING 1691.  2.96  11.1  82.  67. 149.  299.   13.  .000  .000
AUG 20   66 FIRST POD 3775.  5.26  16.4  98. 138. 236.  518.   26.  .000  .000
AUG 26   72 END LEAF  4488.  5.30  18.1 101. 165. 267.  518.   52.  .000  .000
AUG 27   73 FULL POD  4606.  5.30  18.1 102. 171. 273.  518.   52.  .000  .000
SEP 26  103 END POD   7462.  4.11  18.1 120. 290. 410.  524.  157.  .025  .072
OCT 11  118 PHYS. MAT 7936.  3.23  18.1 129. 324. 454.  534.  180.  .139  .244
OCT 23  130 HARV. MAT 6223.   .21  18.1 136. 336. 472.  534.  190.  .327  .488
```

Table 23 Continued. File "*OUT1.SB.*"

```
RUN NO.   1

UF  GA  1978          BRAGG 1978 IRR

                      PREDICTED     MEASURED
                      ---------     --------
FLOWERING DATE          213           211
FIRST POD               232           233
FULL POD                239           233
PHYSIOL. MATURITY       284           282
POD YLD (KG/HA)        3948.00       4009.00
SEED YLD (KG/HA)       3088.00       3041.00
SHELLING PERCENTAGE      78.22         75.85
WT. PER SEED (G)          .144          .144
SEED NUMBER (SEED/M2)  2150.00       2223.00
SEEDS/POD                2.05          1.96
MAXIMUM LAI              5.31          4.67
BIOMASS (KG/HA) AT R8  6223.00       6068.00
STALK (KG/HA) AT R8    2198.00       1958.00
HARVEST INDEX             .496          .501

         Irrigation Summary
         ==================

19 IRRIGATION APPLICATIONS @   .75 EFFICIENCY.

CROP AGE   15   64   69   71   74   76   78   80   84   87   90   93   96
AMOUNT,mm  13.  13.  13.  13.  11.  11.  11.  11.  11.  11.   8.   8.   8.

CROP AGE   99  103  106  113  117  128
AMOUNT,mm   8.   7.   8.   7.   8.  10.

        SOYBEAN YIELD :  3088.3 KG/HA [   46.0 BU/ACRE ]
```

OUT2 : Crop Data

Table 24. File "*OUT2.SB.*"

SOYGRO V5.42
==========

RUN 1 BRAGG 1978 IRR
INST_ID: UF SITE_ID: GA EXPT_NO: 01 YEAR: 1978 TRT_NO: 1
EXPERIMENT : BRAGG, IRRIGATED & NON-IRRIGATED
TREATMENT : IRRIGATED
WEATHER SET : GAINESVILLE (29.6N,82.4W), FLORIDA 1978
SOIL TYPE : Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
VARIETY : BRAGG MATURITY GROUP : 7
IRRIGATION : ACCORDING TO THE FIELD SCHEDULE

JUL DAY	VST-AGE	LAI	PODS NO	STEM WT	SEED WT	LEAF WT	CANO-WT	POD WT	SHELL WT	ROOT WT	SEED NO	HARVEST IND	SHELL %	SLA	=>
166	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	180.0	=>
167	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	180.0	=>
169	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	180.0	=>
171	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	180.0	=>
173	.35	.03	.0	3.6	.0	17.2	20.9	.0	.0	19.0	.0	.000	.0	199.6	=>
175	.77	.05	.0	4.6	.0	20.9	25.5	.0	.0	22.5	.0	.000	.0	246.5	=>
177	1.19	.07	.0	6.4	.0	27.3	33.7	.0	.0	28.8	.0	.000	.0	274.3	=>
179	1.77	.11	.0	9.6	.0	37.4	47.0	.0	.0	38.3	.0	.000	.0	295.6	=>
181	2.30	.15	.0	14.8	.0	50.4	65.3	.0	.0	52.9	.0	.000	.0	301.3	=>
183	2.83	.20	.0	23.2	.0	67.8	91.0	.0	.0	72.5	.0	.000	.0	301.2	=>
185	3.41	.28	.0	34.3	.0	87.6	121.9	.0	.0	89.9	.0	.000	.0	321.0	=>
187	3.94	.37	.0	47.6	.0	108.0	155.7	.0	.0	110.8	.0	.000	.0	338.9	=>
189	4.49	.47	.0	68.0	.0	135.4	203.3	.0	.0	134.8	.0	.000	.0	348.9	=>
191	5.04	.58	.0	96.2	.0	169.1	265.4	.0	.0	165.5	.0	.000	.0	344.1	=>
193	5.60	.72	.0	124.7	.0	200.6	325.3	.0	.0	194.0	.0	.000	.0	357.1	=>
195	6.16	.87	.0	162.1	.0	239.8	401.9	.0	.0	229.0	.0	.000	.0	364.2	=>
197	6.72	1.01	.0	192.6	.0	270.2	462.8	.0	.0	254.8	.0	.000	.0	374.9	=>
199	7.27	1.21	.0	245.8	.0	321.4	567.2	.0	.0	298.3	.0	.000	.0	375.2	=>
201	7.82	1.42	.0	305.8	.0	376.1	681.9	.0	.0	344.2	.0	.000	.0	378.2	=>
203	8.39	1.65	.0	382.7	.0	439.8	822.6	.0	.0	394.6	.0	.000	.0	374.2	=>
205	8.98	1.87	.0	474.4	.0	507.7	982.1	.0	.0	442.9	.0	.000	.0	367.6	=>
207	9.54	2.12	.0	573.5	.0	573.4	1147.0	.0	.0	485.4	.0	.000	.0	369.1	=>
209	10.07	2.38	.0	673.6	.0	633.7	1307.3	.0	.0	519.7	.0	.000	.0	375.2	=>
211	10.60	2.67	.0	799.6	.0	704.5	1504.1	.0	.0	556.1	.0	.000	.0	378.7	=>
213	11.15	2.96	.0	921.3	.0	770.2	1691.5	.0	.0	589.5	.0	.000	.0	383.9	=>
215	11.68	3.23	.0	1077.4	.0	853.5	1930.9	.0	.0	637.7	.0	.000	.0	378.1	=>
217	12.23	3.51	.0	1234.9	.0	934.5	2169.3	.0	.0	688.8	.0	.000	.0	376.1	=>
219	12.78	3.80	.0	1381.2	.0	1006.9	2388.1	.0	.0	737.1	.0	.000	.0	377.1	=>
221	13.35	4.07	.0	1526.5	.0	1076.1	2602.6	.0	.0	787.1	.0	.000	.0	377.9	=>
223	13.90	4.33	.0	1658.6	.0	1135.3	2793.9	.0	.0	833.0	.0	.000	.0	381.8	=>
225	14.44	4.62	.0	1785.4	.0	1196.1	2981.5	.0	.0	877.4	.0	.000	.0	386.5	=>
227	15.00	4.89	.0	1939.6	.0	1271.3	3211.0	.0	.0	936.3	.0	.000	.0	384.5	=>
229	15.57	5.09	.0	2090.1	.0	1341.7	3431.7	.0	.0	995.5	.0	.000	.0	379.2	=>
231	16.13	5.22	.0	2244.0	.0	1411.5	3655.5	.0	.0	1058.7	.0	.000	.0	369.6	=>
233	16.68	5.29	59.6	2406.1	.0	1483.5	3891.2	1.5	1.5	1130.5	.0	.000	.0	356.6	=>
235	17.25	5.31	153.7	2553.6	.0	1546.4	4116.7	16.7	16.7	1195.3	.0	.000	.0	343.4	=>
237	17.80	5.30	259.6	2701.4	.0	1611.1	4362.9	50.4	50.4	1261.3	.0	.000	.0	329.0	=>
239	18.06	5.30	346.1	2843.5	.8	1676.0	4605.8	86.3	85.5	1322.6	56.5	.000	.9	316.2	=>

Table 24 Continued. File "*OUT2.SB.*"

241	18.06	5.29	413.3	2970.1	8.5	1732.0	4836.0	134.0	125.5	1372.7	150.0	.002	6.3	305.5	=>
243	18.06	5.27	508.5	3083.2	25.5	1779.3	5065.6	203.1	177.6	1414.1	260.1	.005	12.6	296.2	=>
245	18.06	5.24	631.8	3169.6	53.8	1811.5	5280.2	299.2	245.4	1438.6	390.0	.010	18.0	289.2	=>
247	18.06	5.19	795.0	3246.8	96.3	1836.0	5514.8	431.9	335.6	1458.8	525.5	.017	22.3	282.9	=>
249	18.06	5.13	966.6	3295.0	156.6	1843.0	5743.2	605.2	448.6	1463.8	712.1	.027	25.9	278.5	=>
251	18.06	5.06	1185.2	3317.6	232.6	1836.1	5988.4	834.7	602.2	1455.6	842.4	.039	27.9	275.7	=>
253	18.06	4.99	1351.2	3299.9	329.4	1809.0	6140.1	1031.1	701.7	1421.3	1128.4	.054	31.9	275.6	=>
255	18.06	4.90	1620.4	3279.4	466.6	1779.1	6381.9	1323.5	857.0	1386.5	1490.0	.073	35.3	275.6	=>
257	18.06	4.81	1916.1	3256.6	648.8	1745.9	6589.0	1586.5	937.6	1353.9	1935.2	.098	40.9	275.6	=>
259	18.06	4.71	2038.4	3232.4	885.4	1710.5	6770.3	1827.5	942.0	1320.9	2148.9	.131	48.5	275.6	=>
261	18.06	4.62	1859.9	3208.1	1106.5	1675.1	6933.1	2049.9	943.4	1287.7	2148.9	.160	54.0	275.6	=>
263	18.06	4.52	1568.3	3184.0	1341.8	1639.9	7106.0	2282.2	940.4	1256.2	2148.9	.189	58.8	275.6	=>
265	18.06	4.37	1256.5	3149.5	1559.7	1584.1	7227.5	2493.9	934.2	1226.3	2149.9	.216	62.5	275.6	=>
267	18.06	4.24	1077.7	3119.4	1761.9	1537.0	7346.3	2689.9	928.0	1195.7	2149.9	.240	65.5	275.6	=>
269	18.06	4.11	1050.6	3089.7	1959.7	1490.8	7461.9	2881.5	921.8	1165.1	2149.9	.263	68.0	275.6	=>
271	18.06	4.01	1050.6	3065.9	2148.3	1456.4	7586.3	3064.0	915.7	1136.4	2149.9	.283	70.1	275.6	=>
273	18.06	3.88	1048.7	3034.5	2258.7	1406.8	7609.7	3168.4	909.7	1110.6	2149.9	.297	71.3	275.6	=>
275	18.06	3.75	1048.7	3005.7	2449.6	1362.3	7721.2	3353.2	903.7	1084.5	2149.9	.317	73.1	275.6	=>
277	18.06	3.66	1048.7	2982.5	2636.7	1328.8	7845.9	3534.6	897.9	1060.4	2149.9	.336	74.6	275.6	=>
279	18.06	3.57	1048.7	2959.3	2783.9	1295.4	7931.0	3676.3	892.4	1035.0	2149.9	.351	75.7	275.6	=>
281	18.06	3.49	1048.7	2939.5	2859.0	1266.8	7953.2	3746.9	887.9	1010.6	2149.9	.359	76.3	275.6	=>
283	18.06	3.36	1048.7	2909.3	2955.0	1218.0	7965.5	3838.2	883.2	992.4	2149.9	.371	77.0	275.6	=>
285	18.06	2.56	1048.7	2758.9	3025.3	930.2	7592.5	3903.5	878.2	968.6	2149.9	.398	77.5	275.6	=>
287	18.06	1.60	1048.7	2573.1	3060.6	580.5	7087.4	3933.8	873.2	941.7	2149.9	.432	77.8	275.6	=>
289	18.06	1.01	1048.7	2443.1	3075.5	365.9	6754.4	3945.3	869.9	917.2	2149.9	.455	78.0	275.6	=>
291	18.06	.65	1048.7	2349.5	3083.3	234.2	6534.0	3950.3	867.0	901.3	2149.9	.472	78.1	275.6	=>
293	18.06	.41	1048.7	2275.5	3087.0	149.9	6375.2	3949.8	862.8	880.9	2149.9	.484	78.2	275.6	=>
295	18.06	.26	1048.7	2222.7	3089.8	95.9	6267.1	3948.5	858.6	862.3	2149.9	.493	78.3	275.6	=>
296	18.06	.21	1048.7	2198.0	3088.3	76.7	6223.2	3948.5	860.1	852.2	2149.9	.496	78.2	275.6	=>

Table 24 Continued. File "*OUT2.SB.*"

	SEED SIZE	NIT %	WATER STRESS	ROOT LENGTH DENSITY L1	L2	L3	L4	L5	L6	L7	L8
=>											
=>	.0	4.70	1.00	.05	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.07	.04	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.08	.05	.00	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.11	.06	.01	.00	.00	.00	.00
=>	.0	4.70	1.00	.05	.15	.08	.02	.00	.00	.00	.00
=>	.0	4.70	.89	.05	.20	.11	.04	.01	.00	.00	.00
=>	.0	4.70	1.00	.06	.25	.13	.05	.03	.00	.00	.00
=>	.0	4.70	1.00	.10	.29	.15	.07	.05	.01	.00	.00
=>	.0	4.70	1.00	.14	.33	.17	.08	.06	.01	.00	.00
=>	.0	4.70	1.00	.16	.39	.20	.10	.07	.03	.00	.00
=>	.0	4.70	1.00	.19	.45	.23	.11	.09	.05	.00	.00
=>	.0	4.70	1.00	.24	.49	.25	.13	.11	.07	.00	.00
=>	.0	4.70	1.00	.27	.56	.29	.15	.13	.10	.00	.00
=>	.0	4.70	1.00	.32	.60	.31	.16	.14	.12	.01	.00
=>	.0	4.70	1.00	.40	.67	.34	.18	.16	.15	.01	.00
=>	.0	4.70	1.00	.48	.75	.38	.20	.19	.18	.02	.00
=>	.0	4.70	1.00	.50	.83	.42	.23	.21	.21	.04	.00
=>	.0	4.70	1.00	.58	.90	.45	.25	.23	.24	.05	.00
=>	.0	4.70	1.00	.64	.96	.48	.27	.25	.27	.06	.00
=>	.0	4.70	1.00	.69	1.00	.50	.28	.26	.29	.06	.01
=>	.0	4.70	1.00	.75	1.05	.53	.29	.28	.30	.07	.01
=>	.0	4.70	1.00	.82	1.11	.56	.31	.30	.33	.08	.01
=>	.0	4.70	1.00	.90	1.18	.59	.33	.32	.36	.09	.02
=>	.0	4.70	1.00	.97	1.25	.63	.35	.34	.39	.10	.02
=>	.0	4.70	1.00	1.04	1.32	.66	.37	.36	.42	.11	.03
=>	.0	4.70	1.00	1.13	1.40	.70	.40	.38	.45	.12	.04
=>	.0	4.70	1.00	1.20	1.46	.73	.42	.40	.47	.13	.04
=>	.0	4.70	1.00	1.27	1.53	.77	.44	.42	.50	.14	.05
=>	.0	4.70	1.00	1.36	1.61	.81	.46	.45	.53	.16	.05
=>	.0	4.70	1.00	1.46	1.70	.85	.49	.48	.57	.17	.06
=>	.0	4.70	1.00	1.56	1.80	.90	.52	.51	.61	.19	.07
=>	.0	4.70	1.00	1.66	1.90	.95	.55	.53	.65	.20	.07
=>	.0	4.70	1.00	1.77	1.99	1.00	.58	.56	.69	.21	.08
=>	1.4	4.70	1.00	1.86	2.09	1.04	.60	.59	.72	.23	.09

Table 24 Continued. File "*OUT2.SB.*"

=>	5.6	4.70	1.00	1.95	2.16	1.08	.63	.61	.76	.24	.09
=>	9.8	4.69	1.00	2.02	2.23	1.12	.65	.64	.78	.25	.10
=>	13.8	4.67	1.00	2.07	2.28	1.14	.66	.65	.80	.26	.10
=>	18.3	4.64	1.00	2.11	2.31	1.15	.67	.66	.82	.26	.11
=>	22.0	4.60	1.00	2.13	2.33	1.16	.68	.66	.82	.26	.11
=>	27.6	4.54	1.00	2.14	2.33	1.16	.68	.67	.83	.27	.11
=>	29.2	4.47	1.00	2.10	2.29	1.15	.67	.66	.81	.26	.11
=>	31.3	4.40	1.00	2.05	2.24	1.12	.65	.64	.79	.26	.10
=>	33.5	4.32	1.00	2.01	2.19	1.09	.64	.63	.78	.25	.10
=>	41.2	4.23	1.00	1.96	2.14	1.07	.62	.61	.76	.24	.10
=>	51.5	4.13	.50	1.90	2.09	1.05	.61	.60	.74	.24	.10
=>	62.4	4.02	.57	1.86	2.05	1.02	.59	.58	.73	.23	.10
=>	72.5	3.91	1.00	1.81	2.00	1.00	.58	.57	.71	.23	.09
=>	82.0	3.80	1.00	1.77	1.96	.97	.57	.56	.69	.22	.09
=>	91.2	3.68	1.00	1.72	1.91	.95	.56	.55	.68	.22	.09
=>	99.9	3.56	.57	1.67	1.87	.92	.54	.53	.66	.21	.09
=>	105.1	3.43	1.00	1.64	1.84	.90	.53	.52	.65	.21	.09
=>	113.9	3.29	1.00	1.61	1.80	.88	.52	.51	.63	.21	.08
=>	122.6	3.15	.73	1.57	1.76	.86	.51	.50	.62	.20	.08
=>	129.5	3.00	1.00	1.53	1.73	.85	.50	.49	.61	.20	.08
=>	133.0	2.84	.29	1.48	1.70	.83	.49	.48	.59	.19	.08
=>	137.4	2.72	1.00	1.44	1.67	.82	.48	.47	.58	.19	.08
=>	140.7	2.54	.40	1.40	1.64	.80	.47	.46	.57	.19	.08
=>	142.4	2.32	.39	1.35	1.60	.78	.46	.45	.55	.18	.08
=>	143.1	2.00	.23	1.30	1.56	.77	.44	.44	.54	.18	.07
=>	143.4	2.00	.71	1.26	1.53	.75	.44	.43	.53	.18	.07
=>	143.6	2.00	.34	1.22	1.49	.74	.43	.42	.52	.18	.07
=>	143.7	2.00	.91	1.19	1.47	.72	.42	.41	.50	.17	.07
=>	143.7	2.00	.80	1.17	1.46	.71	.41	.41	.50	.17	.07

OUT3 : Soil Water and Weather Data

Table 25. File "*OUT3.SB.*"

SOYGRO V5.42
==========

RUN 1 BRAGG 1978 IRR
INST_ID: UF SITE_ID: GA EXPT_NO: 01 YEAR: 1978 TRT_NO: 1
EXPERIMENT : BRAGG, IRRIGATED & NON-IRRIGATED
TREATMENT : IRRIGATED
WEATHER SET : GAINESVILLE (29.6N,82.4W), FLORIDA 1978
SOIL TYPE : Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
VARIETY : BRAGG MATURITY GROUP : 7
IRRIGATION : ACCORDING TO THE FIELD SCHEDULE

JUL	---------- DAILY ----------							PERIOD		SOIL WATER CONTENT W/DEPTH								TOTAL
DAY	EP	ET	EO	SR	PHOTOP	MAX	MIN	RAIN	IRRIG	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	PESW
166	.0	3.5	5.0	19.37	13.89	31.7	23.3	.0	.0	.019	.084	.086	.086	.086	.076	.076	.130	154.9
167	.0	2.2	5.4	21.67	13.89	31.1	19.4	2.0	.0	.018	.083	.086	.086	.086	.076	.076	.130	154.7
169	.0	.2	6.4	25.67	13.90	31.1	18.9	2.0	.0	.018	.080	.086	.086	.086	.076	.076	.130	154.4
171	.0	.1	3.3	13.08	13.90	31.1	22.2	2.0	.0	.018	.078	.086	.086	.086	.076	.076	.130	154.1
173	.1	2.1	4.7	18.67	13.90	30.6	21.1	4.5	.0	.030	.075	.085	.086	.086	.076	.076	.130	154.3
175	.2	.3	5.2	19.97	13.90	33.9	21.7	4.5	.0	.018	.071	.083	.086	.086	.076	.076	.130	153.0
177	.4	.7	6.9	24.96	13.89	35.0	22.8	10.3	.0	.018	.076	.081	.086	.086	.076	.076	.130	153.2
179	.5	.7	6.1	20.77	13.89	36.1	22.8	10.3	.0	.018	.069	.078	.085	.086	.076	.076	.130	151.9
181	.7	7.4	7.4	25.06	13.88	36.1	23.3	10.3	13.0	.019	.086	.078	.084	.086	.076	.076	.130	153.5
183	1.3	1.5	8.0	26.56	13.86	36.7	22.8	10.3	13.0	.018	.072	.072	.082	.085	.076	.076	.130	150.8
185	.7	3.0	3.4	12.28	13.85	35.0	22.8	13.1	13.0	.030	.062	.067	.080	.084	.076	.076	.130	149.1
187	.5	2.8	2.8	10.78	13.83	32.2	22.8	25.1	13.0	.112	.095	.072	.077	.082	.076	.076	.130	156.6
189	.9	5.1	5.1	19.97	13.81	32.8	21.1	72.4	13.0	.074	.154	.156	.142	.119	.086	.082	.133	194.7
191	2.6	4.7	6.3	24.67	13.79	33.3	21.1	84.3	13.0	.019	.108	.109	.112	.106	.083	.082	.134	173.2
193	.8	2.8	2.8	11.29	13.77	32.2	21.7	98.6	13.0	.116	.114	.101	.103	.104	.084	.084	.137	178.4
195	1.7	4.4	4.4	17.77	13.74	31.1	21.7	126.8	13.0	.043	.113	.118	.110	.102	.081	.081	.134	175.0
197	.4	1.1	1.1	4.29	13.71	31.7	22.8	138.7	13.0	.145	.110	.099	.097	.094	.078	.079	.132	171.5
199	2.1	5.0	5.0	20.27	13.68	30.6	21.7	151.4	13.0	.097	.125	.104	.101	.098	.080	.080	.133	173.6
201	1.9	4.2	4.2	17.18	13.65	30.6	22.2	157.2	13.0	.054	.096	.097	.100	.099	.080	.081	.135	168.8
203	3.1	5.7	5.7	22.27	13.61	33.3	23.9	167.9	13.0	.043	.088	.088	.090	.090	.076	.078	.132	159.9
205	5.8	6.8	7.0	26.26	13.58	35.0	23.3	169.9	13.0	.018	.057	.073	.080	.082	.070	.077	.132	148.5
207	2.1	3.5	3.5	14.08	13.54	33.9	21.1	203.9	13.0	.126	.153	.115	.098	.088	.068	.076	.132	172.7
209	1.4	2.2	2.2	9.19	13.50	27.8	21.7	262.1	13.0	.140	.155	.156	.157	.157	.103	.090	.138	216.3
211	2.8	4.1	4.1	17.18	13.46	30.6	21.7	270.5	13.0	.077	.112	.111	.116	.117	.089	.087	.138	190.1
213	3.1	4.4	4.4	18.07	13.41	31.7	21.7	298.6	13.0	.127	.150	.144	.126	.119	.088	.089	.141	201.8
215	4.6	6.2	6.2	25.67	13.37	31.7	21.1	395.8	13.0	.117	.147	.152	.155	.155	.138	.130	.171	252.9
217	3.7	4.9	4.9	19.97	13.32	32.2	22.2	400.6	13.0	.088	.099	.109	.125	.135	.108	.117	.174	223.8
219	4.6	5.9	5.9	23.87	13.28	33.3	21.7	436.9	13.0	.125	.147	.151	.139	.133	.098	.105	.164	227.9
221	5.4	6.6	6.6	26.46	13.23	33.3	23.3	444.3	13.0	.078	.100	.104	.108	.107	.083	.088	.145	191.4
223	2.3	2.8	2.8	11.68	13.18	31.1	20.6	500.9	13.0	.144	.153	.155	.156	.157	.098	.092	.144	221.7
225	2.1	2.5	2.5	10.39	13.13	31.1	22.8	504.2	13.0	.105	.108	.116	.130	.139	.101	.099	.151	207.1
227	4.4	5.0	5.0	20.27	13.07	33.9	22.2	504.5	13.0	.061	.079	.089	.096	.103	.083	.086	.141	172.7
229	4.3	4.9	4.9	19.37	13.02	34.4	22.8	506.5	13.0	.061	.062	.080	.083	.089	.076	.080	.137	160.1
231	3.7	4.1	4.1	15.98	12.97	35.0	20.0	518.2	26.0	.141	.130	.097	.089	.086	.070	.076	.132	167.9
233	5.3	6.0	6.0	22.67	12.91	35.0	22.8	518.2	26.0	.067	.080	.081	.083	.083	.069	.074	.131	153.1
235	4.3	4.8	4.8	19.77	12.86	32.2	22.2	518.2	39.0	.139	.091	.080	.077	.077	.063	.072	.130	153.3
237	4.1	4.6	4.6	19.07	12.80	32.2	21.1	518.2	52.0	.139	.102	.087	.081	.071	.059	.069	.129	152.8
239	5.8	6.5	6.5	24.77	12.74	35.0	21.1	518.2	52.0	.062	.069	.074	.078	.073	.056	.067	.128	141.3

Table 25 Continued. File "*OUT3.SB.*"

241	5.3	5.9	5.9	23.87	12.68	33.9	21.7	518.2	63.0	.084	.072	.072	.071	.066	.054	.064	.127	138.4
243	5.0	5.6	5.6	21.27	12.63	35.0	22.8	518.2	74.0	.082	.071	.074	.063	.061	.052	.062	.126	134.8
245	4.0	4.6	4.6	17.28	12.57	35.0	22.8	518.2	85.0	.087	.072	.077	.060	.058	.050	.061	.124	133.4
247	4.8	5.5	5.5	21.57	12.51	34.4	21.7	518.7	96.0	.081	.071	.078	.061	.056	.049	.059	.123	131.3
249	4.1	4.6	4.6	19.17	12.45	32.2	19.4	518.7	96.0	.046	.051	.059	.057	.054	.047	.058	.121	122.3
251	3.9	4.4	4.4	17.77	12.39	34.4	20.0	518.7	107.0	.073	.050	.054	.055	.052	.046	.056	.120	120.6
253	2.0	2.2	2.2	9.09	12.33	32.8	22.8	519.0	118.0	.132	.068	.051	.053	.051	.045	.055	.118	123.0
255	4.4	5.0	5.0	20.87	12.27	32.8	19.4	519.0	118.0	.042	.046	.048	.051	.049	.044	.054	.115	113.1
257	4.0	4.5	4.5	17.58	12.21	35.0	20.0	519.0	126.0	.040	.044	.046	.049	.048	.042	.053	.113	109.8
259	4.3	5.0	5.0	20.47	12.14	33.3	20.6	519.8	134.0	.075	.047	.042	.046	.045	.040	.051	.108	107.4
261	3.3	4.1	5.2	21.27	12.08	33.3	21.1	519.8	134.0	.022	.037	.039	.043	.043	.038	.048	.101	98.3
263	3.5	4.2	4.8	20.17	12.02	33.3	17.2	519.8	142.0	.040	.039	.038	.042	.041	.037	.047	.096	95.2
265	4.0	4.7	4.7	19.17	11.96	33.9	20.6	519.8	150.0	.061	.045	.036	.040	.040	.036	.046	.091	93.1
267	3.3	3.9	3.9	16.08	11.90	31.7	21.7	523.6	150.0	.038	.047	.036	.040	.040	.035	.045	.089	90.4
269	2.9	3.5	3.5	14.78	11.84	31.1	20.6	523.9	157.0	.067	.047	.035	.039	.039	.034	.044	.084	88.8
271	2.5	3.2	3.6	15.78	11.78	28.9	18.3	523.9	157.0	.032	.039	.035	.038	.038	.033	.044	.079	82.8
273	1.0	1.3	1.3	5.39	11.72	28.3	21.1	524.7	165.0	.086	.057	.034	.038	.038	.033	.043	.079	86.7
275	3.5	4.4	4.4	19.07	11.66	30.0	17.8	533.8	165.0	.075	.066	.049	.037	.037	.033	.043	.078	88.4
277	2.4	3.0	3.0	12.88	11.60	30.6	19.4	533.8	165.0	.035	.039	.045	.037	.037	.032	.042	.074	80.7
279	3.3	4.2	4.2	17.68	11.54	32.8	17.2	533.8	172.0	.047	.044	.042	.036	.036	.032	.042	.071	78.9
281	1.6	2.2	4.2	20.77	11.48	25.6	7.2	533.8	172.0	.016	.037	.039	.036	.035	.031	.041	.068	73.9
283	2.7	3.5	3.5	15.18	11.42	29.4	18.3	533.8	180.0	.060	.044	.038	.035	.035	.031	.040	.067	74.9
285	1.3	2.1	3.0	12.78	11.36	29.4	19.4	533.8	180.0	.027	.038	.036	.034	.034	.030	.040	.066	70.5
287	1.1	1.2	2.2	9.09	11.30	30.6	19.4	534.1	180.0	.016	.034	.035	.034	.034	.029	.039	.064	67.6
289	1.0	1.0	3.9	19.57	11.24	25.6	4.4	534.1	180.0	.016	.031	.034	.033	.033	.029	.039	.063	65.5
291	.8	.9	1.5	7.19	11.19	24.4	12.2	534.1	180.0	.016	.030	.033	.033	.033	.029	.038	.063	63.7
293	.8	.9	4.1	17.97	11.13	28.9	13.3	534.1	180.0	.016	.028	.032	.032	.032	.028	.038	.062	61.9
295	.9	3.0	3.1	13.38	11.07	28.9	15.6	534.1	190.0	.024	.043	.032	.032	.032	.028	.038	.062	63.0
296	.9	1.3	3.7	15.68	11.05	28.9	15.6	534.1	190.0	.016	.040	.031	.032	.032	.028	.037	.062	61.7