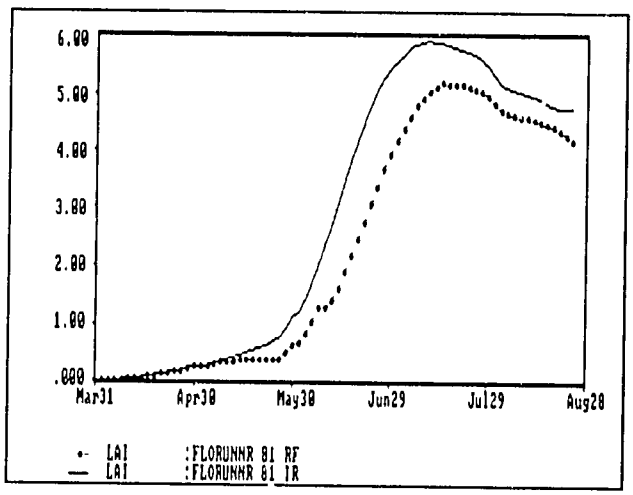
PNUTGRO V1.02

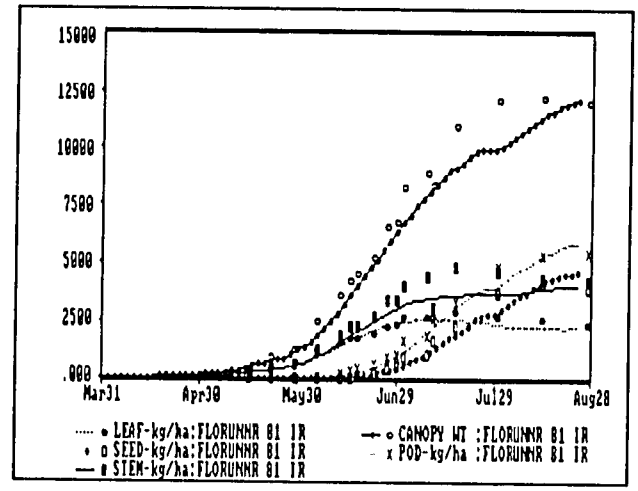
PEANUT CROP GROWTH SIMULATION MODEL

USER'S GUIDE

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

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





May 1989

University of Florida

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International Benchmark Sites Network for Agrotechnology Transfer

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Agronomy Department and Agricultural Engineering Department

University of Florida, Gainesville, Florida 32611

&

IBSNAT Project, Department of Agronomy and Soil Science,

University of Hawaii, Honolulu, Hawaii 96822

Florida Agricultural Experiment Station Journal No. 8420

Department of Agricultural Engineering
10 Frazier Rogers Hall
University of Florida
Gainesville
Florida 32611, U.S.A.

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Chapter 1
INTRODUCTION

PNUTGRO V1.02 is a process-oriented peanut (*Arachis hypogaea* [L.]) crop growth model developed at the University of Florida by an interdisciplinary research team. This version was developed during 1985-1989, by adapting code and changing crop and varietal input parameters from our soybean crop growth simulation model, SOYGRO Versions 4.2, 5.0, 5.41 and 5.42 (Wilkerson et al., 1983a; Jones et al., 1987, 1988, 1989). PNUTGRO V1.02 is most similar to SOYGRO V5.42, having similar inputs and outputs, similar graphics, and benefiting from similar code improvements because it was co-developed with SOYGRO V5.42. The original version of SOYGRO was developed from 1980 to 1983 and published by Wilkerson et al. (1983a) and documented as Version 4.2 (Wilkerson et al., 1983b). Our adaptation to create PNUTGRO V1.0 was guided by previous adaptations of SOYGRO V4.2 and 5.0 to simulate peanut growth (Boote et al., 1983 and 1985, respectively). PNUTGRO V1.02 uses the Ritchie (1985) soil water balance model, which was one of the major improvements made in the release of SOYGRO V5.0 (Wilkerson et al., 1985).

PNUTGRO V1.02 is one of three models developed by our interdisciplinary group to simulate soybean, peanut, and *phaseolus* bean as part of an international research project funded by the IBSNAT[1] (International Benchmark Sites Network for Agrotechnology Transfer) Project. A major objective of this project is to adapt, develop, and use crop models for studying agricultural production potential in various soils and climates around the world. Thus, the present model improvements focused on making our models sufficiently robust to use in other regions of the world where soils and climate differed from those in Florida. The IBSNAT project has 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 peanut model was adapted to be consistent with 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.

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[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.

PNUTGRO V1.02

Improvements in Version 1.0 of PNUTGRO over the 1985 version (Boote et al., 1985) and 1987 ICRISAT preliminary version of PNUTGRO include the addition of: 1) temperature and radiation effects on specific leaf area, 2) effects of specific leaf area on photosynthesis, 3) possibility of allowing effects of temperature, radiation, and photoperiod on root:shoot partitioning (water stress effects were already considered), 4) ability to allow for determinate or indeterminate vegetative growth, 5) use of cohorts of pegs, shells, and seeds with peg addition starting at the R2 beginning peg-growth stage (previously cohorts of shells and seeds were used beginning at the R4 growth stage), 6) soil water in fruiting zone affects rate of peg (early fruit) formation, and 7) improvements in soil water balance. The present version was also compared (calibrated) and validated versus additional data sets. PNUTGRO Version 1.01 released in May, 1988 was created to correct some errors in the soil water balance that were found in Version 1.00. At the same time other changes were made in the code. PNUTGRO Version 1.02 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 PNUTGRO V1.02 are described in the Technical Documentation (Boote et al., 1989).

Currently legume crop growth simulation models are also available for soybean (*Glycine max.* [L.] Merr.), SOYGRO Version 5.42, (Jones et al., 1989) 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

PNUTGRO V1.02 predicts dry matter growth, leaf area index (LAI), crop development, and final yield of peanut 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 PNUTGRO 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 leafspot damage and various types of pest damage on plants and pods. A simulation model of the progression of late leafspot (*Cercosporidium personatum* [Berk. & Curt.] Deighton) on Florunner peanut has currently been developed (Bourgeois, 1989). This model has been coupled to PNUTGRO Version 1.02 and predicts diseased leaf area, loss of leaf area, and disease severity. There are also other factors, particularly in the soil, that are not included in the model (such as various plant nutrients or calcium effects on fruiting). Therefore results from the model should be viewed as potential yields under the specified regimes of weather and soil conditions. Other factors could be limiting and further reduce yields.

Chapter 3
SYSTEM REQUIREMENTS

PNUTGRO V1.02 and earlier versions 1.0 and 1.01 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. PNUTGRO 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 sections of the PNUTGRO 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.PN 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 PNUTGRO 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 PNUTGRO 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 9 s on a AST Premium/386 (20 Mhz), 10.4 s on a Compaq Desk Pro-386 (16 Mhz), 10.8 s on an IBM PS/2-80 (16 Mhz), 26.3 s on an IBM PS/2-60 (12 Mhz), 30.2 s on a Fountain AT (8 Mhz), 41.8 s on an IBM AT (8 Mhz), 1:18 min on

---

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

an IBM PC (4 Mhz) with a math coprocessor and 19:42 min on an IBM PC (4 Mhz) without a math coprocessor.

Chapter 4
GETTING STARTED

PNUTGRO V1.02 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 PNUTGRO. 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 PNUTGRO from the diskettes, then the Program (No. 1) and Graphics (No. 3) diskettes must contain the system file COMMAND.COM. If you run PNUTGRO from your hard-disk, then you will not have to create these system diskettes. The step-by-step procedure for installing PNUTGRO 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 PNUTGRO, 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 PNUTGRO 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 PNUTGRO ON A TWO-DISKETTE SYSTEM

Installation

To run PNUTGRO 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 PNUTGRO.

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 PNUTGRO 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 PNUTGRO V1.02.**"

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 PNUTGRO diskette (No. 3) into drive A:

15. Enter:

```
COPY A:*.* B:
```

The computer should terminate with "*10 files copied.*"

16. Remove diskettes from both drives.

17. Label the diskette from drive B: "**3. GRAPHICS PNUTGRO V1.02.**"

18. Insert DOS diskette into drive A:

19. Enter:

```
DISKCOPY A: B:
```

20. Remove the system diskette from A:

21. Insert the PNUTGRO 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 PNUTGRO V1.02.**"

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, PNUTGRO V1.02.**"

Execution

To run PNUTGRO 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:

   PNGRO

   to start the PNUTGRO 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 peanut growth and yield. An example run is included later in this User's Guide (Chapter 9).

Chapter 6
RUNNING PNUTGRO 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 PNUTGRO

4. Go into the new subdirectory by entering:

   CD PNUTGRO

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

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

   b. Enter:

      COPY A:*.* C:\PNUTGRO

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

   c. Remove PNUTGRO Program diskette from drive A:

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

   e. Enter:

      COPY A:*.* C:\PNUTGRO

   The computer should terminate with "*43 files copied.*"

f. Remove Data diskette from drive A:

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

h. Enter:

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

The computer should terminate with "*10 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:\PNUTGRO
```

The computer should terminate with "*44 files copied.*"

l. Remove the Source Code diskette

Execution

After installing the model in subdirectory PNUTGRO, you are ready to run the model by simply entering PNUTGRO. 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 PNUTGRO
   ```

4. Enter:

   ```
   PNUTGRO
   ```

You will be prompted to select items from screen menus to simulate peanut 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 PNUTGRO 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 PNUTGRO GRAPHICS

The PNUTGRO 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, pod weight, etc.) or weather/soil data. When more than one PNUTGRO simulation is performed in a session, the user can also select the run number for graphical analysis. For example, users could choose to plot pod weight for two different simulations, irrigated and rainfed. Or users could select to view leaf weight, pod 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 pod 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 PNUTGRO 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:\PNUTGRO** or the appropriate drive and directory where you installed PNUTGRO.

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 PNUTGRO V1.02 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 PNUTGRO V1.02 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 PNUTGRO.

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 PNUTGRO.

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: PNGRO is the command to run the model for a floppy disk system and PNUTGRO 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.PN), simulated plant variables (OUT2.PN), weather and soil variables (OUT3.PN), and end of season summary results such as yield and season length, for each season simulated (OUT5.PN). 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.PN, OUT2.PN, and OUT3.PN (Appendix F). File OUT5.PN 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.PN and OUT3.PN 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 third experiment (1981 Irrigated Florunner) and the first treatment in that experiment. Remember to enter GRAPHICS before running PNUTGRO 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 PNGRO (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 PNUTGRO (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.

```
PNUTGRO V1.02

K. J. Boote, J. W. Jones, G. Hoogenboom,
G. G. Wilkerson, and S. S. Jagtap

Agronomy Department and Agricultural Engineering Department
University of Florida, Gainesville, Florida

PNUTGRO is a process oriented peanut growth and yield model
developed at the University of Florida. The PNUTGRO model is
similar to SOYGRO V5.42 which has coding and input-output structures
developed for use in the IBSNAT project. A number of minor
coding changes were made and crop and genotype-specific coefficients
were developed for peanut from literature and experimental data.
PNUTGRO was developed to satisfy needs of the above IBSNAT project
and as part of a Peanut Systems Research project. Users can simulate
experiments for validation and also change model inputs for
sensitivity analysis in adapting it for their own uses.

Program Support : V. C. Chang, and M. D. Fishwick

                                    Press < ENTER > key to continue
```

Press Enter or Return

```
                                        INST.  SITE  EXPT.
   CASE STUDY EXPERIMENTS                ID     ID    NO   YEAR
   ----------------------------------   ----   ----  ----  ----
 1) IRRIGATED, FLORUNNER                UF     GA    01   1976
 2) IRRIGATED, FLORUNNER & STARR        UF     GA    01   1979
 3) IRRIGATED AND RAINFED, FLORUNNER    UF     GA    01   1981
 4) IRRIGATED AND RAINFED, FLORUNNER    UF     GA    01   1984
 5) RAINFED, FLORUNNER,GOOD DISEASE CONTROL UF GA    01   1986

 1] <=== CASE STUDY SELECTED
    <--- NEW SELECTION?                                   INST.  SITE  EXPT.
```

Type: 3 and press Enter or Return

```
TRT                                     INST.  SITE  EXPT.
NO.  IRRIGATED AND RAINFED, FLORUNNER    ID     ID    NO   YEAR
---  ----------------------------------  ----   ----  ----  ----
 1)  IRRIGATED, DRY AT 100 DAP           UF     GA    01   1981
 2)  IRRIGATED, ALL SEASON               UF     GA    01   1981
 3)  RAINFED                             UF     GA    01   1981

 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: FLORUNNR 81 IR (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 : APR  1

INST_ID: UF  SITE_ID: GA  EXPT_NO: 01  YEAR: 1981  TRT_NO:  1
EXPERIMENT   : IRRIGATED AND RAINFED, FLORUNNER
TREATMENT    : IRRIGATED, DRY AT 100 DAP
WEATHER SET  : GAINESVILLE, FLORIDA 1981
VARIETY      : FLORUNNER, std    MATURITY GROUP :  2
IRRIGATION   : ACCORDING TO THE FIELD SCHEDULE
PLANTING DATE: APR  1 PLANTS/M2: 12.87 ROW SPACING: .762m PLANT SPACING: .102m

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   .550 15.800
  .30-  .45  .023    .086   .230   .063   .086   .320 28.000
  .45-  .60  .023    .086   .230   .063   .086   .320 28.000
  .60-  .90  .021    .076   .230   .055   .076   .380 27.600
  .90- 1.20  .020    .076   .230   .056   .076   .400 17.500
 1.20- 1.50  .027    .130   .230   .103   .130   .300   .300
 1.50- 1.80  .070    .258   .360   .188   .258   .200   .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 1981 FLORUNNR 81 IR

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
APR 1	0	SOWING	0.	.00	.0	4.	0.	4.	0.	0.	.000	.000
APR 10	9	EMERGENCE	21.	.03	.1	14.	0.	14.	1.	15.	.000	.000
APR 15	14	V1 STAGE	41.	.06	1.1	20.	1.	21.	1.	23.	.000	.000
MAY 11	40	FLOWERING	313.	.36	7.3	36.	19.	55.	11.	40.	.012	.084
MAY 24	53	R2 STAGE	791.	.72	9.7	53.	45.	98.	11.	74.	.135	.300
JUN 1	61	R3 STAGE	1318.	1.24	11.8	63.	67.	130.	31.	91.	.113	.214
JUN 7	67	R4 STAGE	2108.	2.10	13.9	78.	89.	168.	66.	91.	.000	.000
JUN 28	88	R6 STAGE	6129.	5.43	20.5	101.	189.	290.	204.	136.	.000	.000
JUL 17	107	END POD	9118.	5.87	23.3	108.	278.	387.	258.	136.	.000	.008
AUG 10	131	END LEAF	11039.	5.01	25.2	119.	370.	489.	325.	155.	.129	.180
AUG 24	145	PHYS. MAT	12039.	4.75	25.2	127.	421.	547.	350.	197.	.000	.000
AUG 24	145	HARV. MAT	12039.	4.75	25.2	127.	421.	547.	350.	197.	.000	.000

Press < ENTER > key to continue

Press Enter or Return

RUN NO. 1

UF GA 1981 FLORUNNR 81 IR

	PREDICTED	MEASURED
FLOWERING DATE	131	135
FIRST FULL SIZE POD	158	156
FIRST FULL SEED	179	174
PHYSIOL. MATURITY	236	239
POD YLD (KG/HA)	5830.00	5926.00
SEED YLD (KG/HA)	4364.00	.00
SHELLING PERCENTAGE	78.29	.00
PERCENT MATURE PODS	85.16	50.60
WT. PER SEED (G)	.500	.392
SEED NUMBER (SEED/M2)	913.00	1042.00
SEEDS/POD	1.64	1.77
MAXIMUM LAI	5.94	6.34
BIOMASS (KG/HA) AT R8	12039.00	11981.00
STALK (KG/HA) AT R8	4003.00	4186.00
HARVEST INDEX (PODS)	.484	.495

Press < ENTER > key to continue

Press Enter or Return

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

12 IRRIGATION APPLICATIONS @   .75 EFFICIENCY.

CROP AGE    2    9   13   38   45   51   61   69   71  131  136  141
AMOUNT,mm   6.   8.   8.  17.  17.  17.  17.  19.  25.  19.  23.  19.

         PEANUT POD YIELD :  5829.8 KG/HA [ 5200.6 LBS/ACRE ]


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

Type: N and press Enter or Return

```
Stop - Program terminated.
```

Graphics Display

When you are running PNUTGRO 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:\PNUTGRO, 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    74   236
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. FLORUNNR 81 IR
 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 (Pod/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: 5 (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#,RUN#
LINE# 5 : ENTER VARIABLE#,RUN#
```

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
Type: 8,1 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 PNUTGRO 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).

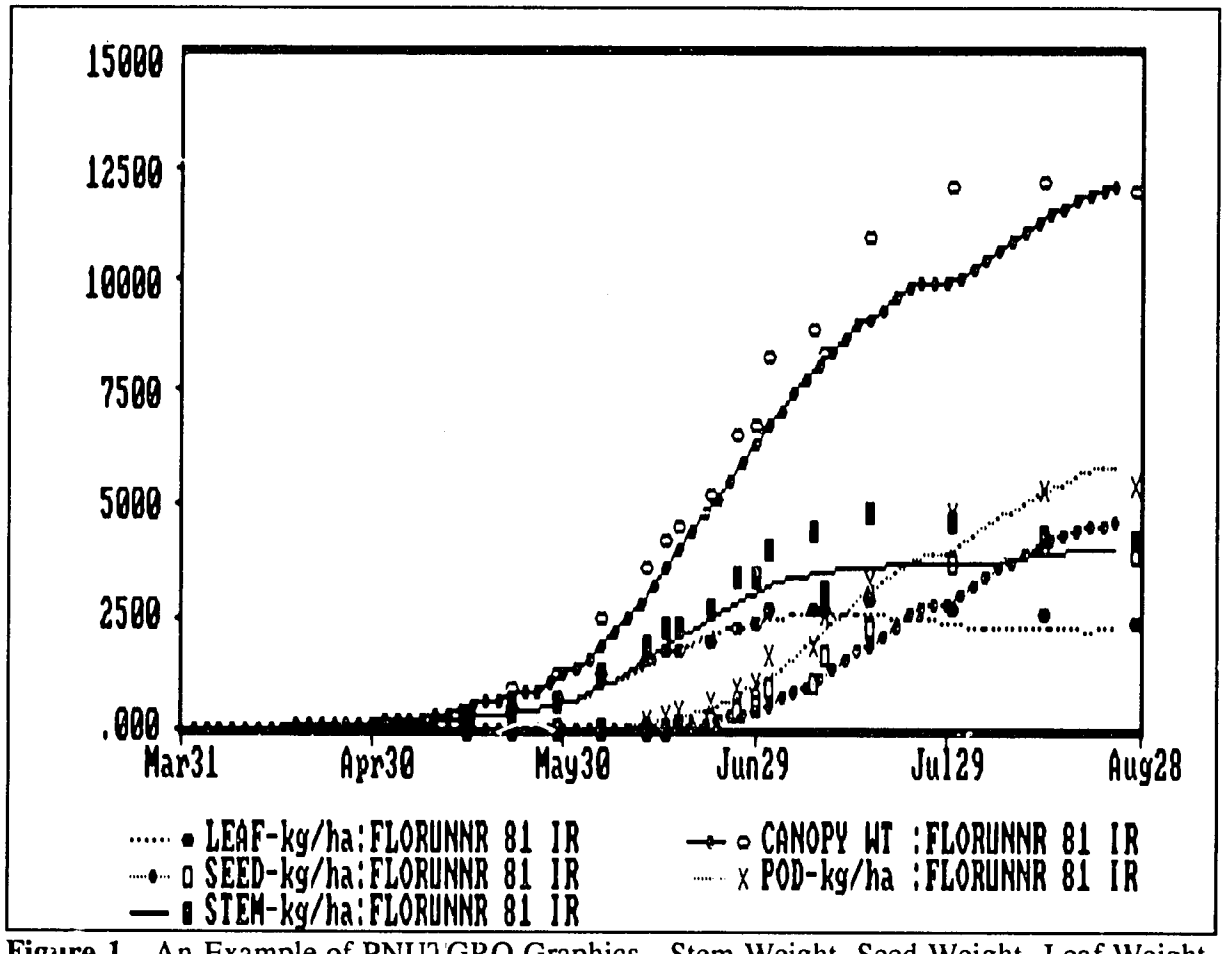

Figure 1. An Example of PNUTGRO Graphics. Stem Weight, Seed Weight, Leaf Weight, Canopy Weight and Pod Weight as a Function of Day of the Year or Date.

```
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 PNUTGRO V1.02 are given in the Technical Documentation (Boote et al., 1989).

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 PNUTGRO V1.02. 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 PNEXP.DIR to indicate to PNUTGRO that a new experiment is available for simulation (See Table 9 where an example is highlighted).

2. If the experiment was performed in a new weather year or site, create a new weather data file (i.e., UFGA0112.W81, 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.PN2 (Table 12). If the data for the soil at the experiment site are already in SPROFILE.PN2, 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. PHFAC3 in the soil profile characterization file should be set by users in the range of 0.6 to 0.84 to represent soil fertility effects on growth rate (the DSSAT retrieval program defaults all PHFAC3 values to 1.00, which could be incorrect for many locations).

4. Create file _____.PN8 with a 2-line entry for each treatment, i. e., management variables. 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., UFGA8101.PN8 is FILE8 for institute UF, site GA, year 81, and experiment 01 (Table 15).

5. Create file _____.PN6 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 _____.PN5 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 FILE5. The number of soil layers and their thicknesses must be exactly the same as those in the soil data file SPROFILE.PN2, 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.PN9 (Table 16). In diskette No. 2, the GENETICS.PN9 data file contains coefficients for several cultivars. "Starr" is typical of short season Spanish types with small pods. "Florunner" is typical of full season runner-market type cultivars. "Florigiant" is typical of full season Virginia-market type cultivars which have large pods for the confectionery trade. "Florunner" is the only cultivar for which the model has been highly validated. If you have a cultivar that is not included in the list, you can choose one from the list using a cultivar that is very similar to the cultivar of your experiment. A detailed procedure to determine genetic coefficients for a new cultivar is described in Chapter 12.

8. For field comparisons, put treatment final yield data (averages) in file _____.PNA, 2 lines per treatment (Table 18). The following field measured variables are defined in file _____.PNA : 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), pod dry yield (shells and seeds, kg/ha) and percent of mature pods at harvest (%). 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 _____.PNB. An example of this file is on the data disk, No. 2, in file UFGA8101.PNB (Table 19). The order and the type of variables for file _____.PNB 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 _____.PNB 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 _____.PNB, excluding the first column which is the Julian day of the year. This Julian day of year 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 _____.PNC. An example of this file is on the data disk, No. 2, in file UFGA8101.PNC (Table 20). Unfortunately no soil water content data were taken during the 1981 peanut 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 _____.PNC 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 _____.PNC 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 _____.PNC, 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.PN0 (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 PNUTGRO 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.PN9, a soil type which is not defined in file SPROFILE.PN2, an experiment or set of treatments which cannot be simulated by the model because the model was not designed to respond to certain factors, i.e. fertility, pests, diseases, or various other reasons. In many 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 PNUTGRO V1.02 (Boote et al., 1989).

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 PEANUT VARIETY

Table 1 gives definitions for the genetic coefficients in the cultivar input file GENETICS.PN9 which allows simulating the response of various cultivars to weather and management conditions (Table 1). These coefficients allow the same peanut crop growth model to predict differences in development, growth, and yield among cultivars when planted in the same environment. The genetic coefficients can be divided into those that relate to development, vegetative growth, and reproductive growth. Each cultivar is described in the GENETICS.PN9 file (Table 16) by seven 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 (particularly those related to season length and pod size). One of the major questions asked by new users of the PNUTGRO model is how to estimate these coefficients when they have not been previously defined for a cultivar. The following is a set of procedures which have been developed to allow users of the model to estimate these genetic coefficients relative to experimental data collected on peanut growth, phenology, and yield under field conditions.

Experimental Conditions and Measurements

Ideally, the experimental conditions for estimating genetic coefficients should be those allowing optimum 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 has encountered 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.

The measurements that are needed to estimate the genetic coefficients are described in IBSNAT Technical Report No. 1 (IBSNAT, 1988) and are referred to as the Minimum Data Set. Daily weather data are required. Soil properties are required so the model can simulate the daily availability and distribution of water in the soil. Data on vegetative and reproductive growth and development are also required. These data are summarized in Table 2.

General Procedures

If experimental data is available, one can use a trial and error approach to estimate the approximate values of genetic coefficients for a genotype that is not described in the genetics file (GENETICS.PN9). 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, a genotype most similar to that of the genotype in question.

Table 1. Definition of Genetic Coefficients that Must Be Estimated for Each Cultivar.

VARTHR(5)	Physiological days (at optimum temperature) from V1 stage to time of flower appearance (R1 stage). We assume no juvenile phase and that floral induction occurs prior to the V1 stage.
VARTHR(6)	Physiological days from beginning flower (R1) to beginning peg (R2 stage).
LNGPEG	Physiological days from beginning peg (R2) to beginning pod (R3 stage). Also, for all pods, this is the duration of the slow pod expansion phase prior to rapid pod expansion.
LAGSD	Physiological days from beginning peg (R2) to beginning seed (R5 stage). Also, for all pods, this is the time from start of slow pod growth until the seed begins to grow in the pod.
VARTHR(8)	Physiological days from beginning flower (R1) until rapid leaf formation (V stage progression) ends. (Peanut is indeterminant, but does slow down node formation.)
VARTHR(9)	Physiological days from beginning flower (R1) until the time a full pod load is "normally" attained (if no drought stress). Capacity to add pods is reduced slowly after this date.
VARTHR(10)	Duration of the total reproductive period from first flower to physiological/harvest maturity (when pods would normally be mature). Since vines stay green and late pods can be added, physiological maturity is not really definable.
TRIFOL	Number of trifoliates produced per day at optimum temperature.
SIZELF	Arbitrary size of a normal leaf at nodes 8 to 10.
SLAVAR	Specific leaf area (cm^2/g) of new growth during peak vegetative growth under optimum temperature.
PGLF	Normalized photosynthetic rate of peanut leaves as compared to soybean (allows using the same soil files and PHFAC3). Values compare to light-saturated leaf assimilation in mg CO_2 m^{-2} s^{-1}.
CNMOB	Fraction of available vegetative protein pool mobilized per physiological day.
LNGSH	Length of time an individual shell may grow, slow plus rapid phase, physiological days.
XFRT	Maximum fraction of daily available assimilate (after subtracting maintenance respiration) which is allowed to go to seeds + shells.
PODVAR	Maximum rate of pod (peg) addition when temperature is optimum, soil water is optimum, P_G is optimum, and partitioning to pods is 1.00. Pods per physiological day.
SHVAR	Maximum growth rate of an individual shell under optimum conditions, mg/shell/day.
SDVAR	Maximum growth rate of an individual seed under optimum conditions, mg/seed/day.
SDPDVR	Number of seeds per pod.
THRESH	Maximum threshing percentage, Seed * 100./(Seed + Shell).

2. Create a new genotype entry into the GENETICS.PN9 file, entering the name of the genotype in question, and the selected initial coefficient values. You may use any file editor, being careful to save as an ASCII file, avoid using the tabs key or save using a NOTABS option.

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

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 to observed data is satisfactory.

5. If more treatments/location combinations are available, note the values estimated for the first treatment/location combination, and then repeat (steps 3 and 4) for all other combinations. When all runs are complete, compute mean values for the genetic coefficients and enter these into the genetic coefficient file.

Table 2. Summary of Minimum Data Required for Running PNUTGRO Version 1.02 to Estimate Genetic Coefficients.

A. Weather

1. Daily Temperature, Maximum and Minimum, C
2. Daily Rainfall, mm
3. Daily Solar Radiation, MJ

B. Management Data

1. Planting Date
2. Row Spacing
3. Plant Population, pl/m^2
4. Cultivar Name and Type

C. Crop

1. Dates of

   a) First true leaf expansion, V-1
   b) 50 % of plants produced first flower (R1 stage)
   c) 50 % of plants produced first peg (R2 stage)
   d) 50 % of plants have first pod beginning to swell (twice the diameter of peg attachment (R3 stage)
   e) 50 % of plants have achieved a fully-expanded pod (R4 stage)
   f) 50 % of plants have begun seed growth in at least one pod, seed cotyledons have begun growth beyond the liquid endosperm stage (R5 stage)

2. Growth Analysis Date (at four or more dates during the season).

   a) Total crop dry weight, g/m^2 (everything except roots)
   b) Leaf dry weight, g/m^2
   c) Stem dry weight, g/m^2
   d) Seed dry weight, g/m^2
   e) Shell dry weight, g/m^2
   f) Number of pods in which seeds have begun, no/m^2
   g) Leaf area index (LAI)

3. Final Harvest Data

   a) Number of pods/m^2
   b) Number of seeds/m^2
   c) Total crop dry weight, g/m^2 (everything except roots)
   d) Pod dry weight, g/m^2 (or shell dry weight)
   e) Seed dry weight, g/m^2

Estimating Phenology Genetic Coefficients

Present evidence indicates that cultivated peanut varieties are responsive primarily to temperature, and that effects of photoperiod, if present, affect mainly the intensity of partitioning and have little or no effect on timing of phenological stages. Thus, users should ignore the coefficients (VARN1, VARN0, VARTH, and VARDH) on the first line, except to be sure that VARTH and VARDH are 1.0. (These four coefficients will not influence phenology in PNUTGRO; however, increasing VARTH above 1.0 defines a non-zero slope of sensitivity to nightlength, and as the model is presently configured, will increase partitioning to vegetation and reduce partitioning to fruits.)

The model computes the effective physiological days, using the temperature function defined in the CROPPARM.PN0 file and 24 hour temperature curve calculated from the input daily maximum and minimum temperature. Physiological days are equivalent to calendar days if temperature is optimum for 24 hours per day. When a specified physiological day threshold is reached, then a given phenological stage will occur. The phenological stage thresholds in Table 3 are given in physiological days.

Table 3 gives phenological thresholds (VARTHR's) for three market type peanut cultivars: short season cultivars similar to Starr, full season runner cultivars similar to Florunner, and full season large podded types similar to Florigiant. Table 4 further illustrates the range of genetic coefficients which may be possible (estimates only by K. J. Boote). There are intermediate cultivars, as well as shorter season types (such as Pronto or very early African lines) and later season types (such as the Southern Runner cultivar in the USA). Short season cultivars may emerge and reach the V1 stage slightly earlier (VARTHR(1) and VARTHR(2), and may flower and begin pegging somewhat earlier (VARTHR(5) and VARTHR(6)). The most significant differences in long versus short season cultivars is the length of their reproductive period, especially from flowering to harvest maturity (VARTHR(10)).

The variable VARTHR(4) is the threshold of physiological days (PD) from the V-1 stage to floral expression, which appears to vary from about 14 to 20 PD. Using the "test" genetic coefficients for a short season cultivar, the VARTHR(4) should first be set to 15.3, and then varied in subsequent runs until the time to first flower is accurately predicted.

For calibration of other thresholds versus field-observed phenological stages, follow the sequence of steps given in Table 4. Table 4 illustrates the ranges of coefficients expected for the three market type cultivars of peanut. If data is available on date of beginning peg (R2), adjust threshold of VARTHR(6) to predict this date.

The next two phenological coefficients (LNGPEG and LAGSD) have dual use. For example, LNGPEG defines the physiological days from beginning peg (R2) until the beginning pod stage (R3). LNGPEG also defines the duration of the slow phase of pod expansion until beginning of rapid pod expansion, for subsequently set pods. This phase is fairly stable at 4.0 to 6.5 physiological days (5 to 8 calendar days at Gainesville). The coefficient LAGSD defines the

time from beginning peg (R2) until beginning seed (R5). This coefficient is similarly used to describe the time of the first events on the plant as well as for latter set cohorts of pegs. Experience indicates that the timing of beginning seed in a given pod is very close to the timing of full expansion of the pod, with only about 2 days delay in start of seed growth. Thus, if data is available on date of either R4 or R5 stages, we adjust the LAGSD coefficient to match the observed date. The LAGSD coefficient is greater for most larger-podded cultivars, and may range from 10 to 17 PD.

Probably the most important coefficient is VARTHR(10), because this describes the physiological days from beginning flower (R1) to physiological/harvest maturity (R8). It is important because it sets the length of the reproductive period, and is a primary determinant of the pod filling period. Thus, it has a major impact on yield potential. Because of the rather indeterminate and stay-green nature of peanut (if protected from disease, drought, and frost), there is no conveniently observed date of optimum harvest maturity. You may wish to set VARTHR(10) to simulate the exact final harvest date of your experiment since that way the yield and other traits will be simulated to the exact date of your experimental harvest. Remember,

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

COEFFICIENT †	SHORT SEASON (SPANISH)	FULL SEASON (RUNNER-TYPE)	FULL SEASON (VIRGINIA-TYPE)
VARTHR(1)	4.60	5.00	5.00
VARTHR(2)	7.70	8.30	8.30
VARTHR(5)	15.3	15.7	16.3
VARTHR(6)	7.00	8.00	8.00
VARTHR(7)	31.0	37.6	37.6
VARTHR(8)	57.55	70.00	70.00
VARTHR(9)	43.00	54.00	54.00
VARTHR(10)	71.50	87.00	86.40
TRIFOL	0.423	0.423	0.423
SIZELF	20.0	20.0	20.0
SLAVAR	245.	245.	245.
PGLF	1.384	1.384	1.384
CNMOB	0.037	0.029	0.029
LNGPEG	5.5	5.5	5.5
LAGSD	11.0	11.0	14.0
LNGSH	19.0	19.5	22.0
XFRT	0.77	0.85	0.81
PODVAR	22.0	18.5	11.0
SHVAR	16.8	19.0	37.9
SDVAR	14.9	17.5	24.5
SDPDVR	1.8	1.7	1.7
THRESH	77.0	80.0	74.0

† The values given here are based primarily on experi ents with the Florunner cultivar (full season runner-type). Values, especially for short season (Spanish) and full season Virginia-type, may change as more data is acquired.

before you simulate for other general situations, you should set the VARTHR(10) to give you the normal expected maturity date for your selected cultivar. The values for VARTHR(10) for the many cultivars in the GENETICS.PN9 file are little more than guesses, and require further work. For the Florunner cultivar, simulated maturity is at 139 calendar days, based on four Gainesville planting dates. This may be a bit long since Florunner is stated to be a 135-day cultivar.

Estimating Vegetative Growth Coefficients

These coefficients are not as important as phenology coefficients, and should be adjusted only if adjustments to phenology and pod growth coefficients are insufficient to describe genotypic differences in growth and yield. TRIFOL can be varied until the V-stage vs. time is predicted, and SIZELF can be varied within the limits given in Table 3 to fit leaf area vs. time during early vegetative growth until V-8 stage occurs.

If data on LAI and leaf mass were collected, then you can compute the specific leaf area (SLA), and may wish to vary the SLAVAR to give a closer fit to SLA during peak vegetative growth. The CNMOB coefficient is not critical to set, but it can be adjusted if you have data on % N in leaf tissue vs. time.

Reproductive Growth Coefficients

These coefficients are important in defining the ability of the cultivar to develop a pod load and in determining seed filling period duration and in determining final seed size and shelling % at harvest. The coefficients SHVAR, SDVAR, SDPDVR, PODVAR, XFRT, LNGSH, LAGSD, and LNGPEG are among those influencing reproductive growth.

If you have a new cultivar for which you know seeds per pod (SDPDVR), maximum shelling percentage (THRESH), and mature weight per seed (WTPSD), use the following procedure to compute shell and seed growth traits (SHVAR and SDVAR). Seeds per pod (SDPDVR) should be set based on the final harvest sample (number of seeds divided by number of pods), however, do not go outside of the range suggested in Table 4 unless you have a Valencia type pod for which SDPDVR is about 2.5. (Experience has shown many errors in this harvest estimate.) The value for THRESH should be set from maximum values typical of your cultivar or it can be set from the shelling % of the final harvest if the crop suffered no stress and went to full maturity. Next, compute the weight per seed (WTPSD) from the final harvest sample or better still, use a value typical for your cultivar. With these three values (SDPDVR, THRESH, and WTPSD) plus assuming a fixed value for LNGPEG and LNGSH, we can compute the shell growth rate (SHVAR) needed to create a pod cavity large enough to allow the desired seed size. The calculation also considers the fraction of pod mass remobilized to the seed. Protein mobilization from the shell is based on initial protein (PROSHI) and final protein (PROSHF) fraction of shell tissue. The values for PROSHI and PROSHF are considered constants and are

Table 4. Calibrating Important Genetic Coefficients by Comparison to Observed Phenological Date, Vegetative Traits, and Reproductive Traits.

OBSERVED VARIABLE	COEFFICIENT	SHORT SEASON (SPANISH)	FULL SEASON (RUNNER-TYPE)	FULL SEASON (VIRGINIA-TYPE)
		Phenology & Development (units are physiological days †)		
Date of first flower (R1)	VARTHR(5)	14.0-18.0	15.0-19.0	15.0-20.0
Date of first peg (R2)	VARTHR(6)	6.0-10.0	7.0-12.0	7.0-12.0
Date of beginning pod (R3)	LNGPEG	4.0-6.0	4.5-6.5	4.5-6.5
Date of full-sized pod (R4) and/or begin seed swell (R5)	LAGSD	10.0-12.0	11.0-14.0	11.0-17.0
Time of last leaf expansion ‡	VARTHR(8)	50.0-60.0	60.0-80.0	60.0-80.0
Physiol. or harvest maturity	VARTHR(10)	55.0-80.0	75.0-100.0	75.0-100.0
		Reproductive Growth		
No. Seeds / No. Pods at final harvest sample	SDPDVR	1.7-1.9	1.6-1.8	1.6-1.8
Seed Wt. / Pod Wt. (Shelling %, final harvest)	THRESH	70.0-79.0	70.0-80.0	65.0-76.0
Dry Weight per Seed vs. Time or at final harvest sample §	LNGSH	17.0-20.0	18.0-21.0	19.0-22.0
	& SHVAR	14.0-20.0	16.0-30.0	34.0-48.0
	& SDVAR	13.0-19.0	15.0-22.0	23.0-30.0
No. of pods/m^2 vs. Time ¶	PODVAR	18.0-30.0	14.0-24.0	08.0-16.0
Shell Wt., g/m^2 vs. Time	SHVAR		(see above)	
Seed Wt., g/m^2 vs. Time	SDVAR		(see above)	
Shelling % vs. Time	SDVAR,SHVAR,SDPDVR,THRESH		(see above)	
Harvest Index, Pod Wt. & Veg. Wt. vs Time	XFRT	0.50-0.95	0.45-0.95	0.40-0.95
		Vegetative Growth		
Vstage vs. Time	TRIFOL	0.35-0.45	0.35-0.45	0.35-0.45
LAI vs. Time, prior to V8	SIZELF	15.0-25.0	15.0-25.0	15.0-25.0
SLA vs. Time	SLAVAR	160-260	160-260	160-260
D.M. Accum. Rate (Linear Phase)	CNMOB	0.035-0.045	0.025-0.035	0.025-0.035
Rate of Veg. Prot. Mobilization				
Genotypic Differences in	PGLF	1.25-1.40	1.30-1.45	1.30-1.45
Soil Fertility Effects on D.M. Accum. Rate	PHFAC3 #	0.60-0.85	0.60-0.85	0.60-0.85

† Physiological days are equivalent to actual days if temperature is optimum for 24 hours per day.

‡ Peanut is indeterminate, but there is a point in the life cycle where rate of leaf appearance slows down dramatically. This setting also affects secondary thickening of leaves.

§ LNGSH and SHVAR together control the size of the pod which in turn allows a given size of seed to fill the cavity. If SDVAR is concurrently too low, seed size and the shelling percentage will not reach the desired value before the season ends. If SDVAR is too great, the shelling percentage and pod growth curve will reach a maximum (plateau) too early before harvest.

¶ Count only those pods which have seeds actively growing inside them. If you count every peg and "stalled" pod, your pod number will be twice as great as simulated.

The PHFAC3 coefficient is defined in the soil profile characterization file SPROFILE.PN2.

defined in the crop parameter definition file CROPPARM.PN0.

The following is a rough algorithm for computing the necessary shell growth rate (SHVAR) to give the desired weight per seed (WTPSD). The value "-0.85 * LNGPEG" is because shell growth is only 15 % as rapid during the slow phase (LNGPEG).

$$\text{SHVAR} = \frac{\text{SDPDVR*WTPSD/THRESH-SDPDVR*WTPSD}}{\text{LNGSH-0.85*LNGPEG}} * \frac{\text{1.-PROSHF}}{\text{1.-PROSHI}}$$

After replacing the parameters for the values of the crop parameter file CROPPARM.PN0, the following equation remains :

$$\text{SHVAR} = \frac{\text{SDPDVR*WTPSD/THRESH-SDPDVR*WTPSD}}{\text{LNGSH-0.85*LNGPEG}} * 1.14655$$

The LNGSH, LNGPEG, and shell growth rate are sensitive to temperature in the field. Moreover, LNGSH and LNGPEG respond differently to temperature than does shell growth rate. Shell growth rate has its optimum rate at 23 C with curvilinear decline on either side of 23 C, whereas the durations of phases has its optimum at between 28 to 32 C. The effect is to create smaller pods and seeds as the temperature increases. Because of the integrated effect of temperature over the shell growth period, you will need to do the computation of SHVAR iteratively. Enter your first computed SHVAR, run the model with the desired weather, then increase SHVAR proportionately to give you the desired weight per seed. Figure 2 illustrates the simulated weight per seed in response to input values of SHVAR for 11 cultivars. Figure 2 can be used as a first step; for example, if you want a seed weight of 1.0, you would pick off a value of SHVAR = 43.64 on the X-axis.

Assuming that you have properly calibrated maximum weight per seed WTPSD from THRESH, SDPDVR, and SHVAR as described above, then you can set SDVAR to give you the approximately correct seed filling period. Cultivars differ in this respect. Unpublished data (Boote, 1976) indicates that the effective seed filling period (ESFP) of spanish types, runner types, and Virginia type peanuts are about 30, 40, and 45 days, respectively. The following is a rough algorithm for setting SDVAR from the ESFP for the different market type cultivars. Again, realize that temperature has effects on the actual rate and duration of seed growth.

$$\text{SDVAR} = \text{SHVAR} * \text{THRESH} * \frac{\text{LNGSH-0.85*LNGPEG}}{\text{ESFP*SDPDVR*(1-THRESH)}}$$

For users who do not wish to go through their own compilation of SHVAR and SDVAR, Figure 3 offers a convenient nomogram showing the SHVAR and SDVAR required to obtain a given seed size. Of course, users will need to individually finetune these values for their own cultivars. Experience indicates a need to increase the values slightly, probably to offset for non-optimum temperature and photoassimilate dificiencies encountered. Values in Fig. 3 already consider efffects of cultivar variation in THRESH, LNGSH, and ESFP. Notice that SHVAR

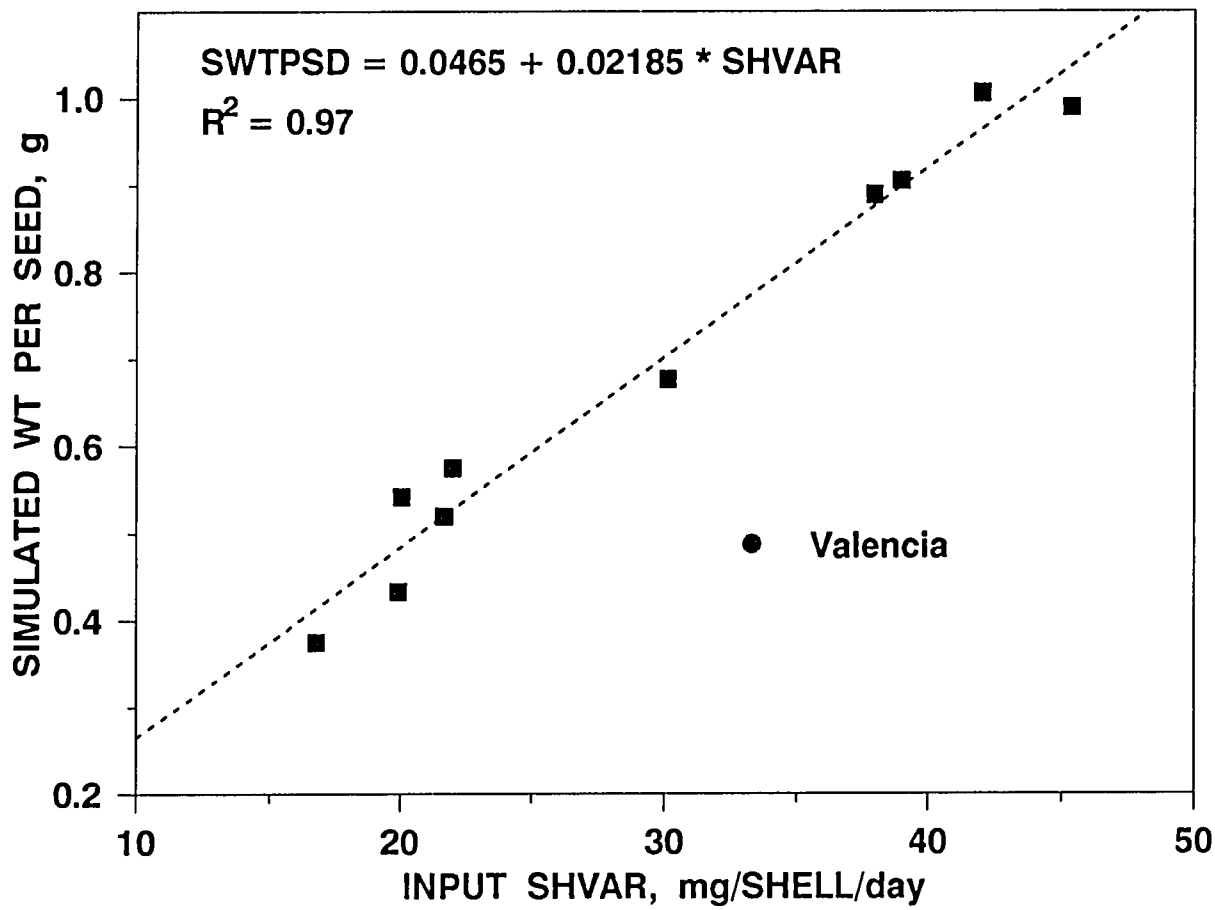

Figure 2. Simulated Weight per Seed in Response to Different Input Values of SHVAR.

for Valencia type cultivars does not fit because it has more seeds per pod.

Having estimated SDPDVR, THRESH, SHVAR, and SDVAR versus final harvest results, you can evaluate effects on pod and seed dry weight accumulation versus time, as well as effect on shelling percentage versus time. You are now ready to make minor adjustments to parameters to better fit seasonal growth data.

If you have data on the increase in pod numbers over time, you can calibrate PODVAR (and/or XFRUIT) to fit the slope of pod number increase over time. CAUTION IS NECESSARY HERE. (If you counted every little pod and peg as a pod in your data set, your experimental pod numbers should be about twice as great as the "actively growing and filling" pods.) If you have data on increase in seed numbers over time, calibrate PODVAR to fit the slope of seed number over time. Reducing the partitioning coefficient (XFRT) reduces the slope of pod or seed numbers as a simple multiplier as follows (XFRT * PODVAR). Reducing XFRT will

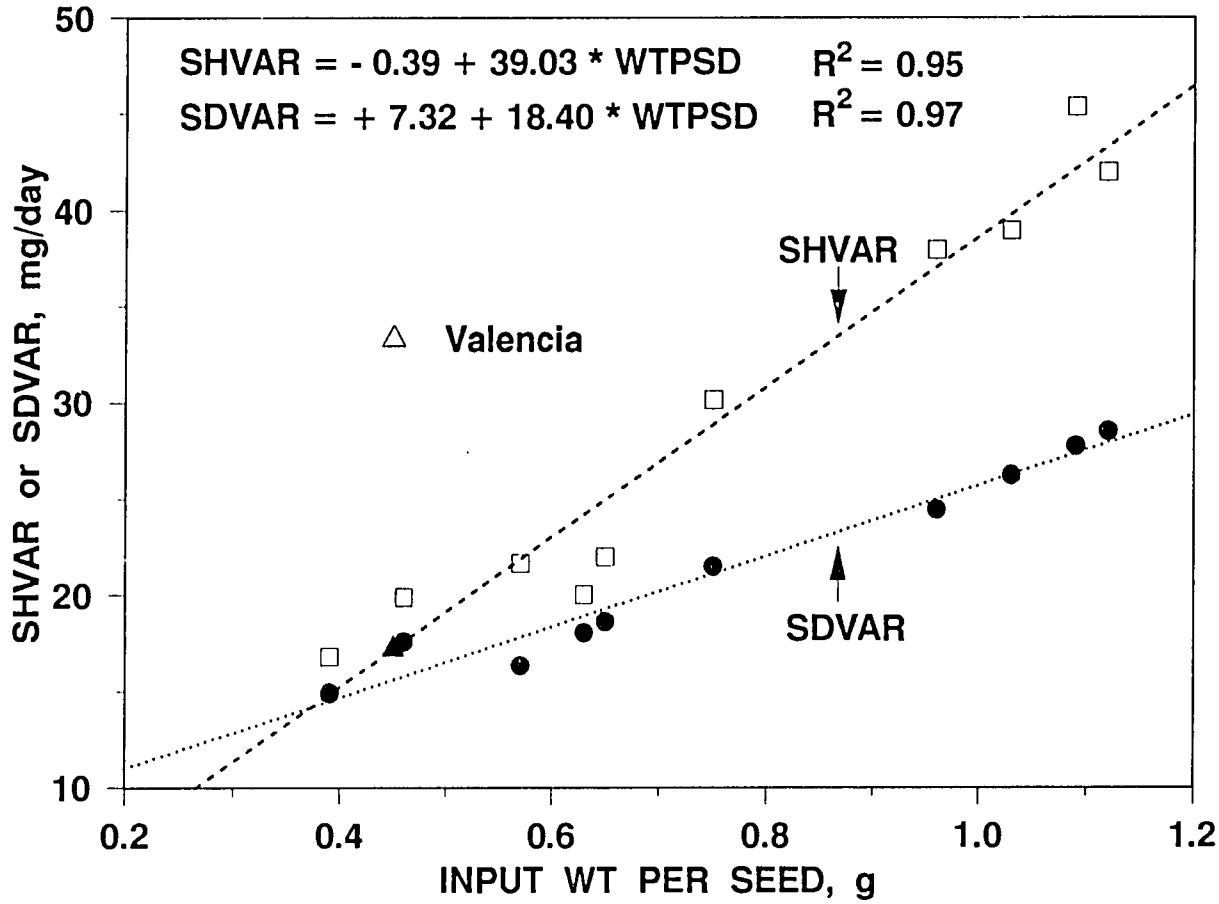

Figure 3. Relationship Between the Desired Individual Seed Weight and the Required Input Values for SHVAR and SDVAR in the Model.

allow LAI and vegetative growth to continue during pod fill, and will "cap" off the increase in pod and seed numbers sooner, and reduce the total rate of seed and pod dry weight accumulation.

If the start of pod number or pod mass versus time is too early, you can increase the values for either VARTHR(5), VARTHR(6), and LNGPEG. If the start of pod number and pod mass is good, but that for seed mass or shelling percentage starts early, then consider increasing LAGSD. If the slopes of pod mass or seed mass versus time are too great, this can be reduced by decreasing the appropriate coefficient: XFRT, PODVAR, SDPDVR, SDVAR, or PHFAC3 (located in the soil profile file SPROFILE.PN2). If shelling percentage is always below the observed data, you need to increase SDVAR (and possibly reduce SHVAR). By contrast, if the shelling percentage is too high, and especially reaches a maximum too soon, you need to decrease SDVAR (and possibly increase SHVAR). If shelling percentage peaks too early, pod

yield potential can be limited because all the pods are filled and the crop has only limited capacity to add new pods.

Biomass Growth Rate

In some cases, we have found the simulated top growth is significantly greater than observed top dry weight during the linear phase of crop growth (mid-season, full canopy, but prior to the middle of seed fill). This may occur even without water stress conditions. Under these situations, we have concluded that factors of soil fertility, pH, and soil-borne pests such as nematodes, maybe causing reductions in photosynthesis or changes in partitioning, or both. In the soil profile defined for the site, you will find a coefficient (PHFAC3) that can be adjusted to increase or reduce the crop growth rate during the linear phase to fit the observed early season biomass accumulation prior to mid-seedfill. Make changes to PHFAC3 only after estimating the other genetic coefficients, because life cycle length and pod growth traits have an impact on the rate of dry matter accumulation. For Florida soils we have used a PHFAC3 of 0.84, but for soybean we have observed values up to 1.0 for Iowa and Illinois soils which presumably are more fertile and have few pests. For peanuts grown on infertile soils in India, we have found PHFAC3 values as low as 0.60 to 0.70. (Note: Values of 1.00 for PHFAC3 in the soil profile file SPROFILE.PN2 are incorrect and merely default values given by the DSSAT soil retrieval program.) Users should begin with PHFAC3 set at 0.84 and subsequently calibrate their own PHFAC3 in the range 0.60 to 0.84 to match the slope of crop dry weight accumulation. If you have drought stress, do not bother to vary PHFAC3 because drought will override any effects. Even for well-watered experiments, you should run subsequent experiments to verify the stability of the selected value for PHFAC3 in a second year or time of year. (Current efforts are being made to include soil nutrient effects explicitly in our GRO models as well as effects of certain nematodes.)

In rare situations where you have two cultivars growing in the same field environment, and one has a steeper slope of dry matter accumulation (not caused by stand or fertility differences), you may wish to vary the PGLF among the cultivars to best fit the slope of total crop dry matter accumulation. Use caution in varying PGLF; always change the PHFAC3 first if you have single cultivar experiments or the cultivars are not grown in the same field in the same growing season.

The reason for the PGLF coefficient in PNUTGRO is that peanut grown in the same field as soybean has a greater crop growth rate than soybean. The CGR of peanut is approximately 40 % greater than that of soybean and is the origin of the PGLF value of 1.384. The PGLF coefficient is primarily to allow us to use the same soil files for peanut and soybean (without changing PHFAC3 from its standard value of 0.84).

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Appendix A
DIRECTORY LISTING OF DISTRIBUTION DISKETTES

Program Disk

Table 5. Directory of PNUTGRO V1.02 disk 1: "*Program Disk.*"

PNUTGRO	BAT	13	5-01-89	8:00a
PNGRO	BAT	68	5-01-89	8:00a
GRO	EXE	139682	5-01-89	8:00a

Table 6. Directory of PNUTGRO V1.02 disk 2: "*Data Disk.*"

UFGA7601	PN5	313	5-01-89	8:00a
UFGA7601	PN6	79	5-01-89	8:00a
UFGA7601	PN8	131	5-01-89	8:00a
UFGA7601	PNB	1677	5-01-89	8:00a
UFGA7601	PNA	95	5-01-89	8:00a
UFGA7901	PN5	625	5-01-89	8:00a
UFGA7901	PN6	53	5-01-89	8:01a
UFGA7901	PN8	261	5-01-89	8:01a
UFGA7901	PNA	189	5-01-89	8:01a
UFGA7901	PNB	139	5-01-89	8:01a
UFGA8101	PN5	937	5-01-89	8:01a
UFGA8101	PN6	430	5-01-89	8:01a
UFGA8101	PN8	391	5-01-89	8:01a
UFGA8101	PNA	283	5-01-89	8:01a
UFGA8101	PNB	1684	5-01-89	8:01a
UFGA8101	PNC	2304	5-01-89	8:01a
UFGA8401	PN5	625	5-01-89	8:01a
UFGA8401	PN6	378	5-01-89	8:01a
UFGA8401	PN8	261	5-01-89	8:01a
UFGA8401	PNA	189	5-01-89	8:01a
UFGA8401	PNB	5421	5-01-89	8:01a
UFGA8601	PN5	625	5-01-89	8:01a
UFGA8601	PN6	79	5-01-89	8:01a
UFGA8601	PN8	261	5-01-89	8:01a
UFGA8601	PNA	189	5-01-89	8:01a
UFGA8601	PNB	3095	5-01-89	8:01a
PNEXP	DIR	1116	5-01-89	8:01a
WTH	DIR	386	5-01-89	8:01a
SIM	DIR	112	5-01-89	8:01a
CROPPARM	PN0	3282	5-01-89	8:01a
SPROFILE	PN2	23359	5-01-89	8:01a
GENETICS	PN9	7021	5-01-89	8:01a
UFGA0310	W76	6989	5-01-89	8:01a
UFGA0112	W79	16130	5-01-89	8:01a
UFGA0112	W81	16131	5-01-89	8:02a
UFGA0112	W84	16175	5-01-89	8:02a
UFGA0112	W86	16131	5-01-89	8:02a
INTRO	DAT	1914	5-01-89	8:02a
OUT1	PN	4046	5-01-89	8:02a
OUT2	PN	13344	5-01-89	8:02a
OUT3	PN	9171	5-01-89	8:02a
OUT4	PN	3	5-01-89	8:02a
OUT5	PN	517	5-01-89	8:02a

Graphics Disk

Table 7. Directory of PNUTGRO V1.02 disk 3: "*Graphics Disk.*"

PNUTGRO	BAT	13	5-01-89	8:03a
PNGRO	BAT	68	5-01-89	8:04a
GRAPH	BAT	27	5-01-89	8:04a
GLABEL	DAT	1068	5-01-89	8:04a
GLABEL2	DAT	784	5-01-89	8:04a
GLABEL4	DAT	498	5-01-89	8:04a
BRUN40	EXE	76816	5-01-89	8:03a
GRPH	EXE	51623	5-01-89	8:03a
HVGRF	EXE	17215	5-01-89	8:03a
MAIN	EXE	11721	5-01-89	8:03a

Source Code

Table 8. Directory of PNUTGRO V1.02 disk 4: "*Source Code.*"

CLEAR	FOR	159	5-01-89	8:04a
CROP	FOR	8481	5-01-89	8:04a
GPHEN	FOR	8413	5-01-89	8:04a
GRO	FOR	5080	5-01-89	8:04a
GROW	FOR	3176	5-01-89	8:04a
IDWTH	FOR	2179	5-01-89	8:04a
PODS	FOR	18054	5-01-89	8:04a
INTRO	FOR	362	5-01-89	8:04a
IPCROP	FOR	4833	5-01-89	8:04a
IPEXP	FOR	6042	5-01-89	8:04a
IPFREQ	FOR	2524	5-01-89	8:04a
IPSENS	FOR	10049	5-01-89	8:04a
IPSOIL	FOR	7220	5-01-89	8:04a
IPTRT	FOR	2973	5-01-89	8:04a
IPVAR	FOR	3554	5-01-89	8:04a
IRRIG	FOR	3075	5-01-89	8:04a
JULIAN	FOR	861	5-01-89	8:04a
NAILUJ	FOR	464	5-01-89	8:04a
PHINIT	FOR	1104	5-01-89	8:04a
PHOTIN	FOR	747	5-01-89	8:04a
PHOTO	FOR	4231	5-01-89	8:05a
ROOTS	FOR	1251	5-01-89	8:05a
SENES	FOR	3428	5-01-89	8:05a
SUNRIS	FOR	1354	5-01-89	8:05a
TABEX	FOR	327	5-01-89	8:05a
VARTY	FOR	3079	5-01-89	8:05a
VEGGR	FOR	8865	5-01-89	8:05a
VERIFY	FOR	2183	5-01-89	8:05a
WATBAL	FOR	15476	5-01-89	8:05a
WCALC	FOR	1902	5-01-89	8:05a
FREEZE	FOR	1149	5-01-89	8:05a
OPSEAS	FOR	9450	5-01-89	8:05a
OPECHO	FOR	4547	5-01-89	8:05a
OPHARV	FOR	7375	5-01-89	8:05a
IPWTH	FOR	4106	5-01-89	8:05a
COMIO	DAT	1439	5-01-89	8:05a
COMSOI	DAT	651	5-01-89	8:05a
COMGRO	DAT	3342	5-01-89	8:05a
COMPILE	BAT	606	5-01-89	8:05a
GROLINK	BAT	60	5-01-89	8:05a
GROOBJ		232	5-01-89	8:05a
GRPH	BAS	39043	5-01-89	8:05a
MAIN	BAS	6136	5-01-89	8:05a
HVGRF	BAS	11263	5-01-89	8:05a

Appendix B
INPUT FILES

Experiment File Directory

Table 9. File "*PNEXP.DIR.*"

```
UFGA7601 IRRIGATED, FLORUNNER                    UFGA0310.W76 SPROFILE.PN2
UFGA7601.PN4 UFGA7601.PN5 UFGA7601.PN6 UFGA7601.PN7 UFGA7601.PN8 GENETICS.PN9
UFGA7601.PNA UFGA7601.PNB OUT1.PN OUT2.PN OUT3.PN OUT4.PN OUT5.PN
UFGA7901 IRRIGATED, FLORUNNER & STARR            UFGA0112.W79 SPROFILE.PN2
UFGA7901.PN4 UFGA7901.PN5 UFGA7901.PN6 UFGA7901.PN7 UFGA7901.PN8 GENETICS.PN9
UFGA7901.PNA UFGA7901.PNB OUT1.PN OUT2.PN OUT3.PN OUT4.PN OUT5.PN
UFGA8101 IRRIGATED AND RAINFED, FLORUNNER        UFGA0112.W81 SPROFILE.PN2
UFGA8101.PN4 UFGA8101.PN5 UFGA8101.PN6 UFGA8101.PN7 UFGA8101.PN8 GENETICS.PN9
UFGA8101.PNA UFGA8101.PNB OUT1.PN OUT2.PN OUT3.PN OUT4.PN OUT5.PN
UFGA8401 IRRIGATED AND RAINFED, FLORUNNER        UFGA0112.W84 SPROFILE.PN2
UFGA8401.PN4 UFGA8401.PN5 UFGA8401.PN6 UFGA8401.PN7 UFGA8401.PN8 GENETICS.PN9
UFGA8401.PNA UFGA8401.PNB OUT1.PN OUT2.PN OUT3.PN OUT4.PN OUT5.PN
UFGA8601 RAINFED, FLORUNNER,GOOD DISEASE CONTROL  UFGA0112.W86 SPROFILE.PN2
UFGA8601.PN4 UFGA8601.PN5 UFGA8601.PN6 UFGA8601.PN7 UFGA8601.PN8 GENETICS.PN9
UFGA8601.PNA UFGA8601.PNB OUT1.PN OUT2.PN OUT3.PN OUT4.PN OUT5.PN
```

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

UFGA GAINESVILLE, FLORIDA 1976	03-01-76	10-31-76	UFGA0310.W76
UFGA GAINESVILLE, FLORIDA 1979	01-01-79	12-31-79	UFGA0112.W79
UFGA GAINESVILLE, FLORIDA 1981	01-01-81	12-31-81	UFGA0112.W81
UFGA GAINESVILLE, FLORIDA 1984	01-01-84	12-31-84	UFGA0112.W84
UFGA GAINESVILLE, FLORIDA 1986	**01-01-86**	**12-31-86**	**UFGA0112.W86**

Table 11. File "*UFGA0112.W81*" (Only the first 50 days of the file are shown.)

```
UFGA 029.63 082.37 12.07  1.00          XLAT, XLONG, PARFAC, PARDAT
UFGA 81   1 13.30  20.0    .0    .0  24.90
UFGA 81   2 14.10  16.7   1.7    .0  25.60
UFGA 81   3 14.20  18.3  -3.9    .0  25.80
UFGA 81   4 12.90  20.0    .0    .0  24.80
UFGA 81   5 12.10  16.1   -.6    .0  24.40
UFGA 81   6  9.70  18.9   -.6    .0  19.20
UFGA 81   7  6.50  18.3   7.8   19.0  13.00
UFGA 81   8 14.50  13.9  -1.1    .0  26.50
UFGA 81   9 10.80  14.4   -.6    .0  20.70
UFGA 81  10 14.30  13.9    .6    .0  26.70
UFGA 81  11 14.20  11.7   -.6    .0  26.00
UFGA 81  12 14.60  11.1  -3.9    .0  25.90
UFGA 81  13 15.20   9.4 -10.0    .0  26.60
UFGA 81  14  9.30  16.7  -5.0    .0  18.00
UFGA 81  15 13.00  20.6   8.3    .5  24.80
UFGA 81  16 11.10  16.7   7.2    .0  21.50
UFGA 81  17 15.20  17.8    .6    .0  27.70
UFGA 81  18 15.50  14.4  -3.9    .0  28.20
UFGA 81  19 14.90  19.4  -3.3    .0  27.90
UFGA 81  20  4.70  16.1   3.3   3.6   9.80
UFGA 81  21 14.70  16.7   7.2   3.8  28.00
UFGA 81  22 12.70  15.6    .6    .0  24.20
UFGA 81  23 12.20  14.4   2.8    .0  23.60
UFGA 81  24 15.10  17.2   2.2    .0  28.40
UFGA 81  25 15.20  20.0  -1.7    .0  28.70
UFGA 81  26 15.00  22.2   1.1    .0  28.90
UFGA 81  27 12.20  22.2   2.2    .0  23.60
UFGA 81  28 10.50  21.1  10.6   3.6  20.60
UFGA 81  29 16.20  20.6    .0    .0  30.40
UFGA 81  30 15.20  23.3  -1.1    .0  28.90
UFGA 81  31 13.80  23.3   5.6    .0  26.50
UFGA 81  32 13.10  25.6   6.7    .0  26.40
UFGA 81  33 14.20  23.9  10.6  24.6  27.10
UFGA 81  34 17.60  16.1  -2.2    .0  32.10
UFGA 81  35 13.00  12.2  -3.9    .0  24.80
UFGA 81  36 16.40  15.0  -2.2    .0  30.80
UFGA 81  37  3.50  14.4   1.1    .8   7.60
UFGA 81  38  8.80  23.9   8.9   1.0  17.90
UFGA 81  39  4.70  20.6  14.4  23.4  10.00
UFGA 81  40 17.40  18.3   4.4    .0  32.60
UFGA 81  41 10.80  26.7   8.9    .0  21.70
UFGA 81  42  8.80  25.6  15.6  15.2  17.70
UFGA 81  43 17.00  21.7  -3.3    .0  31.30
UFGA 81  44  4.00  10.6   3.9    .0   8.50
UFGA 81  45  6.30  15.0   7.8    .0  13.10
UFGA 81  46  9.30  21.1  11.1    .3  19.20
UFGA 81  47 10.60  23.9  10.6    .0  21.70
UFGA 81  48  8.60  24.4  15.0  10.2  18.30
UFGA 81  49  5.50  24.4  17.8   6.9  11.90
UFGA 81  50 17.00  25.6  15.0  75.4  33.40
```

Table 12. File "*SPROFILE.PN2.*"

```
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.PN2.*"

```
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
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Table 12 Continued. File "*SPROFILE.PN2.*"

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 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  0.550  1.40  1.00   .0   .0   .0   .00
  30.   .025   .086   .230   .086   .320  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   .400  1.45  0.10   .0   .0   .0   .00
  30.   .029   .130   .230   .130   .300  1.45  0.04   .0   .0   .0   .00
  30.   .070   .258   .360   .258   .200  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  113.3  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  0.550   .00   .00   .0   .0   .0  15.8
  15.   .023   .086   .230   .086   .320   .00   .00   .0   .0   .0  28.0
  15.   .023   .086   .230   .086   .320   .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   .400   .00   .00   .0   .0   .0  17.5
  30.   .027   .130   .230   .130   .300   .00   .00   .0   .0   .0   0.3
  30.   .070   .258   .360   .258   .200   .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  114.2  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  0.550   .00   .00   .0   .0   .0   .00
  15.   .026   .075   .230   .075   .320   .00   .00   .0   .0   .0   .00
  15.   .026   .075   .230   .075   .320   .00   .00   .0   .0   .0   .00
  30.   .025   .073   .230   .073   .380   .00   .00   .0   .0   .0   .00
  30.   .022   .069   .230   .069   .400   .00   .00   .0   .0   .0   .00
  30.   .023   .072   .230   .072   .300   .00   .00   .0   .0   .0   .00
  30.   .035   .085   .230   .085   .200   .00   .00   .0   .0   .0   .00
  -1.   .0     .0     .0     .0     .0     .0    .0   .0   .0   .0   .0
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Table 12 Continued. File "*SPROFILE.PN2.*"

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17 Quincy, FL   Orangeburg Sandy Loam (F-loamy,silic,thermic Typ Paleudults)
  .13  9.00  00.27  84.00  21.0  29.9 1.0  1.32E-03   82.6  6.67  0.04 0.84
   5.   .125   .198   .294   .198  1.000  1.49  1.73   .0   .0   .0  1.20
  10.   .125   .198   .294   .198   .775  1.49  1.73   .0   .0   .0  1.20
  10.   .125   .198   .294   .198   .775  1.49  1.73   .0   .0   .0  1.20
   9.   .117   .226   .323   .226   .384  1.41   .40   .0   .0   .0  8.10
   9.   .117   .226   .323   .226   .384  1.41   .40   .0   .0   .0  8.10
  10.   .138   .250   .332   .250   .331  1.44   .20   .0   .0   .0  2.30
  11.   .138   .250   .332   .250   .331  1.44   .20   .0   .0   .0  2.30
  38.   .167   .281   .331   .281   .386  1.57   .14   .0   .0   .0  6.60
  43.   .182   .291   .334   .291   .341  1.59   .16   .0   .0   .0  8.30
  30.   .162   .272   .320   .272   .217  1.61   .09   .0   .0   .0 15.30
  28.   .154   .263   .319   .263   .036  1.58   .03   .0   .0   .0 22.30
  -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  0.300  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
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Table 12 Continued. File "*SPROFILE.PN2.*"

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 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.PN2* ."

```
 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 "*UFGA8101.PN5.*"

```
01 UFGA8101
    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.      .    .    .
02 UFGA8101
    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.      .    .    .
03 UFGA8101
    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.      .    .    .
```

FILE6 - Irrigation Management File

Table 14. File "*UFGA8101.PN6.*"

```
01 UFGA8101
 093  06.35
 100  08.38
 104  08.38
 129  17.02
 136  17.02
 142  17.02
 152  17.02
 160  19.05
 162  25.40
 222  19.05
 227  22.86
 232  19.05
  -1  -1.00
02 UFGA8101
 093  06.35
 100  08.38
 104  08.38
 129  17.02
 136  17.02
 142  17.02
 152  17.02
 160  19.05
 162  25.40
 222  19.05
 227  22.86
 232  19.05
  -1  -1.00
03 UFGA8101
 093  06.35
 100  08.38
 104  08.38
  -1  -1.00
```

FILE8 - Treatment Management File

Table 15. File "*UFGA8101.PN8.*"

```
UFGA8101 01 IRRIGATED, DRY AT 100 DAP                    15   02
 091 091  12.87  0.762  0.10  2 00   0.75 00.50   40.0  00.00  0
UFGA8101 02 IRRIGATED, ALL SEASON                        15   02
 091 091  16.08  0.610  0.10  2 00   0.75 00.50   40.0  00.00  0
UFGA8101 03 RAINFED                                      15   02
 091 091  16.08  0.610  0.10  2 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.PN9.*"

```
 01 STARR            01                          VARIETY 1, MAT. GRP 1
 5.00 12.16 01.00 1.0                            VARN1,VARNO,VARTH,VARDH
4.60 7.70 0.0 0.0 15.3  7.00 31.0 57.55  43.0   VARTHR(J),J=1,9
 71.50 0.00                                      VARTHR(J),J=10,11
 16.800 14.900 1.8  22.00  100.                  SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
0.423  20.0 245.  0.0   1.384                   TRI,SIZELF,SLAVAR,STRCON,PGLF
0.77   1.  0.037 0.03   77.0                    XFRT,DETVEG,CNMOB,SHTHIC,THRESH
19.0 11.0 5.5                                   LNGSH,LAGSD,LNGPEG
 02 FLORUNNER, std   02                          VARIETY 2, MAT. GRP 2
 5.00 12.16 01.00 1.0                            VARN1,VARNO,VARTH,VARDH
5.00 8.30 0.0 0.0 15.7  8.00 37.6 70.00  54.0   VARTHR(J),J=1,9
 87.00 0.00                                      VARTHR(J),J=10,11
 19.000 17.500 1.7  18.50  100.                  SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
0.423  20.0 245.  1.0   1.384                   TRI,SIZELF,SLAVAR,STRCON,PGLF
0.85 1.  0.029  0.03    80.0                    XFRT,DETVEG,CNMOB,SHTHIC,THRESH
19.5 11.0 5.5                                   LNGSH,LAGSD,LNGPEG
 03 FLORIGIANT       03                          VARIETY 3, MAT. GRP 3
 5.00 12.16 01.00 1.0                            VARN1,VARNO,VARTH,VARDH
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0   VARTHR(J),J=1,9
 86.40 0.00                                      VARTHR(J),J=10,11
 37.900 24.500 1.7  11.00  100.                  SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
0.423  20.0 245.  1.0   1.384                   TRI,SIZELF,SLAVAR,STRCON,PGLF
0.81 1.  0.029  0.03    74.0                    XFRT,DETVEG,CNMOB,SHTHIC,THRESH
22.0 14.0 5.5                                   LNGSH,LAGSD,LNGPEG
 04 NM VALENCIA A    01                          VARIETY 1, MAT. GRP 1
 5.00 12.16 01.00 1.0                            VARN1,VARNO,VARTH,VARDH
4.60 7.70 0.0 0.0 15.3  7.00 31.0 57.55  43.0   VARTHR(J),J=1,9
 71.50 0.00                                      VARTHR(J),J=10,11
 33.300 17.200 2.5  12.00  100.                  SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
0.423  20.0 245.  0.0   1.384                   TRI,SIZELF,SLAVAR,STRCON,PGLF
0.85   1.  0.037 0.03   77.0                    XFRT,DETVEG,CNMOB,SHTHIC,THRESH
19.0 11.0 5.5                                   LNGSH,LAGSD,LNGPEG
 06 PRONTO           01                          VARIETY 1, MAT. GRP 1
 5.00 12.16 01.00 1.0                            VARN1,VARNO,VARTH,VARDH
4.60 7.70 0.0 0.0 15.3  7.00 31.0 57.55  43.0   VARTHR(J),J=1,9
 70.00 0.00                                      VARTHR(J),J=10,11
 19.800 17.600 1.8  19.00  100.                  SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
0.423  20.0 245.  0.0   1.384                   TRI,SIZELF,SLAVAR,STRCON,PGLF
0.85   1.  0.037 0.03   77.0                    XFRT,DETVEG,CNMOB,SHTHIC,THRESH
18.5 11.0 5.0                                   LNGSH,LAGSD,LNGPEG
```

Table 16 Continued. File "*GENETICS.PN9.*"

```
 12 FLORUNNER, EST    02
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0
 86.40 0.00
 20.000 18.000 1.7  18.00  100.
0.423  20.0 245.  1.0   1.384
0.85 1.  0.029  0.03    80.0
20.0 11.5 5.5
 13 SUNRUNNER         02
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0
 86.40 0.00
 22.000 18.600 1.7  17.50  100.
0.423  20.0 245.  1.0   1.384
0.85 1.  0.029  0.03    79.0
20.0 11.5 5.5
 14 SUNBELT RUNNER    02
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0
 86.40 0.00
 30.100 21.500 1.7  13.50  100.
0.423  20.0 245.  1.0   1.384
0.85 1.  0.029  0.03    76.0
20.0 11.5 5.5
 15 SOUTH RUNNER,     02
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 17.3  9.00 37.6 70.00  54.0
 91.40 0.00
 21.700 16.400 1.7  17.50  100.
0.423  20.0 245.  1.0   1.384
0.75 1.  0.029  0.03    77.0
20.0 12.5 5.5
 16 EARLY BUNCH,      03
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  7.50 37.6 70.00  54.0
 83.40 0.00
 38.600 26.600 1.7  11.00  100.
0.423  20.0 245.  1.0   1.384
0.95 1.  0.029  0.03    75.0
21.0 11.0 4.5
 17 NC7, VIRGINIA     03
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0
 86.40 0.00
 42.000 28.500 1.7  10.00  100.
0.423  20.0 245.  1.0   1.384
0.85 1.  0.029  0.03    75.0
22.0 14.0 5.5
 18 GK3, VIRGINIA     03
 5.00 12.16 01.00 1.0
5.00 8.30 0.0 0.0 16.3  8.00 37.6 70.00  54.0
 86.40 0.00
 45.400 27.800 1.7  10.00  100.
0.423  20.0 245.  1.0   1.384
0.85 1.  0.029  0.03    73.0
22.0 14.0 5.5
```

```
VARIETY 2, MAT. GRP 2
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 2, MAT. GRP 2
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 2, MAT. GRP 2
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 2, MAT. GRP 2
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 2, MAT. GRP 3
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 2, MAT. GRP 3
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
VARIETY 3, MAT. GRP 3
VARN1,VARNO,VARTH,VARDH
VARTHR(J),J=1,9
VARTHR(J),J=10,11
SHVAR,SDVAR,SDPDVR,PODVAR,XMPAG
TRI,SIZELF,SLAVAR,STRCON,PGLF
XFRT,DETVEG,CNMOB,SHTHIC,THRESH
LNGSH,LAGSD,LNGPEG
```

Table 17. File "*CROPPARM.PN0.*"

```
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                    RES30C,R30C2
1.60 1.42 1.44 2.54 2.09 1.74     AGRLF,AGRSTM,AGRRT,AGRSD1,AGRSD2,AGRSH
0.68                              ALPHBR
0.281 0.178 0.115 0.071           PROLFI,PROLFF,PROSTI,PROSTF
0.137 0.094 0.188 0.069           PRORTI,PRORTF,PROSHI,PROSHF
1.00 0.00 0.02                    SENRTE,SENRT2,SENDAY
0.0 0.0 5.0 0.0 14.0 0.12 30.0 0.16          XSTAGE,SENPOR
3.0 0.0 5.0 0.2 10.0 0.6 30.0 0.6            XSENMX,SENMAX
0.65 0.25                         FRSTMF,FRLFF
1.00 1.50 0.00 0.00 0.00          ATOP,TURTOP,ANTOP,ATTOP,APTOP
5                                 NVSPT
0.0 .410 3.3 .400 5.4 .38 7.5 .440 9.6 .44      XLEAF, YLEAF
0.0 .180 3.3 .270 5.4 .32 7.5 .380 9.6 .430     XSTEM, YSTEM
200. 245.  20.0                   FINREF,SLAREF,SIZREF
0.3 540. 220.0  0.40              CONGR1,SLAMAX,SLAMIN,THICKN
7.5                               VSSINK
0.0 0.0 1.0 28.7 2.0 57.5 3.3 99.6 5.4 188.7 7.5 375.8   XVGROW,YVREF
25.0 6500 0.0006 0.1 0.01          RTDEPI,RFAC1,RTSEN,RLDSM,RTSDF
0.0 2.85 3.0 2.85 6.0 2.85 30.0 2.85   XRTFAC,YRTFAC
0.30                              SETMAX
0.150 0.280                       SHLAG,SDPRO
-0.4495 0.125 -0.00269            CONSD1,CONSD2,CONSD3
6  -10.0 11.0 28.0 32.0 55.0 75.0     NTPH,TPHEN(I)
     0.0  0.0  1.0  1.0  0.0  0.0     YPHEN(I)
1 1 1 1 1 1 1 1 4 1 1 1           NTYACC(JJ),JJ=1,12
1 1 1 3 3 3 6 6 6 6 6 11          NPRIOR(JJ),JJ=1,12
0.280 0.21                        WTNEW,PORPT
-2.22 -6.67                       FREEZ1,FREEZ2
12                                NBPDAT
0.,6.37,7.220,10.00,12.78,15.55,21.11,26.67,32.22,37.78,40.56,40.91   BPTMP
0.,0.  ,0.071,0.303,0.586,0.788,0.980,01.00,0.828,0.505,0.061,00.00   BPPHP
10                                NXYTEM
-50. 00.00 14.00 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
4                                 NXFTEM
00.00 26.00 32.00 60.00           XXFTEM
01.00 01.00 01.00 01.00           YXFTEM
0.0  1.6  0.5                     XFRMAX,TURSEN,TURTHR
5 15.0                            NSWBAR DSWBAR
0.00 0.01 0.25  1.00  1.00        XSWBAR
0.00 0.0 1.00 01.00 01.00         YSWBAR
4                                 NSWFAC
00.00  0.01  1.00  1.00           XSWFAC
01.00  1.00 01.00 01.00           YSWFAC
5                                 NXYSLA
-50.00 00.00 15.00 26.00 60.00    XSLA
 00.48 00.48 00.48 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
01.50                             RWUEP1
```

Appendix D
FIELD MEASURED DATA FILES

FILEA - Measured Phenology and Growth Summary Data

Table 18. File "*UFGA8101.PNA.*"

```
UFGA8101  1   0000.   .3923  1042. 1.77  6.34 11981.  4186. 135 239
 156 174   5926.  50.60
UFGA8101  2   0000.   .0000  0000. 0.00  0.00 00000.  0000. 135 239
 156 174   6554.  61.40
UFGA8101  3   0000.   .0000  0000. 0.00  0.00 00000.  0000. 135 239
 156 174   5130.  69.90
```

Table 19. File "*UFGA8101.PNB.*'

```
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  1
12 1 2 3 4 5 6 7 8 9 12 13 14
135.  9.3  0.44    0.   168.     0.   231.    399.     0.     0.  0.000   0.0  187.
142. 11.0  0.93    0.   351.     0.   522.    872.     0.     0.  0.000   0.0  177.
149. 12.8  1.32    0.   564.     0.   682.   1248.     2.     2.  0.002   0.0  194.
156. 14.3  2.68    0.  1203.     0.  1179.   2411.    29.    29.  0.012   0.0  228.
163. 16.4  3.59   45.  1869.    34.  1489.   3594.   237.   203.  0.066  14.1  241.
166. 17.2  3.86   67.  2206.    50.  1714.   4224.   304.   255.  0.072  16.2  225.
168. 17.8  4.11  120.  2294.   115.  1773.   4523.   455.   341.  0.101  25.2  232.
173. 19.3  4.90  151.  2611.   222.  1979.   5191.   601.   379.  0.116  35.6  247.
177. 19.8  5.32  196.  3378.   402.  2281.   6569.   911.   509.  0.139  44.1  233.
180. 20.9  5.61  220.  3317.   533.  2369.   6745.  1059.   526.  0.157  50.2  237.
182. 21.3  6.34  293.  4018.   917.  2645.   8259.  1596.   678.  0.193  57.6  240.
189. 22.3  6.34  310.  4371.  1050.  2653.   8894.  1870.   820.  0.210  56.1  239.
191. 22.5  5.02  397.  3112.  1641.  2653.   8329.  2565.   924.  0.308  64.0  190.
198. 24.0  6.98  509.  4810.  2205.  2865.  10948.  3273.  1068.  0.299  67.4  244.
211. 26.2  5.82  498.  4615.  3650.  2658.  12028.  4756.  1105.  0.395  76.7  219.
225. 25.3  5.63  521.  4327.  4088.  2509.  12106.  5271.  1183.  0.435  77.6  225.
239. 27.2  5.31  574.  4186.  3889.  2340.  11981.  5456.  1566.  0.455  70.8  227.
-1
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  2
-1
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  3
-1
```

Table 20. File "*UFGA8101.PNC.*"

```
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  1
03 4 6 7
095 22.20  30.0  15.6
100 18.20  28.9  15.0
105 18.60  31.7  15.6
110 20.00  31.1  13.9
115 18.00  29.4  14.4
120 21.10  32.2  15.6
125 20.60  31.1  11.1
130 18.00  31.1  13.9
135 23.10  32.2  15.6
140 22.70  32.2  21.1
145 26.50  33.9  17.2
150 25.00  35.0  18.3
155 25.80  35.6  22.8
160 21.90  35.0  21.1
165 26.60  36.7  23.9
170 17.70  37.2  21.7
175 18.00  33.3  21.7
180 22.60  31.1  17.8
185 17.20  31.7  18.9
190 21.20  32.2  21.7
195 22.90  34.4  22.2
200 17.50  32.8  22.8
205 21.00  35.0  22.2
210 19.70  36.1  22.8
215 21.40  35.6  21.1
220 22.80  34.4  23.9
225 21.60  32.8  21.7
230 13.90  33.9  23.9
235 11.30  34.4  23.9
240  2.70  30.6  22.8
-1
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  2
03 4 6 7
095 22.20  30.0  15.6
100 18.20  28.9  15.0
105 18.60  31.7  15.6
110 20.00  31.1  13.9
115 18.00  29.4  14.4
120 21.10  32.2  15.6
125 20.60  31.1  11.1
130 18.00  31.1  13.9
135 23.10  32.2  15.6
140 22.70  32.2  21.1
145 26.50  33.9  17.2
150 25.00  35.0  18.3
155 25.80  35.6  22.8
160 21.90  35.0  21.1
165 26.60  36.7  23.9
```

```
170 17.70  37.2  21.7
175 18.00  33.3  21.7
180 22.60  31.1  17.8
185 17.20  31.7  18.9
190 21.20  32.2  21.7
195 22.90  34.4  22.2
200 17.50  32.8  22.8
205 21.00  35.0  22.2
210 19.70  36.1  22.8
215 21.40  35.6  21.1
220 22.80  34.4  23.9
225 21.60  32.8  21.7
230 13.90  33.9  23.9
235 11.30  34.4  23.9
240  2.70  30.6  22.8
 INST_ID :UF  SITE_ID: GA  EXPT_NO: 01  YEAR : 1981  TRT_NO:  3
03 4 6 7
095 22.20  30.0  15.6
100 18.20  28.9  15.0
105 18.60  31.7  15.6
110 20.00  31.1  13.9
115 18.00  29.4  14.4
120 21.10  32.2  15.6
125 20.60  31.1  11.1
130 18.00  31.1  13.9
135 23.10  32.2  15.6
140 22.70  32.2  21.1
145 26.50  33.9  17.2
150 25.00  35.0  18.3
155 25.80  35.6  22.8
160 21.90  35.0  21.1
165 26.60  36.7  23.9
170 17.70  37.2  21.7
175 18.00  33.3  21.7
180 22.60  31.1  17.8
185 17.20  31.7  18.9
190 21.20  32.2  21.7
195 22.90  34.4  22.2
200 17.50  32.8  22.8
205 21.00  35.0  22.2
210 19.70  36.1  22.8
215 21.40  35.6  21.1
220 22.80  34.4  23.9
225 21.60  32.8  21.7
230 13.90  33.9  23.9
235 11.30  34.4  23.9
240  2.70  30.6  22.8
-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 Index (Pod/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
```

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.PN.*"

```
                              PNUTGRO V1.02
                              =============

INPUT SUMMARY      RUN NO.   1          SIMULATION BEGINS : APR  1

INST_ID: UF  SITE_ID: GA  EXPT_NO: 01  YEAR: 1981  TRT_NO:  1
EXPERIMENT   : IRRIGATED AND RAINFED, FLORUNNER
TREATMENT    : IRRIGATED, DRY AT 100 DAP
WEATHER SET  : GAINESVILLE, FLORIDA 1981
VARIETY      : FLORUNNER, std    MATURITY GROUP :  2
IRRIGATION   : ACCORDING TO THE FIELD SCHEDULE
PLANTING DATE: APR  1 PLANTS/M2: 12.87 ROW SPACING: .762m PLANT SPACING: .102m

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   .550 15.800
  .30-  .45  .023    .086   .230   .063   .086   .320 28.000
  .45-  .60  .023    .086   .230   .063   .086   .320 28.000
  .60-  .90  .021    .076   .230   .055   .076   .380 27.600
  .90- 1.20  .020    .076   .230   .056   .076   .400 17.500
 1.20- 1.50  .027    .130   .230   .103   .130   .300   .300
 1.50- 1.80  .070    .258   .360   .188   .258   .200   .100
            ---------------------------------
    SUM mm   55.2   213.6  453.0  158.4  213.6

  RUN NO.   1        SIMULATION OUTPUT

  UF  GA  1981       FLORUNNR 81 IR

                                                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
-----------------------------------------------------------------------------------
APR  1    0 SOWING       0.   .00   .0   4.   0.   4.    0.    0.  .000  .000
APR 10    9 EMERGENCE   21.   .03   .1  14.   0.  14.    1.   15.  .000  .000
APR 15   14 V1 STAGE    41.   .06  1.1  20.   1.  21.    1.   23.  .000  .000
MAY 11   40 FLOWERING  313.   .36  7.3  36.  19.  55.   11.   40.  .012  .084
MAY 24   53 R2 STAGE   791.   .72  9.7  53.  45.  98.   11.   74.  .135  .300
JUN  1   61 R3 STAGE  1318.  1.24 11.8  63.  67. 130.   31.   91.  .113  .214
JUN  7   67 R4 STAGE  2108.  2.10 13.9  78.  89. 168.   66.   91.  .000  .000
JUN 28   88 R6 STAGE  6129.  5.43 20.5 101. 189. 290.  204.  136.  .000  .000
JUL 17  107 END POD   9118.  5.87 23.3 108. 278. 387.  258.  136.  .000  .008
AUG 10  131 END LEAF 11039.  5.01 25.2 119. 370. 489.  325.  155.  .129  .180
AUG 24  145 PHYS. MAT 12039. 4.75 25.2 127. 421. 547.  350.  197.  .000  .000
AUG 24  145 HARV. MAT 12039. 4.75 25.2 127. 421. 547.  350.  197.  .000  .000
```

Table 23 Continued. File "OUT1.PN."

```
RUN NO.   1

UF  GA  1981          FLORUNNR 81 IR

                      PREDICTED     MEASURED
                      ---------     --------
FLOWERING DATE          131           135
FIRST FULL SIZE POD     158           156
FIRST FULL SEED         179           174
PHYSIOL. MATURITY       236           239
POD YLD (KG/HA)       5830.00       5926.00
SEED YLD (KG/HA)      4564.00           .00
SHELLING PERCENTAGE     78.29           .00
PERCENT MATURE PODS     85.16         50.60
WT. PER SEED (G)         .500          .392
SEED NUMBER (SEED/M2)  913.00       1042.00
SEEDS/POD                1.64          1.77
MAXIMUM LAI              5.94          6.34
BIOMASS (KG/HA) AT R8  12039.00      11981.00
STALK (KG/HA) AT R8     4003.00       4186.00
HARVEST INDEX (PODS)     .484          .495

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

12 IRRIGATION APPLICATIONS @   .75 EFFICIENCY.

CROP AGE    2    9   13   38   45   51   61   69   71  131  136  141
AMOUNT,mm   6.   8.   8.  17.  17.  17.  17.  19.  25.  19.  23.  19.

        PEANUT POD YIELD :  5829.8 KG/HA [ 5200.6 LBS/ACRE ]
```

OUT2 : Crop Data

Table 24. File "*OUT2.PN.*"

PNUTGRO V1.02
==========

RUN 1 FLORUNNR 81 IR
INST_ID: UF SITE_ID: GA EXPT_NO: 01 YEAR: 1981 TRT_NO: 1
EXPERIMENT : IRRIGATED AND RAINFED, FLORUNNER
TREATMENT : IRRIGATED, DRY AT 100 DAP
WEATHER SET : GAINESVILLE, FLORIDA 1981
SOIL TYPE : Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
VARIETY : FLORUNNER, std MATURITY : 2
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	=> => =>
91	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	200.0	=>
92	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	200.0	=>
94	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	200.0	=>
96	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	200.0	=>
98	.00	.00	.0	.0	.0	.0	.0	.0	.0	.0	.0	.000	.0	200.0	=>
100	.11	.03	.0	6.5	.0	14.8	21.3	.0	.0	14.8	.0	.000	.0	200.0	=>
102	.47	.04	.0	9.0	.0	20.1	29.0	.0	.0	20.0	.0	.000	.0	198.3	=>
104	.85	.05	.0	11.7	.0	25.6	37.3	.0	.0	25.3	.0	.000	.0	198.2	=>
106	1.32	.06	.0	14.7	.0	31.5	46.2	.0	.0	30.7	.0	.000	.0	204.2	=>
108	1.80	.08	.0	18.5	.0	38.3	56.8	.0	.0	36.9	.0	.000	.0	201.8	=>
110	2.31	.09	.0	23.2	.0	46.1	69.3	.0	.0	43.8	.0	.000	.0	201.4	=>
112	2.87	.11	.0	28.6	.0	54.7	83.3	.0	.0	51.2	.0	.000	.0	203.6	=>
114	3.45	.13	.0	35.0	.0	64.2	99.2	.0	.0	58.9	.0	.000	.0	207.1	=>
116	3.95	.15	.0	42.1	.0	74.0	116.0	.0	.0	66.9	.0	.000	.0	206.7	=>
118	4.40	.17	.0	49.3	.0	83.6	133.0	.0	.0	75.2	.0	.000	.0	203.7	=>
120	4.90	.19	.0	57.6	.0	94.1	151.6	.0	.0	86.0	.0	.000	.0	202.4	=>
122	5.25	.20	.0	63.8	.0	101.4	165.2	.0	.0	106.9	.0	.000	.0	196.4	=>
124	5.52	.21	.0	71.1	.0	109.8	180.9	.0	.0	125.8	.0	.000	.0	189.6	=>
126	5.98	.24	.0	86.0	.0	126.4	212.4	.0	.0	142.4	.0	.000	.0	193.8	=>
128	6.50	.29	.0	103.5	.0	146.3	249.8	.0	.0	161.8	.0	.000	.0	196.4	=>
130	7.03	.33	.0	122.4	.0	167.2	289.6	.0	.0	173.0	.0	.000	.0	198.3	=>
132	7.54	.39	.0	154.2	.0	202.0	356.1	.0	.0	188.9	.0	.000	.0	194.9	=>
134	7.82	.42	.0	179.0	.0	228.2	407.2	.0	.0	247.9	.0	.000	.0	184.9	=>
136	8.25	.49	.0	218.8	.0	270.1	489.0	.0	.0	291.8	.0	.000	.0	182.1	=>
138	8.72	.57	.0	262.6	.0	313.5	576.0	.0	.0	345.7	.0	.000	.0	181.1	=>
140	9.02	.58	.0	281.1	.0	331.2	612.3	.0	.0	413.4	.0	.000	.0	176.5	=>
142	9.35	.64	.0	319.8	.0	369.2	689.0	.0	.0	459.4	.0	.000	.0	174.2	=>
144	9.73	.72	.0	373.7	.0	417.7	791.4	.0	.0	519.8	.0	.000	.0	172.6	=>
146	10.05	.76	.0	403.6	.0	444.6	848.5	.2	.2	593.9	.0	.000	.0	171.1	=>
148	10.73	.95	.0	490.5	.0	524.2	1015.4	.7	.7	631.0	.0	.001	.0	180.7	=>
150	11.35	1.12	.0	586.5	.0	607.8	1196.1	1.8	1.8	684.1	.0	.002	.0	184.9	=>
152	11.78	1.24	2.9	651.9	.0	662.2	1318.0	3.9	3.9	755.0	.0	.003	.0	186.7	=>
154	12.46	1.47	11.7	773.1	.0	759.7	1541.1	8.3	8.3	803.7	.0	.005	.0	193.6	=>
156	13.20	1.76	22.3	910.4	.0	876.7	1804.0	16.9	16.9	856.2	.0	.009	.0	201.1	=>
158	13.92	2.10	28.7	1066.7	.0	1012.3	2108.0	29.0	29.0	913.7	4.9	.014	.0	207.6	=>

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

160	14.60	2.46	40.9	1245.7	2.1	1163.2	2456.4	47.6	45.4	977.6	12.0	.019	4.5	211.5	=>
162	15.32	2.84	56.9	1418.4	7.2	1304.2	2796.4	73.7	66.5	1037.7	28.8	.026	9.8	217.9	=>
164	16.00	3.22	74.9	1604.8	19.4	1450.6	3169.3	114.0	94.6	1100.6	48.7	.036	17.0	222.0	=>
166	16.68	3.59	91.4	1807.2	36.2	1604.3	3575.4	164.0	127.8	1166.7	69.5	.046	22.1	224.0	=>
168	17.35	3.96	113.6	2004.0	59.4	1748.1	3977.9	225.9	166.5	1228.2	96.8	.057	26.3	226.6	=>
170	18.00	4.31	134.8	2192.1	92.3	1879.1	4374.9	303.7	211.5	1285.9	127.3	.069	30.4	229.4	=>
172	18.61	4.62	160.5	2377.3	137.6	2001.4	4780.3	401.5	263.9	1340.9	155.4	.084	34.3	231.1	=>
174	19.20	4.90	187.3	2537.5	191.4	2100.9	5151.5	513.2	321.7	1386.8	193.1	.100	37.3	233.1	=>
176	19.74	5.14	214.7	2701.8	258.9	2197.1	5544.3	645.4	386.5	1432.4	229.1	.116	40.1	233.9	=>
178	20.27	5.34	241.4	2859.1	338.3	2283.1	5934.9	792.7	454.4	1474.6	272.9	.134	42.7	234.0	=>
180	20.76	5.52	267.8	3005.4	436.2	2359.0	6329.1	964.7	528.5	1512.4	318.4	.152	45.2	233.8	=>
182	21.16	5.65	293.6	3132.8	550.8	2422.3	6712.1	1157.1	606.3	1544.4	341.0	.172	47.6	233.4	=>
184	21.55	5.77	320.4	3238.3	671.0	2468.6	7062.5	1355.6	684.6	1568.6	387.1	.192	49.5	233.9	=>
186	21.91	5.86	348.3	3329.5	807.4	2504.8	7407.0	1572.7	765.3	1588.0	432.4	.212	51.3	234.1	=>
188	22.21	5.91	373.0	3399.8	954.5	2526.5	7728.1	1801.8	847.3	1613.4	476.0	.233	53.0	233.8	=>
190	22.50	5.93	396.9	3458.9	1118.7	2539.8	8046.5	2047.8	929.2	1624.9	521.6	.254	54.6	233.7	=>
192	22.74	5.94	418.0	3509.2	1295.1	2547.4	8360.0	2303.4	1008.4	1633.9	568.1	.276	56.2	233.3	=>
194	22.95	5.93	431.2	3540.7	1485.7	2543.8	8651.6	2567.1	1081.4	1638.3	613.3	.297	57.9	233.1	=>
196	23.10	5.90	449.4	3565.8	1688.4	2535.4	8931.5	2830.3	1141.9	1640.9	674.7	.317	59.7	232.8	=>
198	23.27	5.87	476.5	3581.9	1873.5	2521.0	9118.0	3015.1	1141.6	1641.2	710.6	.331	62.1	232.8	=>
200	23.43	5.84	503.7	3602.7	2081.1	2510.1	9336.5	3223.6	1142.6	1642.5	733.1	.345	64.6	232.5	=>
202	23.58	5.80	503.7	3625.2	2295.5	2500.1	9564.8	3439.5	1144.0	1644.0	763.9	.360	66.7	232.2	=>
204	23.72	5.76	497.0	3643.1	2507.9	2486.9	9782.8	3652.8	1144.9	1651.6	798.6	.373	68.7	231.7	=>
206	23.79	5.71	473.3	3643.2	2640.1	2466.0	9892.8	3783.7	1143.5	1664.3	804.6	.382	69.8	231.5	=>
208	23.84	5.65	473.3	3637.1	2712.6	2441.8	9931.8	3852.9	1140.3	1667.0	804.6	.388	70.4	231.4	=>
210	23.88	5.51	473.3	3623.0	2773.9	2382.0	9915.8	3910.8	1136.8	1665.3	804.6	.394	70.9	231.3	=>
212	24.05	5.34	473.3	3629.5	2953.0	2314.0	10034.2	4090.6	1137.7	1664.5	804.6	.408	72.2	230.8	=>
214	24.20	5.17	473.3	3641.4	3152.1	2247.3	10177.8	4289.1	1137.0	1664.3	804.6	.421	73.5	230.2	=>
216	24.37	5.13	473.3	3671.9	3350.9	2238.9	10398.0	4487.3	1136.3	1664.7	804.6	.432	74.7	229.2	=>
218	24.60	5.10	473.3	3717.6	3531.6	2236.4	10621.9	4667.9	1136.3	1667.8	804.6	.439	75.7	227.9	=>
220	24.88	5.06	477.8	3767.6	3700.8	2234.3	10839.8	4837.9	1137.2	1671.4	804.6	.446	76.5	226.4	=>
222	25.17	5.01	492.4	3810.8	3856.8	2229.2	11039.1	4999.1	1142.4	1673.7	804.6	.453	77.1	224.7	=>
224	25.17	4.95	505.7	3848.4	4003.8	2222.0	11226.3	5156.0	1152.2	1675.0	804.6	.459	77.7	222.9	=>
226	25.17	4.90	517.5	3882.9	4138.9	2214.2	11402.3	5305.2	1166.3	1675.8	812.2	.465	78.0	221.3	=>
228	25.17	4.85	528.1	3917.7	4265.0	2206.7	11573.4	5449.0	1183.9	1676.7	837.1	.471	78.3	219.6	=>
230	25.17	4.79	537.1	3948.6	4385.2	2197.1	11734.8	5589.2	1203.9	1679.4	859.7	.476	78.5	218.1	=>
232	25.17	4.76	544.6	3961.5	4482.8	2189.8	11848.5	5697.1	1214.3	1678.9	879.8	.481	78.7	217.3	=>
234	25.17	4.76	550.7	3976.3	4530.8	2196.6	11943.0	5770.0	1239.3	1678.6	897.8	.483	78.5	216.5	=>
236	25.17	4.75	555.8	4002.5	4564.0	2206.1	12038.5	5829.8	1265.8	1680.3	913.1	.484	78.3	215.3	=>

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

=>	SEED SIZE	NIT %	WATER STRESS	L1	L2	L3	L4	L5	L6	L7	L8
=>						ROOT LENGTH DENSITY					
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.04	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.05	.03	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.07	.04	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.08	.05	.00	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.10	.06	.01	.00	.00	.00	.00
=>	.0	4.50	1.00	.04	.12	.07	.01	.00	.00	.00	.00
=>	.0	4.50	1.00	.05	.14	.08	.02	.00	.00	.00	.00
=>	.0	4.50	1.00	.07	.15	.09	.02	.00	.00	.00	.00
=>	.0	4.50	1.00	.07	.18	.10	.03	.00	.00	.00	.00
=>	.0	4.50	.96	.07	.19	.11	.03	.01	.00	.00	.00
=>	.0	4.50	.84	.07	.22	.12	.04	.02	.00	.00	.00
=>	.0	4.50	.52	.07	.25	.14	.05	.03	.00	.00	.00
=>	.0	4.50	.66	.07	.29	.16	.06	.04	.00	.00	.00
=>	.0	4.50	1.00	.07	.33	.19	.08	.05	.01	.00	.00
=>	.0	4.50	.88	.07	.37	.21	.09	.07	.02	.00	.00
=>	.0	4.50	1.00	.10	.39	.22	.10	.07	.02	.00	.00
=>	.0	4.50	1.00	.11	.41	.23	.10	.08	.03	.00	.00
=>	.0	4.50	.61	.11	.48	.27	.12	.10	.05	.00	.00
=>	.0	4.50	1.00	.16	.58	.32	.16	.13	.08	.00	.00
=>	.0	4.50	.61	.16	.63	.35	.17	.15	.10	.00	.00
=>	.0	4.50	.42	.16	.74	.41	.21	.18	.14	.01	.00
=>	.0	4.50	1.00	.20	.83	.46	.24	.21	.18	.02	.00
=>	.0	4.50	.56	.20	.88	.49	.25	.23	.19	.03	.00
=>	.0	4.50	.67	.19	.99	.55	.29	.26	.24	.05	.00
=>	.0	4.50	1.00	.25	1.06	.59	.31	.29	.26	.07	.00
=>	.0	4.50	.90	.24	1.11	.62	.33	.30	.28	.09	.00
=>	.0	4.50	1.00	.29	1.21	.67	.36	.33	.32	.13	.00
=>	.0	4.50	1.00	.33	1.26	.70	.38	.35	.34	.15	.00
=>	.0	4.50	1.00	.35	1.32	.73	.39	.37	.36	.18	.01
=>	.0	4.50	1.00	.41	1.38	.76	.41	.39	.39	.20	.02

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

=>	17.9	4.49	1.00	.44	1.45	.80	.43	.41	.41	.23	.03
=>	25.1	4.49	1.00	.50	1.51	.84	.46	.43	.44	.25	.05
=>	39.7	4.48	1.00	.56	1.57	.87	.47	.45	.46	.28	.06
=>	52.0	4.47	1.00	.62	1.64	.90	.50	.47	.48	.30	.08
=>	61.4	4.45	1.00	.61	1.71	.94	.52	.49	.51	.33	.10
=>	72.5	4.43	1.00	.67	1.76	.97	.54	.51	.53	.36	.12
=>	88.6	4.41	1.00	.72	1.82	1.00	.55	.53	.55	.38	.14
=>	99.1	4.37	1.00	.77	1.87	1.03	.57	.55	.57	.40	.15
=>	113.0	4.34	1.00	.81	1.91	1.05	.58	.56	.59	.41	.17
=>	124.0	4.30	1.00	.85	1.95	1.08	.60	.57	.60	.43	.18
=>	137.0	4.25	1.00	.89	1.99	1.10	.61	.58	.62	.45	.19
=>	161.5	4.21	1.00	.93	2.02	1.12	.62	.60	.63	.46	.20
=>	173.3	4.17	1.00	.93	2.05	1.13	.63	.60	.64	.47	.21
=>	186.7	4.13	1.00	.91	2.08	1.15	.64	.61	.65	.48	.22
=>	200.5	4.09	.88	.89	2.10	1.16	.64	.62	.66	.49	.23
=>	214.5	4.04	1.00	.91	2.12	1.17	.65	.63	.67	.50	.23
=>	228.0	4.00	1.00	.92	2.13	1.18	.65	.63	.67	.51	.24
=>	242.2	3.95	1.00	.93	2.14	1.18	.66	.63	.68	.51	.24
=>	250.3	3.90	1.00	.94	2.14	1.18	.66	.64	.68	.51	.24
=>	263.7	3.84	1.00	.94	2.15	1.19	.66	.64	.68	.51	.24
=>	283.9	3.79	1.00	.95	2.15	1.19	.66	.64	.68	.52	.24
=>	300.5	3.73	1.00	.95	2.15	1.19	.66	.64	.68	.52	.25
=>	314.0	3.68	.75	.96	2.15	1.19	.66	.64	.69	.52	.25
=>	328.1	3.62	.33	.96	2.17	1.20	.67	.65	.69	.53	.25
=>	337.1	3.57	.26	.94	2.16	1.21	.67	.65	.70	.53	.26
=>	344.8	3.50	.29	.92	2.14	1.21	.67	.65	.70	.53	.26
=>	367.0	3.44	1.00	.92	2.14	1.21	.67	.65	.70	.54	.26
=>	391.8	3.39	1.00	.93	2.15	1.21	.67	.65	.70	.54	.26
=>	416.5	3.33	1.00	.93	2.15	1.21	.67	.65	.70	.54	.26
=>	438.9	3.27	1.00	.94	2.15	1.21	.68	.65	.70	.54	.27
=>	460.0	3.22	1.00	.95	2.16	1.22	.68	.65	.70	.55	.27
=>	479.4	3.16	1.00	.95	2.17	1.22	.68	.65	.70	.55	.27
=>	497.6	3.10	1.00	.96	2.17	1.22	.68	.65	.70	.55	.27
=>	509.6	3.04	1.00	.96	2.17	1.23	.68	.66	.70	.55	.27
=>	509.5	2.98	1.00	.97	2.18	1.23	.68	.66	.70	.55	.28
=>	510.1	2.92	1.00	.97	2.18	1.23	.68	.66	.69	.55	.28
=>	509.5	2.85	1.00	.98	2.19	1.23	.69	.66	.69	.56	.28
=>	504.7	2.85	1.00	.98	2.18	1.23	.69	.66	.69	.55	.28
=>	499.8	2.85	1.00	.98	2.19	1.23	.69	.66	.69	.55	.28

OUT3 : Soil Water and Weather Data

Table 25. File "*OUT3.PN.*"

PNUTGRO V1.02
==========

RUN 1 FLORUNNR 81 IR
INST_ID: UF SITE_ID: GA EXPT_NO: 01 YEAR: 1981 TRT_NO: 1
EXPERIMENT : IRRIGATED AND RAINFED, FLORUNNER
TREATMENT : IRRIGATED, DRY AT 100 DAP
WEATHER SET : GAINESVILLE, FLORIDA 1981
SOIL TYPE : Millhopper Fine Sand (Loamy,silic,hyperth Gross. Paleudults)
VARIETY : FLORUNNER, std MATURITY : 2
IRRIGATION : ACCORDING TO THE FIELD SCHEDULE

JUL	---------- AVERAGE ----------							PERIOD		SOIL WATER CONTENT W/DEPTH								TOTAL
DAY	EP	ET	EO	SR	HLIGHT	MAX	MIN	RAIN	IRRIG	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	PESW
91	.0	3.5	4.7	19.30	12.30	30.6	17.8	.0	.0	.019	.084	.086	.086	.086	.076	.076	.130	154.9
92	.0	.2	5.9	25.10	12.33	27.8	16.7	.0	.0	.018	.083	.086	.086	.086	.076	.076	.130	154.7
94	.0	.6	5.2	21.40	12.39	30.6	17.8	.0	6.3	.019	.085	.087	.086	.086	.076	.076	.130	155.1
96	.0	.7	5.9	26.10	12.45	27.8	12.2	.5	6.3	.018	.082	.087	.086	.086	.076	.076	.130	154.7
98	.0	.1	3.4	15.50	12.51	25.6	11.7	.5	6.3	.018	.079	.087	.086	.086	.076	.076	.130	154.4
100	.0	4.3	4.3	18.20	12.57	28.9	15.0	.5	14.7	.032	.088	.089	.086	.086	.076	.076	.130	156.3
102	.2	.4	5.9	24.60	12.63	31.1	13.9	.5	14.7	.019	.083	.088	.086	.086	.076	.076	.130	154.9
104	.3	5.2	5.8	23.90	12.68	31.7	15.6	.5	23.1	.019	.087	.087	.088	.086	.076	.076	.130	155.6
106	.2	.3	3.0	12.90	12.74	26.1	17.2	.5	23.1	.018	.082	.086	.088	.086	.076	.076	.130	154.9
108	.4	.5	5.5	23.10	12.80	31.1	13.3	.5	23.1	.018	.076	.084	.088	.086	.076	.076	.130	153.9
110	.4	.5	4.8	20.00	12.86	31.1	13.9	.5	23.1	.018	.070	.081	.087	.086	.076	.076	.130	152.8
112	.5	1.4	5.5	23.10	12.91	30.0	16.1	9.1	23.1	.046	.084	.083	.087	.086	.076	.076	.130	155.9
114	.5	1.3	4.2	17.20	12.97	29.4	18.3	10.1	23.1	.040	.077	.081	.086	.086	.076	.076	.130	154.4
116	.6	1.2	4.4	19.20	13.02	27.8	13.9	10.1	23.1	.018	.069	.078	.085	.086	.076	.076	.130	151.9
118	.9	1.0	6.0	25.10	13.07	31.7	12.8	10.1	23.1	.017	.062	.072	.083	.085	.076	.076	.130	150.0
120	.9	.9	5.1	21.10	13.13	32.2	15.6	10.1	23.1	.017	.057	.066	.081	.085	.076	.076	.130	148.1
122	1.0	1.0	6.9	27.70	13.18	33.3	17.8	10.1	23.1	.017	.053	.061	.077	.083	.076	.076	.130	146.0
124	1.0	1.1	5.8	25.20	13.23	29.4	11.1	10.1	23.1	.016	.050	.058	.072	.080	.076	.076	.130	143.9
126	.6	.7	3.1	12.80	13.28	31.1	17.8	10.1	23.1	.016	.047	.056	.068	.077	.075	.076	.130	142.2
128	.9	1.2	3.7	15.80	13.32	30.0	13.3	11.4	23.1	.016	.045	.054	.065	.073	.074	.076	.130	140.4
130	1.1	2.1	4.3	18.00	13.37	31.1	13.9	11.4	40.1	.065	.081	.060	.064	.071	.074	.076	.130	146.9
132	1.8	2.6	6.0	26.60	13.41	28.9	10.6	11.4	40.1	.036	.061	.058	.063	.068	.073	.076	.130	142.1
134	1.7	2.1	5.6	23.00	13.46	32.2	15.6	11.4	40.1	.017	.051	.054	.060	.064	.069	.076	.130	137.5
136	2.3	6.4	6.5	27.40	13.50	32.2	13.3	11.4	57.2	.073	.082	.057	.058	.061	.066	.076	.130	142.0
138	2.5	3.3	6.5	24.00	13.54	35.6	16.1	11.4	57.2	.017	.052	.053	.055	.059	.062	.076	.130	133.7
140	1.6	1.6	5.7	22.70	13.58	32.2	21.1	11.4	57.2	.016	.045	.049	.053	.056	.058	.075	.130	130.3
142	1.8	6.6	6.6	29.30	13.61	30.6	10.0	11.4	74.2	.061	.080	.052	.052	.054	.056	.074	.130	134.9
144	2.3	2.4	5.4	22.20	13.65	32.2	17.2	11.4	74.2	.017	.049	.049	.050	.052	.053	.073	.130	127.3
146	1.8	1.9	3.5	14.30	13.68	32.8	18.9	11.4	74.2	.016	.042	.045	.048	.050	.051	.069	.130	123.5
148	3.3	6.0	6.0	24.20	13.71	32.2	21.1	31.2	74.2	.028	.086	.071	.048	.049	.050	.067	.130	131.6
150	4.2	4.4	6.5	25.00	13.74	35.0	18.3	31.2	74.2	.017	.044	.055	.047	.048	.049	.064	.130	122.8
152	2.1	5.0	5.0	19.90	13.77	34.4	16.1	31.2	91.2	.097	.078	.053	.046	.047	.047	.061	.130	128.2
154	4.6	7.7	7.7	27.10	13.79	36.1	22.8	50.5	91.2	.029	095	.087	.063	.047	.046	.060	.129	133.3
156	3.0	5.7	5.7	20.20	13.81	36.1	22.8	60.7	91.2	.096	.080	.071	.061	.046	.046	.058	.129	131.5
158	4.2	7.2	7.2	26.10	13.83	35.6	22.2	66.0	91.2	.036	.066	.064	.058	.046	.045	.057	.129	125.0

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

160	3.7	5.8	5.8	21.90	13.85	35.0	21.1	66.0	110.2	.110	.080	.058	.054	.045	.044	.055	.128	127.3
162	2.6	3.9	3.9	13.70	13.86	36.1	22.8	100.3	135.6	.131	.150	.153	.139	.091	.047	.054	.127	169.3
164	4.9	6.8	6.8	24.80	13.88	35.6	22.8	114.8	135.6	.117	.142	.117	.114	.099	.076	.071	.126	173.3
166	5.7	7.2	7.2	24.30	13.89	37.2	22.8	114.8	135.6	.035	.078	.083	.087	.085	.072	.074	.129	152.4
168	5.9	6.0	6.0	19.20	13.89	38.3	23.9	114.8	135.6	.017	.054	.065	.077	.076	.063	.068	.127	138.6
170	4.3	5.2	5.2	17.70	13.90	37.2	21.7	162.1	135.6	.136	.148	.142	.118	.100	.067	.064	.126	174.8
172	3.7	4.4	4.4	17.70	13.90	33.9	21.7	185.3	135.6	.097	.116	.128	.141	.135	.089	.079	.129	188.0
174	3.4	4.0	4.0	15.00	13.90	35.0	23.3	185.3	135.6	.063	.081	.090	.096	.095	.076	.075	.129	159.5
176	5.8	6.6	6.6	24.60	13.90	35.6	21.1	185.3	135.6	.038	.059	.076	.085	.084	.070	.071	.128	147.4
178	5.4	6.1	6.1	24.10	13.89	34.4	21.1	203.9	135.6	.101	.099	.090	.088	.085	.064	.066	.126	152.9
180	4.7	5.3	5.3	22.60	13.88	31.1	17.8	203.9	135.6	.063	.070	.076	.081	.079	.062	.062	.124	141.6
182	4.5	5.0	5.0	21.00	13.87	32.8	17.2	203.9	135.6	.040	.051	.060	.071	.070	.058	.059	.121	130.0
184	4.8	5.3	5.3	21.00	13.86	34.4	21.1	203.9	135.6	.023	.046	.053	.060	.060	.054	.055	.117	120.3
186	4.9	5.0	5.0	20.10	13.84	33.9	21.7	203.9	135.6	.016	.040	.048	.054	.054	.050	.051	.109	111.3
188	5.1	5.4	5.4	20.60	13.82	35.0	22.2	204.2	135.6	.016	.036	.043	.049	.049	.045	.047	.096	100.8
190	4.7	5.2	5.2	21.20	13.80	32.2	21.7	226.5	135.6	.142	.099	.060	.048	.048	.045	.046	.093	113.5
192	5.6	6.1	6.1	23.00	13.78	35.0	23.3	226.5	135.6	.069	.050	.056	.047	.047	.044	.046	.089	101.6
194	4.5	5.0	5.0	19.50	13.75	34.4	22.2	233.4	135.6	.118	.046	.048	.046	.046	.042	.044	.081	97.6
196	5.3	5.8	5.8	22.40	13.73	34.4	26.1	247.9	135.6	.094	.077	.071	.045	.045	.041	.043	.077	100.4
198	2.5	2.8	2.8	11.20	13.70	32.8	23.3	258.1	135.6	.149	.097	.072	.045	.045	.041	.043	.075	104.1
200	3.9	4.3	4.3	17.50	13.67	32.8	22.8	258.1	135.6	.082	.071	.071	.046	.044	.041	.043	.073	96.6
202	3.7	4.0	4.0	16.90	13.63	28.9	23.9	258.6	135.6	.063	.051	.057	.045	.044	.040	.042	.071	89.7
204	5.2	5.7	5.7	23.00	13.60	33.9	22.2	259.4	135.6	.049	.040	.046	.044	.042	.039	.041	.065	81.6
206	3.3	3.9	7.2	25.80	13.56	36.1	22.2	259.4	135.6	.025	.034	.040	.041	.040	.037	.039	.060	73.3
208	2.7	2.7	6.9	25.20	13.52	35.6	23.3	259.4	135.6	.016	.031	.037	.039	.039	.035	.037	.057	67.2
210	2.4	2.4	5.5	19.70	13.48	36.1	22.8	259.4	135.6	.016	.028	.035	.038	.037	.034	.036	.055	62.2
212	4.0	4.5	4.5	18.40	13.44	32.8	20.6	278.0	135.6	.137	.073	.047	.037	.037	.034	.036	.055	73.6
214	3.8	4.3	4.3	16.30	13.39	35.0	22.8	278.8	135.6	.068	.043	.046	.037	.036	.033	.035	.055	65.6
216	4.8	5.4	5.4	21.70	13.35	33.3	22.8	289.0	135.6	.082	.040	.047	.037	.036	.033	.035	.055	64.7
218	5.2	5.9	5.9	23.50	13.30	33.9	22.8	319.2	135.6	.091	.095	.085	.080	.050	.033	.034	.055	84.1
220	5.2	5.9	5.9	22.80	13.25	34.4	23.9	322.2	135.6	.072	.067	.072	.073	.049	.033	.034	.055	76.5
222	4.8	5.4	5.4	20.10	13.20	35.6	22.2	324.7	154.7	.137	.107	.078	.063	.048	.033	.034	.054	82.4
224	3.4	3.9	3.9	15.70	13.15	32.8	22.2	329.8	154.7	.114	.083	.075	.060	.048	.032	.034	.054	77.0
226	3.5	4.0	4.0	16.30	13.10	33.3	22.2	330.3	154.7	.070	.053	.060	.057	.047	.032	.034	.054	68.2
228	4.9	5.7	5.7	23.00	13.05	33.9	20.6	330.3	177.6	.090	.083	.076	.064	.046	.032	.033	.054	74.9
230	3.0	3.5	3.5	13.90	12.99	33.9	23.9	331.3	177.6	.072	.055	.061	.060	.046	.032	.033	.054	67.6
232	1.4	1.7	1.7	6.80	12.94	32.2	22.2	343.7	196.6	.151	.153	.101	.072	.045	.032	.033	.054	88.2
234	2.9	3.4	3.4	14.20	12.88	30.0	22.2	343.7	196.6	.085	.091	.083	.083	.081	.032	.033	.054	82.6
236	4.4	5.1	5.1	20.90	12.83	31.7	21.7	350.0	196.6	.092	.077	.078	.082	.082	.034	.033	.054	80.9