United States
Department of
Agriculture

Forest Service

**Northeastern Forest
Experiment Station**

General Technical
Report NE-222

OPTIGRAMI V2
User's Guide

Penny S. Lawson
R. Edward Thomas
Elizabeth S. Walker

Abstract

OPTIGRAM! V2 is a computer program available for IBM compatible personal computers with 80286 and higher processors. OPTIGRAM! V2 determines the least-cost lumber grade mix required to produce a given cutting order for clear parts from rough lumber of known grades in a crosscut-first rough mill operation. It is a user-friendly integrated application that includes optimization for species graded under standard National Hardwood Lumber Association grade rules, as well as yellow-poplar and black walnut. Output information includes gross volume of lumber required in each lumber grade, estimated total production cost, board footage of parts generated, percent yield, and range of costs within each lumber grade for which the given solution is valid.

The Authors

PENNY S. LAWSON is a computer programmer with the Northeastern Forest Experiment Station's Forestry Sciences Laboratory at Princeton, West Virginia. She received a B.S. degree in math/computer science and a B.S. degree in computer information systems from Concord College in 1989. She joined the USDA Forest Service in 1990.

R. EDWARD THOMAS is a computer programmer with the Northeastern Forest Experiment Station's Forestry Sciences Laboratory at Princeton, West Virginia. He received a B.S. degree in computer science and philosophy from Concord College in 1988 and an M.S. degree in computer science from West Virginia University in 1993. He joined the USDA Forest Service in 1988.

ELIZABETH S. WALKER is a computer programmer with the Northeastern Forest Experiment Station's Forestry Sciences Laboratory at Princeton, West Virginia. She received a B.S. degree in math and computer science from Concord College in 1985. She joined the USDA Forest Service in 1988.

Manuscript received for publication April 1, 1996.

The computer program described in this publication is available upon request with the understanding that the U.S. Department of Agriculture cannot assure its accuracy, completeness, reliability, or suitability for any other purpose than that reported. The recipient may not assert any proprietary rights thereto nor represent it to anyone as other than a Government-produced computer program.

For an executable copy of the program write to:

USDA FOREST SERVICE
FORESTRY SCIENCES LABORATORY
ATTN: PENNY LAWSON
241 MERCER SPRINGS ROAD
PRINCETON, WV 24740

USDA FOREST SERVICE
5 RADNOR CORP CTR STE 200
RADNOR, PA 19087-4585

May 1996

Contents

1. Introduction

The user-friendly OPTIGRAMI V2 program determines least-cost lumber grade mix and can be used to obtain costs for rough dimension part orders in a crosscut-first rough mill operation. It uses a linear programming technique to determine the least-cost lumber grade mix based on cutting bill requirements and grade-based differences in lumber and processing costs.

OPTIGRAMI V2 was developed to read input files from OPTIGRAMI for PC's (Timson and Martens 1990). OPTIGRAMI V2 is now fully integrated with the linear programming module so all solutions are generated automatically within the program. OPTIGRAMI V2 includes optimization for species graded under the standard National Hardwood Lumber Association (NHLA) grade rules, as well as yellow-poplar and black walnut. Output information includes: gross volume of lumber required in each lumber grade, estimated total production cost, board footage of parts generated, percentage of yield, and the range of costs within each lumber grade for which the given solution is valid.

OPTIGRAMI V2 was developed for IBM[1] compatible personal computers using the C, Pascal, and assembly programming languages. The integrated linear programming modules are ORSYS Turbo Pascal Units provided by Eastern Software Products, Inc.

The yield tables used in OPTIGRAMI V2 will accommodate cutting lengths from 10 to 100 inches and fixed widths to 6 inches. The yield charts were utilized in both OPTIGRAMI for PC's and OPTI-LONG PC version. Yield values used in OPTIGRAMI V2 are listed in Appendix I.

---

[1] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

The yield values used in OPTIGRAMI V2 for OTHER species are derived from nomographs developed by Englerth and Schumann (1969) and yield data developed by Lucas (1973). The yield predictions were developed for hard maple lumber and apply to clear-one face dimension. They may be used for most species graded by the NHLA rules. The maximum length that can be derived depends on the grade:

• First-and-Seconds (FAS)	100 inches
• Selects (SEL)	100 inches
• No. 1 Common (1C)	90 inches
• No. 2 Common (2C)	80 inches
• No. 3A Common (3A)	30 inches

The yield values for YELLOW-POPLAR used by OPTIGRAMI V2 were obtained from charts developed by Martens (1986a). The yield values are derived from nomographs developed by Gilmore et al. (1984). Yields are based on $^4/_4$ kiln-dried yellow-poplar lumber. The dimension cuttings from all grades are clear, two-face, with the exception of the No. 2B grade yield, which is from sound two-face cuttings. For yellow-poplar, the maximum length piece obtainable from each grade is limited to:

• First-and-Seconds (FAS)	100 inches
• First-and-Seconds One Face (F1F)	100 inches
• No. 1 Common (1C)	80 inches
• No. 2A Common (2A)	40 inches
• No. 2B Common (2B)	40 inches

The yield values for BLACK WALNUT used by OPTIGRAMI V2 were developed by Martens (1986b). The yield values were derived from nomographs developed by Schumann (1971) . The yields are based on $^4/_4$ kiln dried walnut lumber with sap no defect for each of the four top grades. The yields apply to clear, one-face rough dimension. The maximum length piece obtainable from each grade is limited to:

• First-and-Seconds (FAS)	100 inches
• Selects (SEL)	90 inches
• No. 1 Common (1C)	80 inches
• No. 2 Common (2C)	70 inches

2. Installation

An easy-to-use installation program is included with OPTIGRAMI V2.

2.1 Minimum Computer System Requirements

1. An IBM AT, 386, 486, Pentium or compatible computer
2. 640K of Random Access Memory (RAM)
3. A hard disk with at least 2 Mb free space
4. MS DOS 4.0 or later (MS DOS is a trademark of Microsoft Corp.)
5. A high-density 3.5-inch or 5.25-inch floppy drive
6. An EGA or VGA graphics display
7. A mouse
8. A printer (optional, but recommended)

2.2 Running the Install Program

To install OPTIGRAMI V2, place the disk in the floppy disk drive and make it the working drive. For example, if the disk is in drive A, enter

```
A:
```

Next, to start the install program, enter

```
INSTALL
```

When the program begins, it displays the screen shown in Figure 1. Press any key to begin installation. There is a brief pause while the program determines the hard drives available on your machine. If the computer has a CD-ROM drive with no disk inserted, you may encounter this error, "**CDR-101: Not ready reading drive D:**". If this occurs, press **F** on the **Abort, Retry, Fail** prompt. The installation will then continue normally.

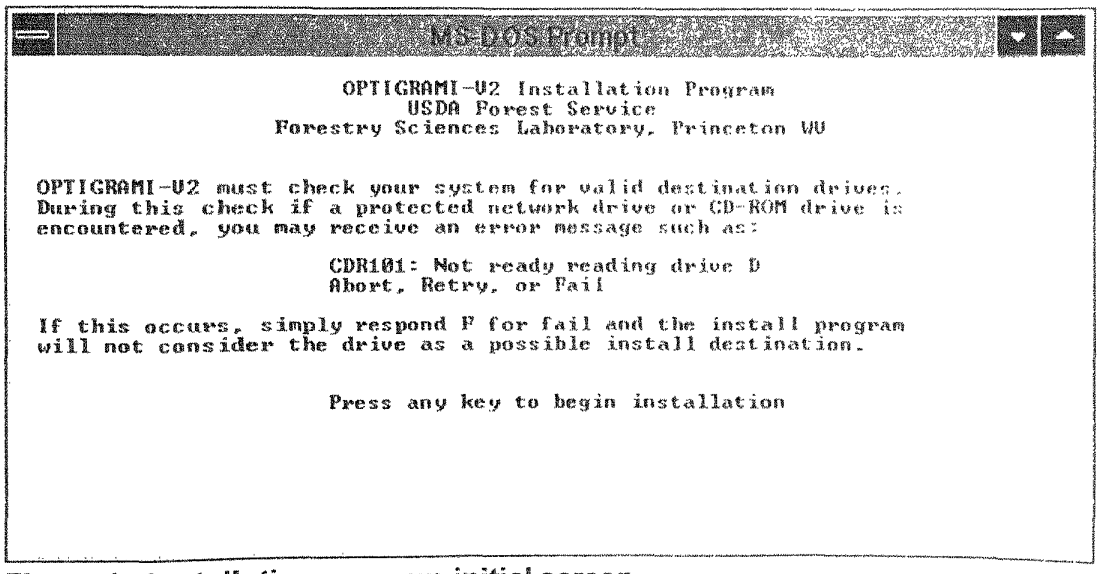

Figure 1. Installation program initial screen.

2.3 Confirming Install Destination

Figure 2 shows the install destination screen with the default destination of drive **C:** and directory `\OPTI2`. If this destination is acceptable, press "C" and proceed to Step 2.5. To install OPTIGRAMI V2 on a different drive or directory, press "M" and proceed to Step 2.4. Press "A" to stop the installation.

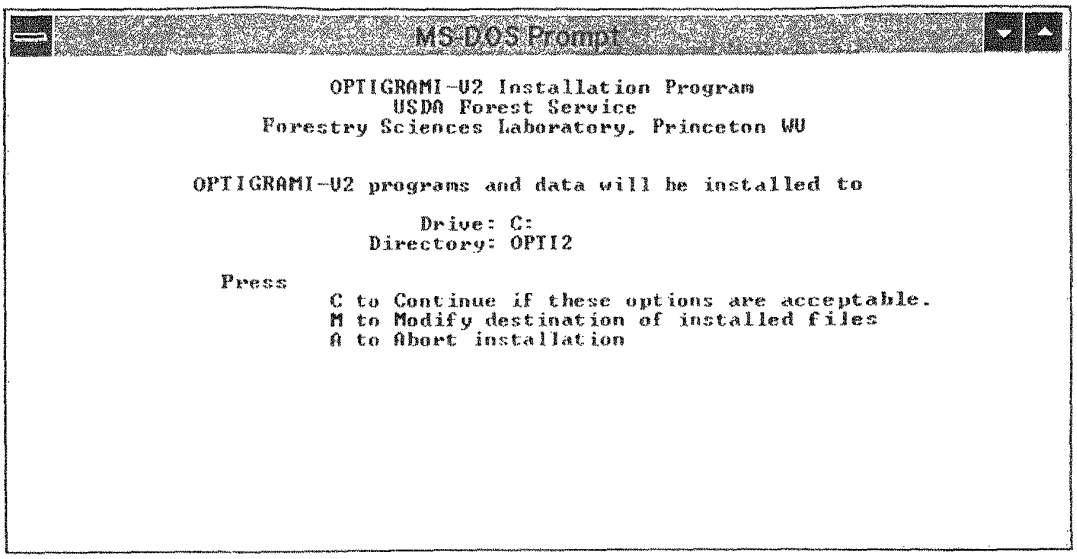

Figure 2. Install destination screen.

2.4 Modifying Install Destination

This step allows you to customize the install location of OPTIGRAMI V2. First, choose a new destination drive from the menu. In the example (Fig. 3), the system check found one hard drive, C:. Enter "1" to select drive C:.

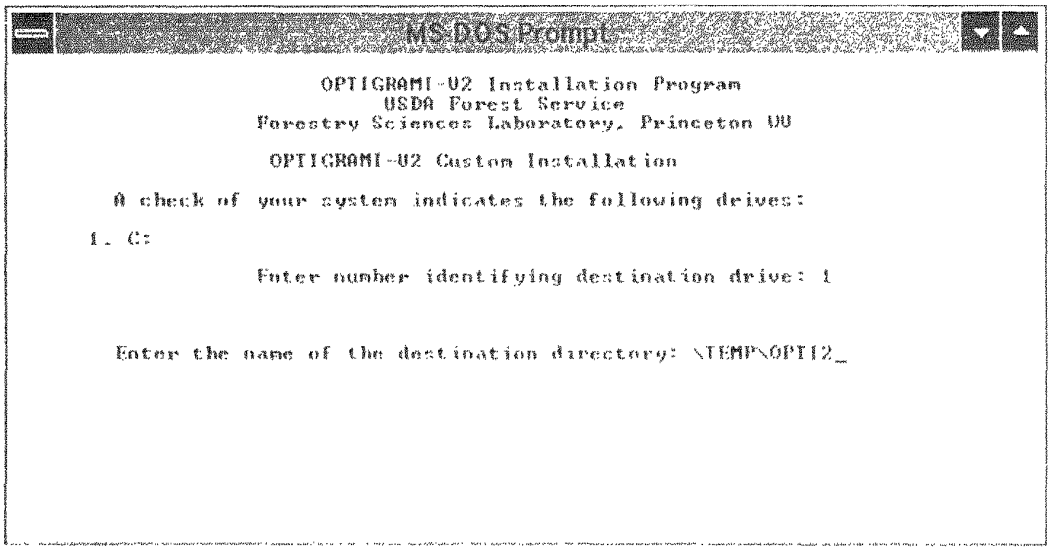

Figure 3. Destination modification screen.

After selecting the drive, you are prompted to enter the name of the installation directory. This may be an existing or new directory. When entering the name of the directory, give the complete path of the directory starting with the root directory. For example, to install OPTIGRAMI V2 in the directory C:\TEMP\OPTI2, at the prompt enter \TEMP\OPTI2

Figure 3 shows this entry. After you enter the new destination, the computer will show the screen in Figure 2 with the new destination drive and directory. Refer to Step 2.3 to continue.

2.5 Software Installation Phase

After the install destination is confirmed, the computer determines if the install directory exists or needs to be created. If the directory exists, you are prompted whether to continue. If you answer "N," the installation will be cancelled. If you answer "Y," OPTIGRAMI V2 will be installed to the directory. As the files are decompressed and copied, the file names scroll down the screen. Please note, OPTIGRAMI V2 seeks confirmation before overwriting any previously existing files. When installation is complete, you will be returned to the DOS prompt. Remove the installation diskette from the floppy disk drive.

2.6 Configuring Your System

The CONFIG.SYS file, located in the root directory of the C: drive, defines devices and run time parameters for your computer. After the OPTIGRAMI V2 files have been copied to your computer, check the CONFIG.SYS file for the following lines:

```
FILES = 30
BUFFERS = 30
```

The sequence, spacing, and location of the lines in the file are not important. It is only important that the values for the FILES and BUFFERS settings are at least 30. If the settings are less than 30, you must edit the CONFIG.SYS file and correct the settings.

After editing the CONFIG.SYS file, you must reboot the computer to effect the changes.

3. Running OPTIGRAMI V2

To start OPTIGRAMI V2, your working drive and directory must contain the OPTIGRAMI V2 files. If you accepted the default installation drive and directory, enter

```
C:
```

followed by

```
CD \OPTI2
```

These two commands will take you to the drive and directory that contain the OPTIGRAMI V2 program.

You are ready to run the OPTIGRAMI V2 application. At the DOS prompt enter

```
OPTI2
```

When OPTIGRAMI V2 begins running, a title screen is displayed. Press "ESC" to escape the program. Press any other key or click the right mouse button to continue.

OPTIGRAMI V2 uses a point and click environment. To choose an item, move the mouse to the menu item or line you desire and press the left mouse button once. Alternately, to choose an item, press the letter of the item you desire. These letters or "hot keys" are highlighted numbers or capital letters-- for example, **R** in "**R**un" and **C** in "**C**utting Bill." A window with arrows (▲ and ▼) to the right allows you to scroll the window's contents. Click on ▼ or press the PAGE DOWN key to scroll the screen down. To close any window, choose the **CANCEL** or **EXIT** item. These items are found in the upper right corner (menu windows) or at the bottom left (list windows) of the screen. A window's hot keys and click items are valid only within that window. For example, if any other windows are open, the click items of the main menu are unavailable.

Several of OPTIGRAMI V2 windows will ask you to enter a value or file name. If you find yourself at one of these prompts by mistake, press ENTER to continue. OPTIGRAMI V2 will return you to the previous window.

4. Choosing a Species for the Program Run

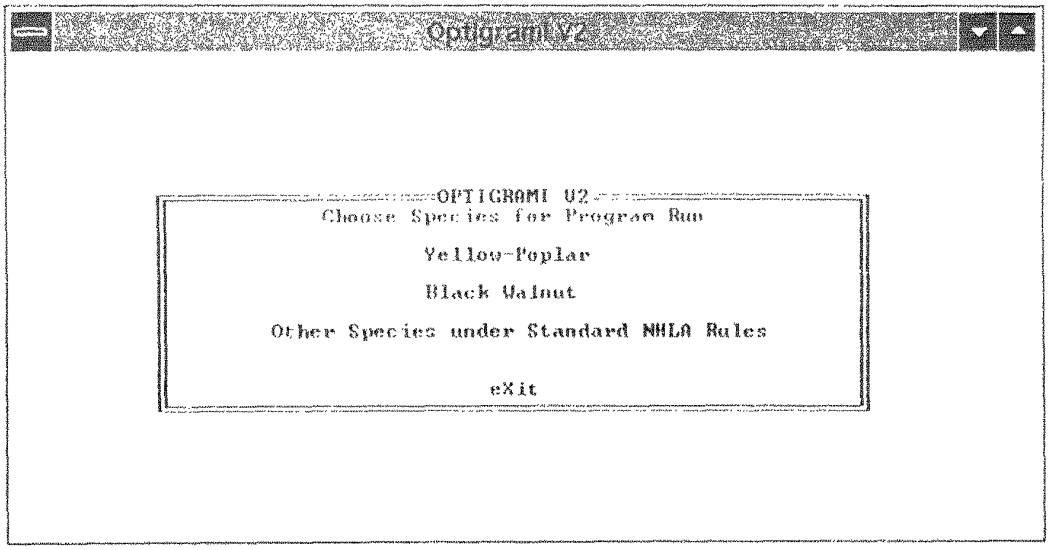

Figure 4. Choose species window.

The opening menu screen for OPTIGRAMI V2 is shown in Figure 4. Select the lumber species or species group you wish to run using your mouse or by entering the highlighted letter of your selection (e.g., **Y**, **B**, or **O**).

After choosing the species for the program run, a pop-up confirmation window will ask you to verify your choice. Click on "**Y**es", or press "Y", to continue to the main menu. Clicking on "**N**o" or pressing "N" will return you to the "Choose Species for Program Run" (Fig. 4) menu where you may choose another species or e**X**it the program.

5. Main Menu

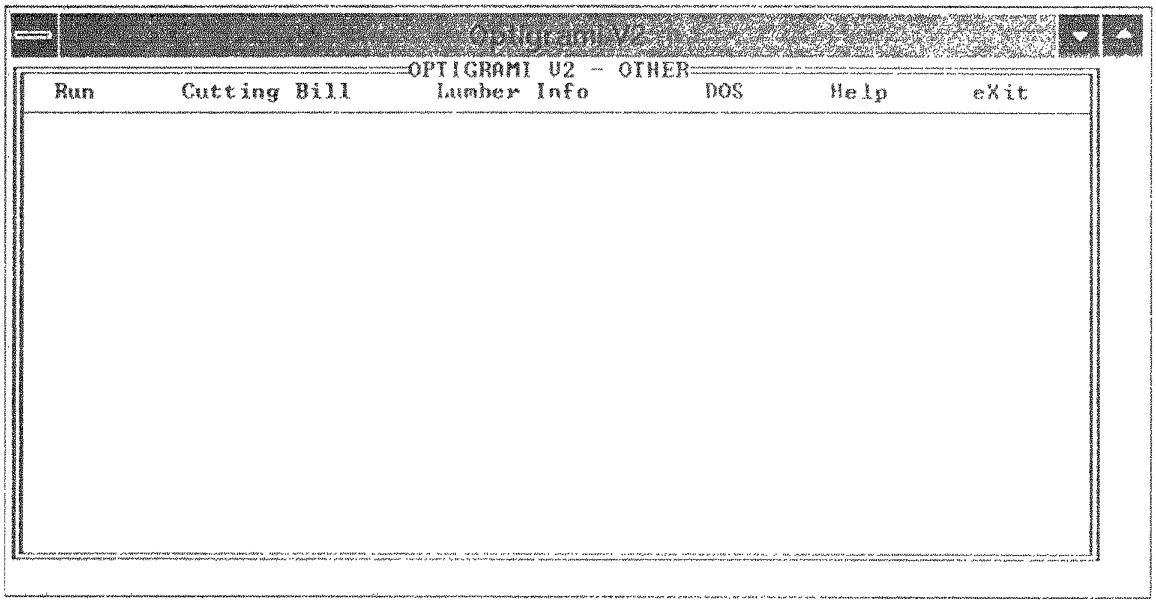

Figure 5. Main menu.

Figure 5 shows the main menu of OPTIGRAMI V2. There is a reminder of the species you have chosen for the program run included in the window title.

To solve a least-cost lumber grade mix problem, you must choose both a "**C**utting bill" and a "**L**umber info" file. You may then "**R**un" the linear program to produce the least-cost grade mix solution. The following sections explain these processes in greater detail.

6. Cutting Bill Setup

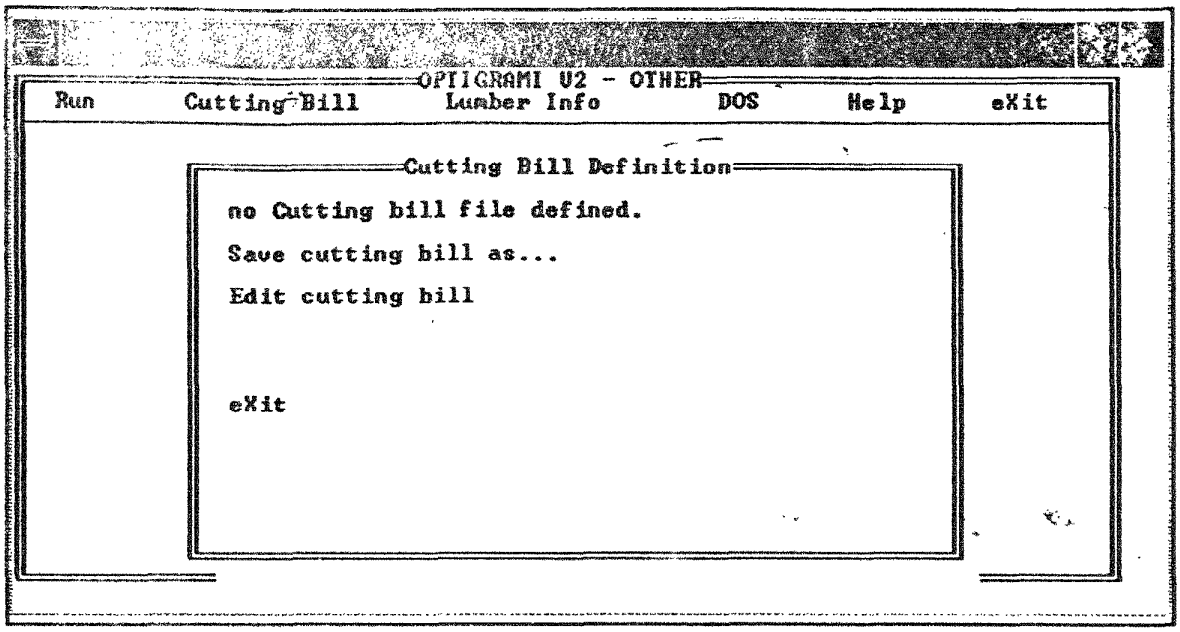

Figure 6. Cutting bill definition menu.

To create a new cutting bill or use an existing one, select the "Cutting Bill" item from the OPTIGRAMI V2 main menu (Fig. 5). This will display the "Cutting Bill Definition" window (Fig. 6). If a cutting bill has not been selected during the current OPTIGRAMI V2 session, only "no Cutting bill file defined" or "eXit" are active. After a cutting bill is selected, the remaining items will be available and the first menu item will appear as "Cutting bill file:" followed by the name of the cutting bill.

6.1 Selecting a Cutting Bill

First click on "no Cutting bill defined" or press "C" in the "Cutting Bill Definition" window (Fig. 6). The "Cutting Bill Selection" window (Fig. 7) displays the names of available cutting bills in the OPTIGRAMI V2 working directory.

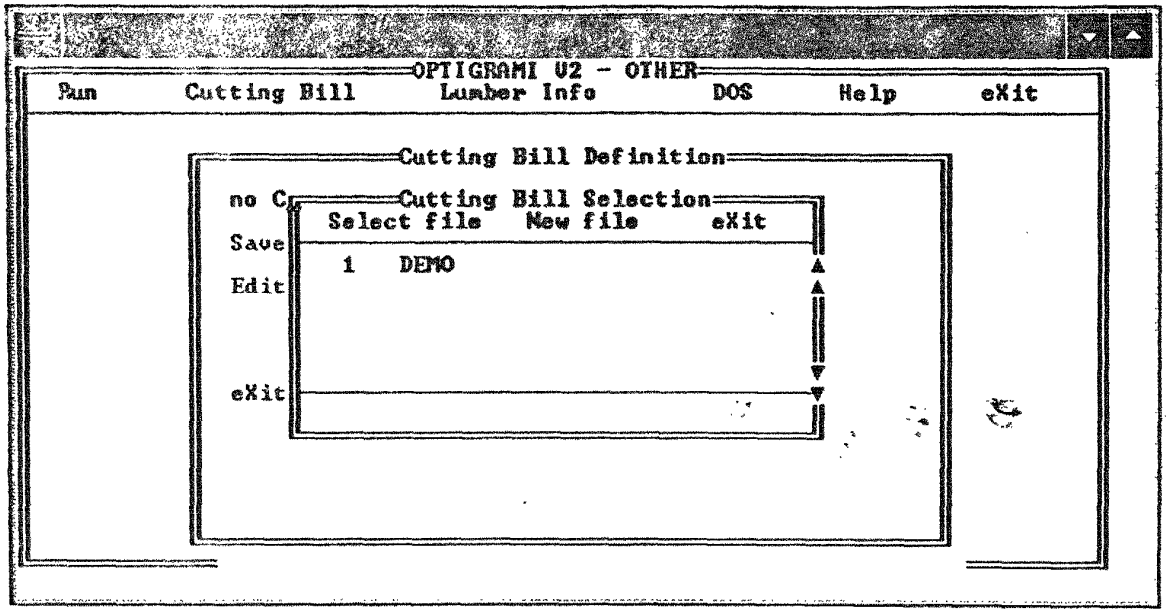

Figure 7. Cutting bill selection window.

Up to 100 file names may be listed alphabetically in the "Cutting Bill Selection" window (Fig. 7). To scroll up and down in the list, click on the arrows at the right of the window. You also may use the PAGE-UP or PAGE-DOWN keys. To select a file, simply click on the file name. Alternatively, click on "Select file" or type "S". OPTIGRAMI V2 will prompt you to enter a file number. The selected file name appears in the box at the bottom of the "Cutting Bill Selection" window. To accept the file selection, type "X" or click on "eXit".

6.2 Editing a Cutting Bill

Click on "Edit cutting bill" or press "E" in the "Cutting Bill Definition" window (Fig. 6) to display the "Edit Cutting Bill" window (Fig.8). You now can add, delete or modify a part in the cutting bill. Also, you may give the cutting bill a title or edit an existing title.

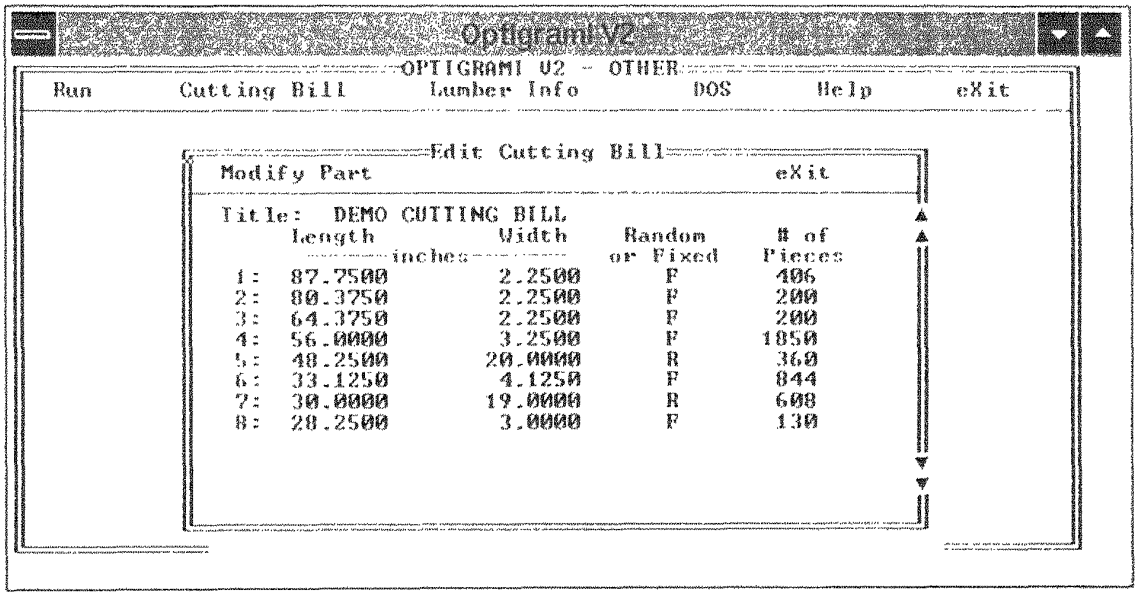

Figure 8. Edit cutting bill window.

6.2.1 Editing a Title

The Title option in the cutting bill is included in the cutting bill file and will be displayed in the detailed report of the solution. "Title" is not the cutting bill file name, rather it is a descriptive heading within the cutting bill Incorporating custom titles into solution reports helps distinguish the cutting bill. To enter a title or edit an existing title, click on "Title:" or press "T". The "Edit Title" window (Fig. 9) will pop up in the bottom of the "Edit Cutting Bill" window (Fig. 8). The pop-up edit window at the bottom of the window allows you to see any previous entry in the title field of the "Edit Cutting Bill" window while you type in the new entry. Enter up to 30 characters in the "Edit Title" window. After you enter a total of 30 characters or when you press the enter key, the "Edit Title" window will close and the new title will be displayed in the "Title:" field.

To delete an existing title, click on "Title:" or press "T" in the "Edit Cutting Bill" window (Fig.8). Simply press return in the "Edit Title" window. The "Edit Title" window will close and the "Title:" field will be erased in the "Edit Cutting Bill" window.

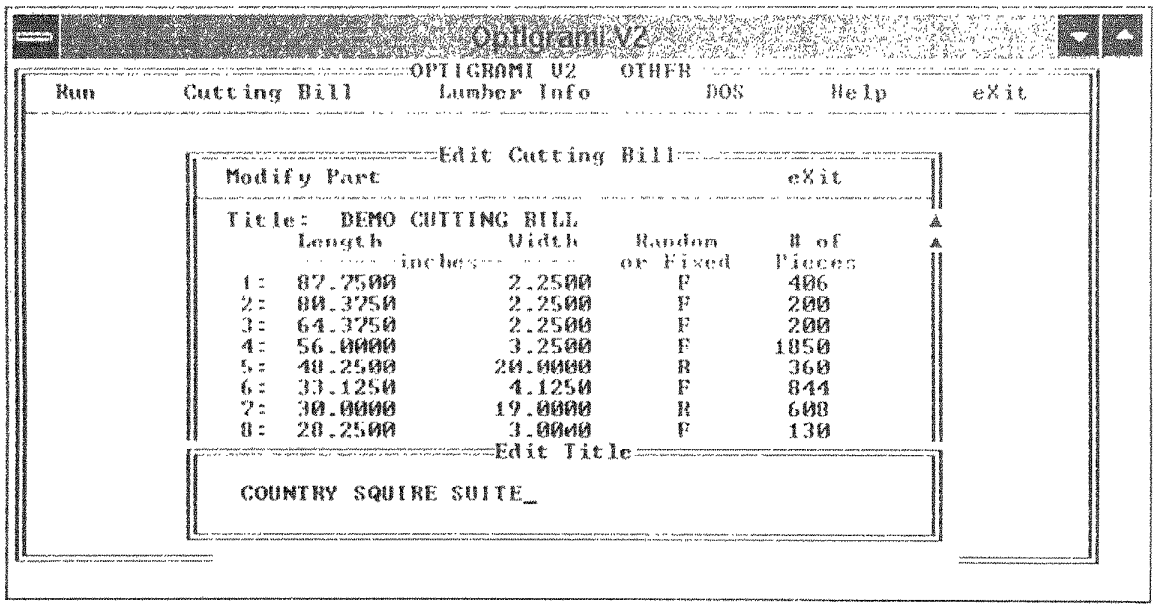

Figure 9. Edit title pop-up window.

6.2.2 Adding a Part

You may enter up to 100 parts in a cutting bill. To scroll up and down in the list of parts, click on the arrows at the right of the "Edit Cutting Bill" window (Fig 8). You also may use the PAGE-UP and PAGE-DOWN keys. To add a part, click anywhere on an empty part line in the "Edit Cutting Bill" window. Alternatively, click on "Modify Part" or press "M"; then enter a part number at the prompt. In the example in Figure 10, you would type "M" and enter "13" on the prompt.

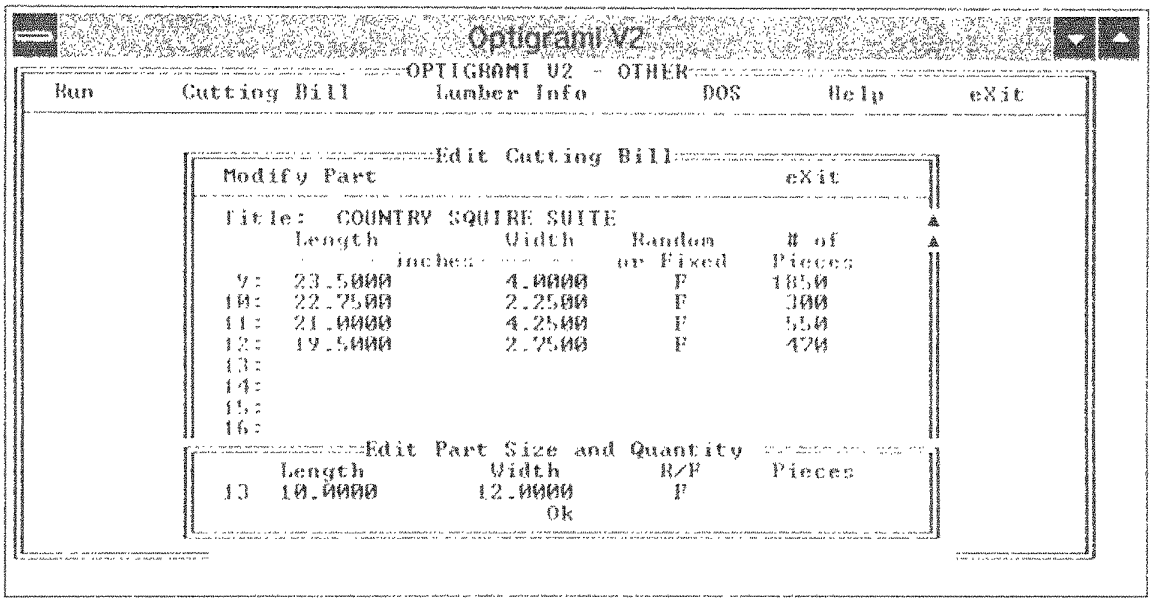

Figure 10. Edit part size and quantity window.

The "Edit Part Size and Quantity" window (Fig. 10) will pop up in the bottom of the "Edit Cutting Bill" (Fig. 8) window. When adding a part, the program will place you in the length entry field first. Valid entries for length are 10 to 100 inches. In the example, after typing "10.00" and pressing enter, the program advances to the width entry field. Valid entries for width are 1 to 100 inches. For all species, the program will accommodate fixed (F) widths (no glueline) up to 6 inches Greater widths (panels) can be entered but must be entered as random (R) since they will be made up from random width pieces. Widths under 6 inches that are made of glued up parts, may be designated random (R) by the user. In the example, after entering width "12.00" and pressing enter, the program advances to the number of pieces entry field. The Random or Fixed (R/F) entry remains "F". After you have entered the number of pieces needed for this part and press return, the program will update the Random or Fixed entry to "R" for Random because the entered width is greater than 6 inches. To further modify any entry in the "Edit Part Size and Quantity" window, click on the entry or entry heading. You may optionally type the appropriate highlighted letter (e.g., **L**,**W**,**R**,or **P**). When finished, click on "**O**k" or type "O" to accept the changes. The "Edit Part Size and Quantity" window will close and the new part will be displayed in the "Edit Cutting Bill" window.

6.2.3 Modifying a Part

To modify a part, click anywhere on the part line in the "Edit Cutting Bill" window (Fig. 8). Alternatively, click on "**M**odify Part" or type "M"; then enter a part number at the prompt. As in Figure 10, the "Edit Part Size and Quantity" window pops up in the bottom of the "Edit Cutting Bill" window. To change the part width, click on "**W**idth" or the width entry. You also could type "W" within the "Edit Part Size and Quantity" window. The previous width is erased by the program. Click on "**L**ength" or the length entry to edit length. Alternatively, type "L". Click on "**P**ieces" or the pieces entry to edit the number of pieces. You also could type "P". To toggle between Random or Fixed width, click on "R/F", or press "R" . To accept the edits on the cutting bill part, click "**O**k" or press "O". The "Edit Part Size and Quantity" window closes and the edits are displayed on the appropriate part line in the "Edit Cutting Bill" window.

6.2.4 Deleting a Part

To delete a part, begin by clicking anywhere on the part line in the "Edit Cutting Bill" window (Fig. 8). Alternatively, click on "**M**odify Part" or type "M"; then enter a part number at the prompt. To delete part 2, you could begin by pressing "M" and entering "2" at the prompt. As in Figure 10, the "Edit Part Size and Quantity" window pops up in the bottom of the "Edit Cutting Bill" window. To complete the deletion, use the "Length" or the "Pieces" field in the "Edit Part Size and Quantity" window. Click on "**L**ength" or the length entry. You also could type "L". Alternatively, click on "**P**ieces" or type "P". After the chosen field has been erased, simply press return. The length, width, and pieces entry fields in the "Edit Part Size and Quantity" window are erased. Click on "**O**k" or type "O". When the "Edit Part Size and Quantity" window closes, the program automatically erases the part line in the "Edit Cutting Bill" window.

6.2.5 Exiting the Edit Cutting Bill Window

After completing all edits, click on "eXit" or type "X" in the "Edit Cutting Bill" window (Fig. 8). As shown in Figure 11, to save the changes click on "Yes" or type "Y". When you exit the "Edit Cutting Bill" window, OPTIGRAMI V2 will sort parts in the cutting bill by length and width in descending order. If you have added, deleted, or modified the size of a part, the sorting may change the sequence of parts. Please note, OPTIGRAMI V2 uses these changes in the current program run. Upon exiting the "Cutting Bill Definition" window (Fig. 6), OPTIGRAMI V2 will ask if you want to save the changes to the current cutting bill to the cutting bill file in the working directory.

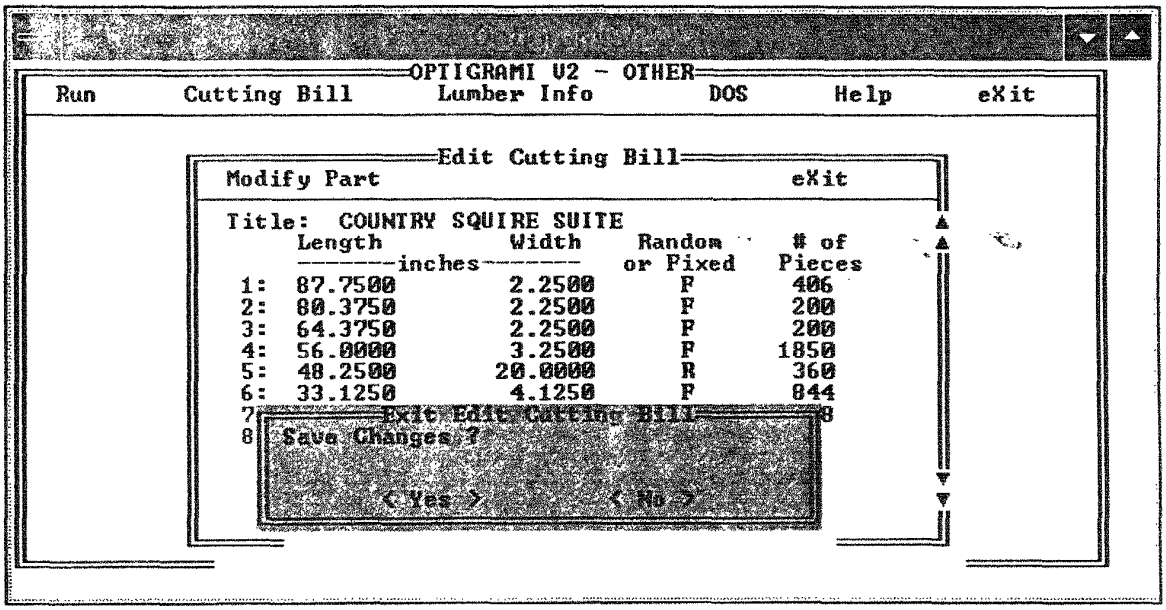

Figure 11. Exit edit cutting bill window.

6.3 Creating a New Cutting Bill

To create a new cutting bill, select the "Cutting Bill" item from the OPTIGRAMI V2 main menu (Fig. 5). In the "Cutting Bill Definition" window (Fig. 6), if you have previously selected a cutting bill, click on "Cutting bill file:". If "no Cutting bill defined" appears in the "Cutting Bill Definition" window (Fig. 6), click on this menu item. You may press "C" in either instance. The "Cutting Bill Selection" window (Fig. 7) displays the names of available cutting bills.

Select "New file" to create a new cutting bill. Enter the name for the new cutting bill at the prompt. The file name is limited to no more than eight characters. In the example shown in Figure 12, "NEWDEMO" is specified as the name of the new cutting bill.

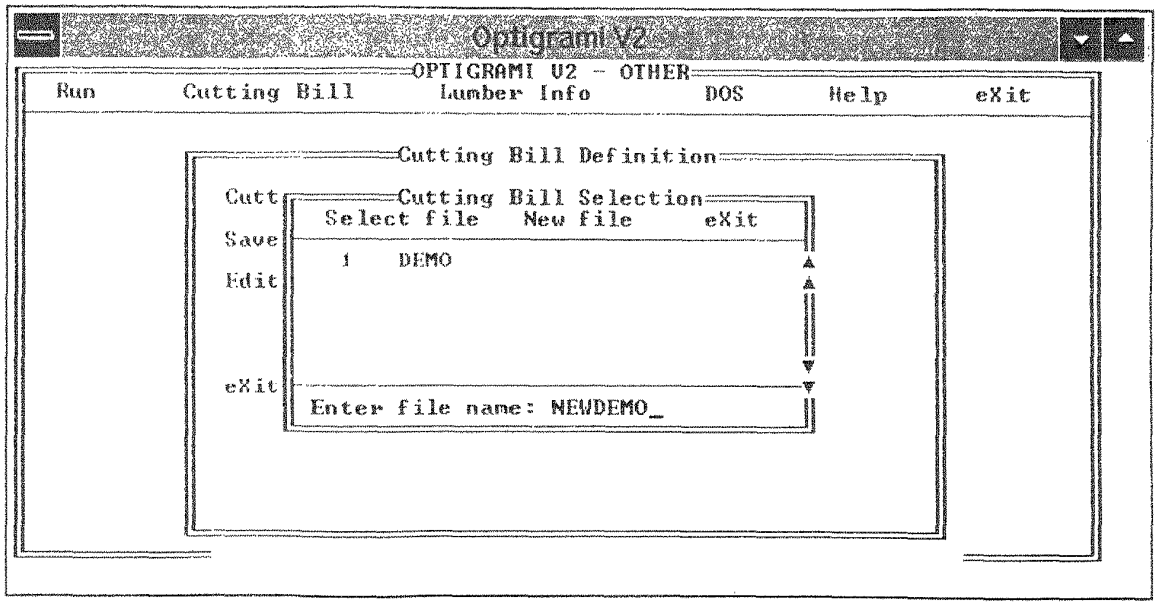

Figure 12. Cutting bill selection window with new file name.

After entering the cutting bill name, OPTIGRAMI V2 displays the new cutting bill file name in the box at the bottom of the "Cutting Bill Selection" window. OPTIGRAMI V2 will notify you if a cutting bill already exists under the proposed name. Click on "eXit" or type "X" to make the new file the chosen cutting bill for the current program run. To validate a new cutting bill file, you must enter at least one cutting bill part in the new file. To enter information in the new cutting bill, refer to Section 6.2, "Editing a Cutting Bill."

6.4 Renaming a Cutting Bill

The "**S**ave Cutting Bill as" option creates a copy of the current cutting bill and saves it under a different name. This option is useful when you want to create a cutting bill that is similar to an existing one. Click on "**S**ave cutting bill as" or type "S" from the "Cutting Bill Definition" window (Fig. 6) to access the "Save Cutting Bill As" window (Fig. 13). Enter the name of the new cutting bill. The file name is limited to no more than eight characters. OPTIGRAMI V2 will notify you if a cutting bill already exists under the proposed name. After the cutting bill is created in the working directory (e.g., C:\OPTI2\DEMO_2.INP), it becomes the chosen cutting bill for the program run.

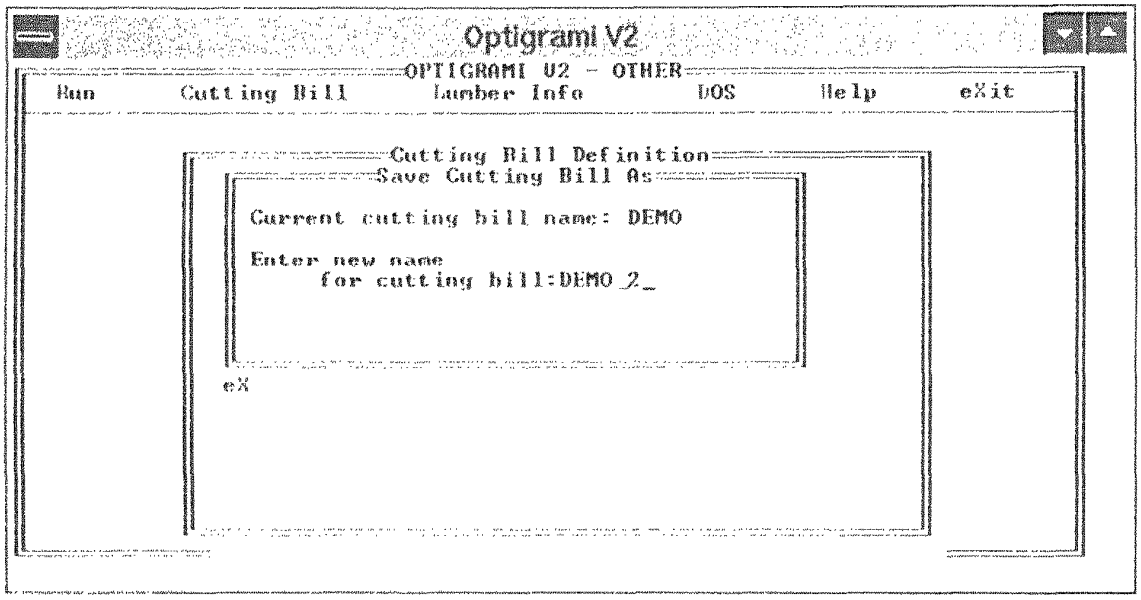

Figure 13. Saving cutting bill as window.

6.5 Exiting the Cutting Bill Definition Window

To exit the "Cutting Bill Definition" window, click on "eXit" or type "X". If you have made any changes to the current cutting bill, OPTIGRAMI V2 will ask if you want to save these changes to the cutting bill file in the working directory. Click on "Yes" or type "Y" to save the changes. In the example in Figure 14, the cutting bill would be saved to a file named C:\OPTI2\DEMO.INP. OPTIGRAMI V2 automatically adds the extension ".INP" to the file name.

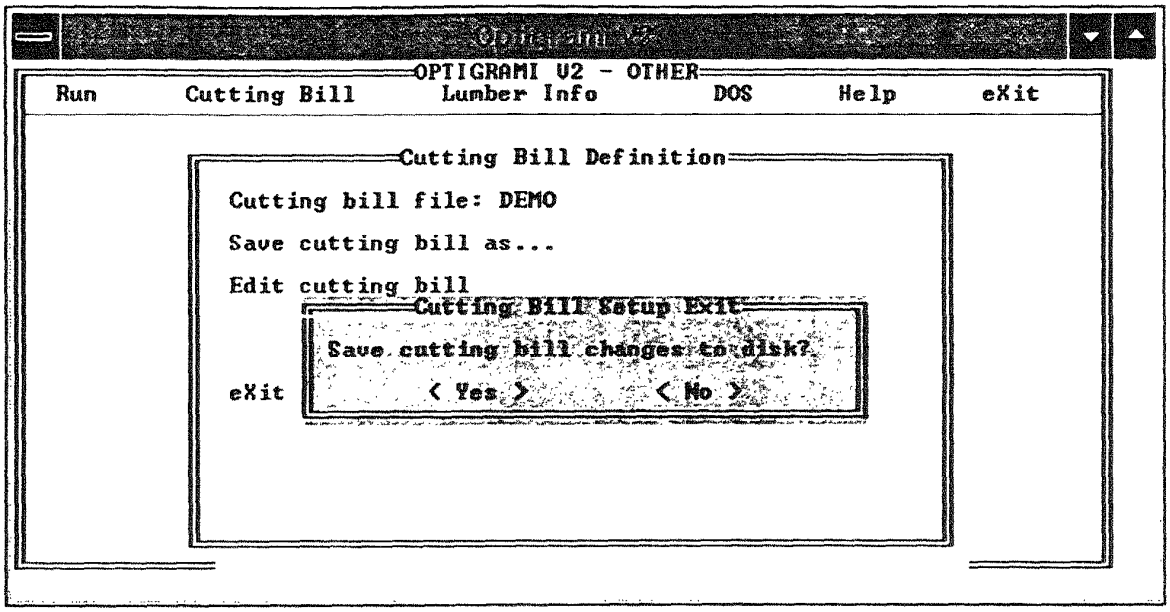

Figure 14. Cutting bill setup exit window.

7. Lumber Information Setup

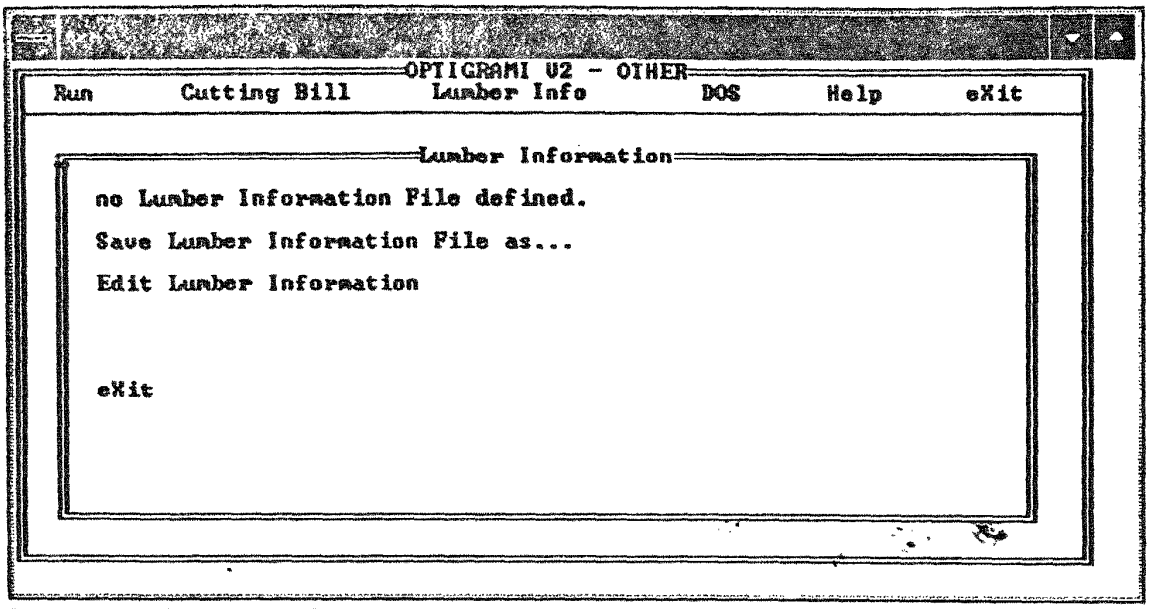

Figure 15. Lumber information menu.

To create new lumber information or use an existing lumber information file, click on "Lumber Info" or type "L" from the OPTIGRAMI V2 main menu (Fig. 5). This will display the "Lumber Information" window (Fig. 15). If lumber information has not been selected during the current OPTIGRAMI V2 session, only "no Lumber Information File defined" or "eXit" are active. After a lumber information file is selected, the remaining items will be available and the first menu item will appear as "Lumber Information File:" followed by the name of the lumber information file currently selected.

7.1 Selecting Lumber Information

First click on "no Lumber Information File defined" or press "L" in the "Lumber Information" window (Fig. 15). The "Lumber Info File Selection" window (Fig. 16) displays the names of available lumber information files in the OPTIGRAMI V2 working directory.

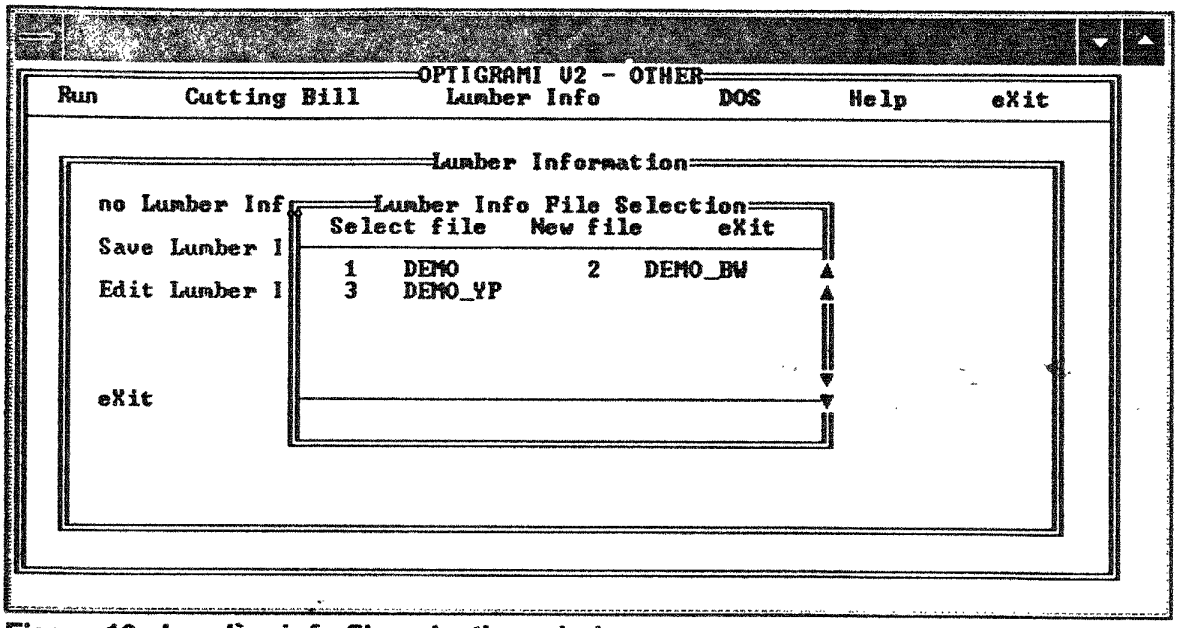

Figure 16. Lumber info file selection window.

Up to 100 file names may be listed alphabetically in the "Lumber Info File Selection" window (Fig. 16). To scroll up and down in the list, click on the arrows at the right of the window. You also may use the PAGE-UP or PAGE-DOWN keys. To select a file, simply click on the file name. Alternatively, click on "Select file" or type "S". OPTIGRAMI V2 will prompt you to enter a file number. The selected file name appears in the box at the bottom of the "Lumber Info File Selection" window. To accept the file selection, type "X" or click on "eXit".

7.2 Editing Lumber Information

Click on "Edit Lumber Information" or press "E" in the "Lumber Information" menu (Fig.15) to display the "Edit Lumber Information" window (Fig.17) where you may modify lumber grade information. Title and species entries allow further description of the lumber information.

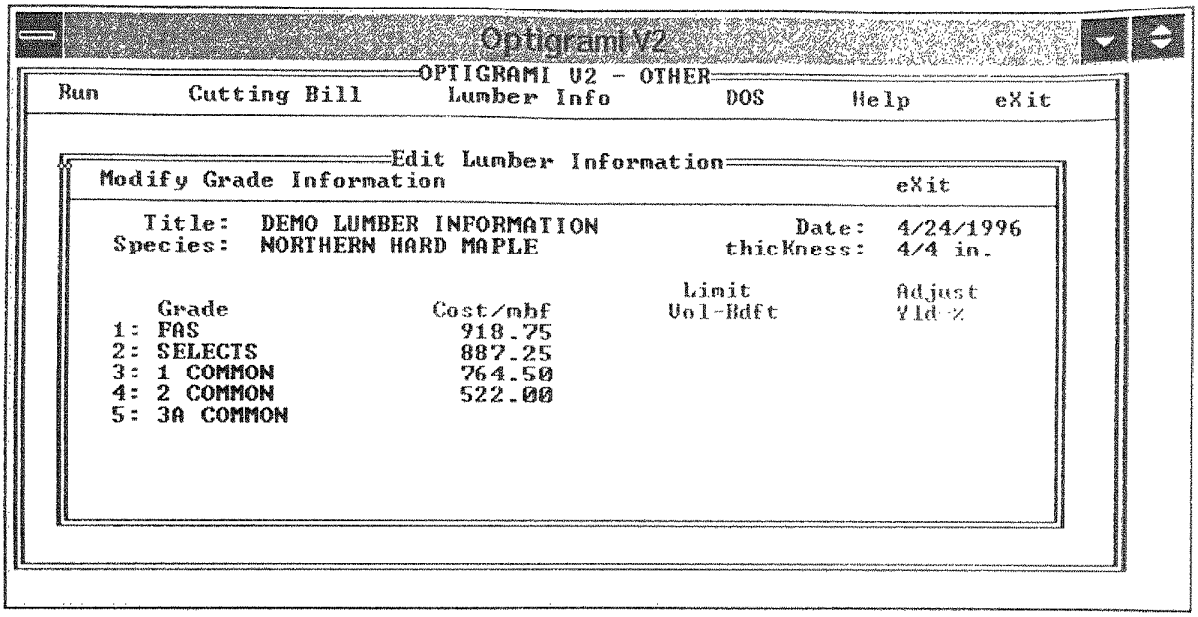

Figure 17. Edit lumber information.

7.2.1 Editing a Title

The lumber information title is included in the lumber information file and will be displayed in the detailed report of the solution. "Title" is not the lumber information file name, rather it is a descriptive heading within the lumber information. Incorporating custom titles into solution reports helps distinguish the lumber information. To enter a title or edit an existing title; click on "Title:" or press "T". The "Edit Title" window (Fig. 18) will pop up in the bottom of the "Edit Lumber Information" window (Fig. 17). The pop-up edit window at the bottom of the window allows you to see any previous entry in the title field of the "Edit Lumber Information" window while you type in the new entry. Enter up to 30 characters in the "Edit Title" window. After you enter a total of 30 characters or when you press the enter key, the "Edit Title" window will close and the new title will be displayed in the "Title:" field.

To delete an existing title, click on "Title:" or type "T" in the "Edit Lumber Information" window. Simply press return in the "Edit Title" window. The "Edit Title" window will close and the "Title:" field will be erased in the "Edit Lumber Information" window.

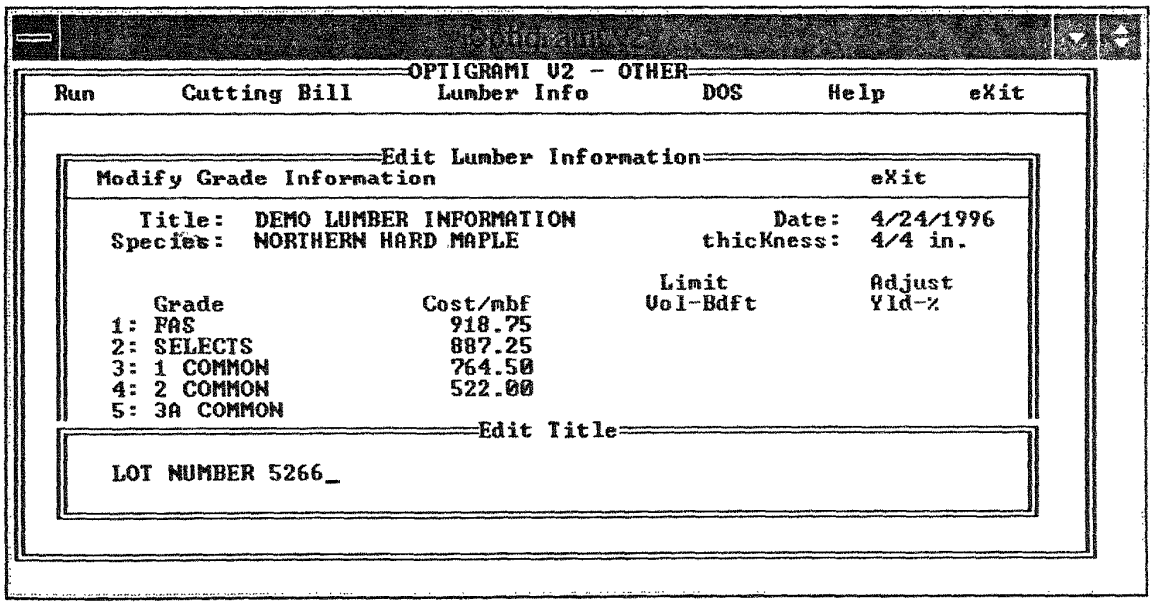

Figure 18. Edit title window.

7.2.2 Editing Species Information

The lumber species field is included in the lumber information file and will be displayed in the detailed report of the solution. Incorporating custom species information into the solution report helps to further distinguish lumber information. To edit the species entry, click on "**S**pecies" or press "S". The "Edit Species" window (Fig. 19) will pop up in the bottom of the "Edit Lumber Information" window (Fig.17). The pop-up edit window at the bottom of the window allows you to see any previous entry in the species field of the "Edit Lumber Information" window while you type in the new entry. Enter up to 30 characters in the "Edit Species" window. After you enter a total of 30 characters or press the enter key, the "Edit Species" window will close and the new species description will be displayed in the "Species:" field of the "Edit Lumber Information" window.

To delete species information, click on "**S**pecies" or type "S" in the "Edit Lumber Information" window (Fig. 17). Simply press return in the "Edit Species" window. The "Edit Species" window will close and the species information will be erased in the "Edit Lumber Information" window.

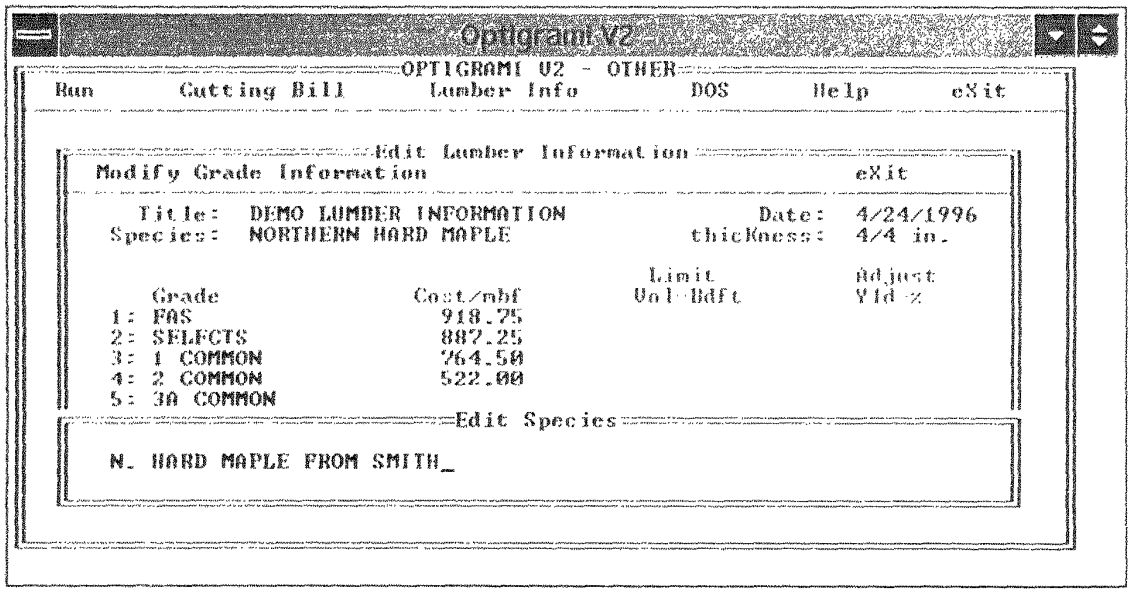

Figure 19. Edit species window.

7.2.3 Editing Lumber Thickness

To edit lumber thickness, click on "thicKness" or type "K" in the "Edit Lumber Information" window (Fig.17). The "Edit Lumber Thickness" window (Fig.20) will pop up in the bottom of the "Edit Lumber Information" window. The previous thickness is given in the thickness field of the "Edit Lumber Informaton" window. The new thickness is entered in the pop-up window. Enter lumber thickness in number of quarters:3=$^{3}/_{4}$ inch, 4=$^{4}/_{4}$ inch, 5=$^{5}/_{4}$ inches, and so on. The range of valid thickness entries is $^{3}/_{4}$ inch to $^{11}/_{4}$ inches (e.g., 3 through 11 quarters).

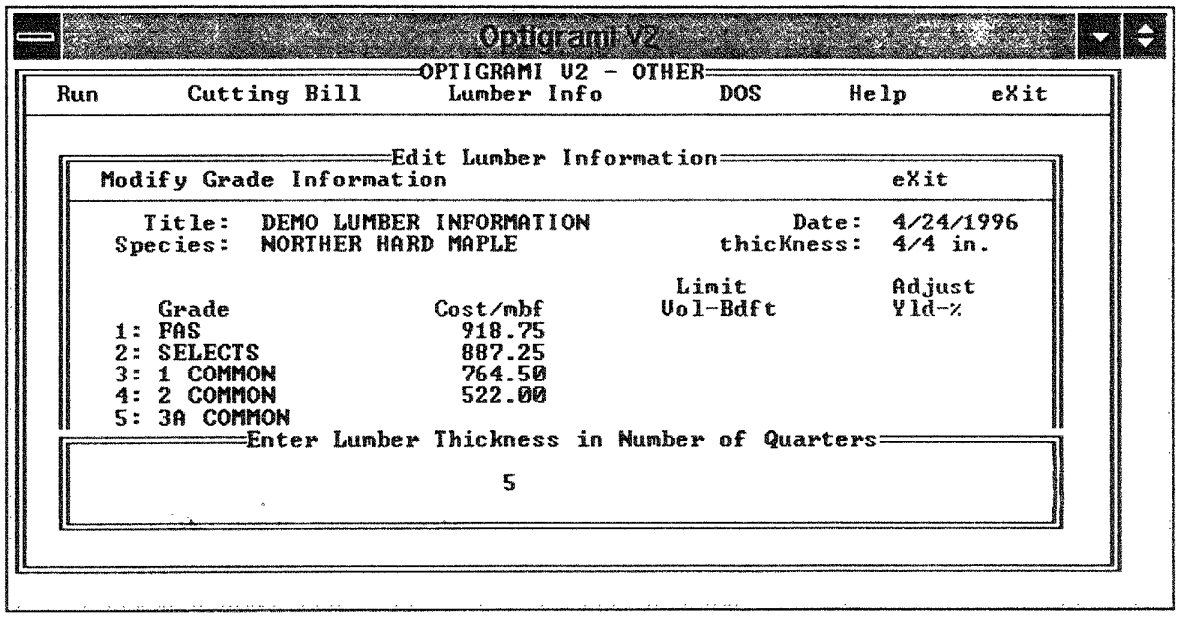

Figure 20. Enter lumber thickness, in number of quarters, pop-up edit window.

7.2.4 Adding Grade Information

To add grade information, click anywhere on an empty grade line in the "Edit Lumber Information" window (Fig. 17). Alternatively, click on "Modify Grade Information" or press "M"; then enter the grade number at the prompt. For example, to enter information for 3A COMMON, you could type "M" and enter "5" at the prompt.

The "Edit Grade Information" window (Fig. 21) will pop up in the bottom of the "Edit Lumber Information" window. When entering new grade information, the program will place you in the "Cost/mbf" field first. The cost of each grade, expressed in dollars per thousand board feet, should represent the sum of all costs associated with that grade through the rough mill. Production cost items to be included are at the discretion of the user but could include lumber purchase, delivery, drying and handling, rough mill cut-up, inventory, and overhead. In the example, after typing "481" and pressing enter, the program advances to the "Limit Volume" field. If there is a limit to the volume of lumber available for the grade, enter the volume available in board feet. If there is no limit on lumber supply in this grade, simply press return and OPTIGRAMI V2 will advance to the "Adjust Yield" entry field.

The "Adjust Yield" entry field allows the user to make adjustments to the yields used by OPTIGRAMI V2 for the different lumber grades. For example, the recommended yield reduction when producing clear-two-face rather than clear-one-face is 2 percent (Englerth and Schumann 1969). Other yield adjustments may be warranted if:

(1) you have reliable mill and grade specific yield data that are based on the experience of cutting bills similar to the current cutting bill under investigation.

(2) you are cutting a part grade other than clear-one-face for black walnut or other hardwood lumber graded under standard NHLA rules, or

(3) you are cutting a lumber thickness other than $^4/_4$ inch.

Yields also may be adjusted for lumber thickness variation. Recommended percentage of yield reductions (Dunmire 1971) for thickness over $^4/_4$ inch are:

Grade	Lumber thickness in inches		
	$^5/_4$	$^6/_4$	$^8/_4$
	percent		
FAS	2	3	4
SEL	3	4	5
1C	3	4	5
2C	4	5	6

If basic yield values are to be reduced by 10 percent, enter 90. Alternatively, if basic yield values are to be increased by 5 percent, enter 105. If there are no yield adjustments, simply press return. To further modify any entry in the "Edit Grade Information" window, click on the entry or the entry heading. Alternatively, type the appropriate highlighted letter (e.g., **C**,**V**,or **Y**). To accept the entries, click on "**O**k" or type "O". The "Edit Grade Information" window will close and the new grade information will be displayed in the "Edit Lumber Information" window.

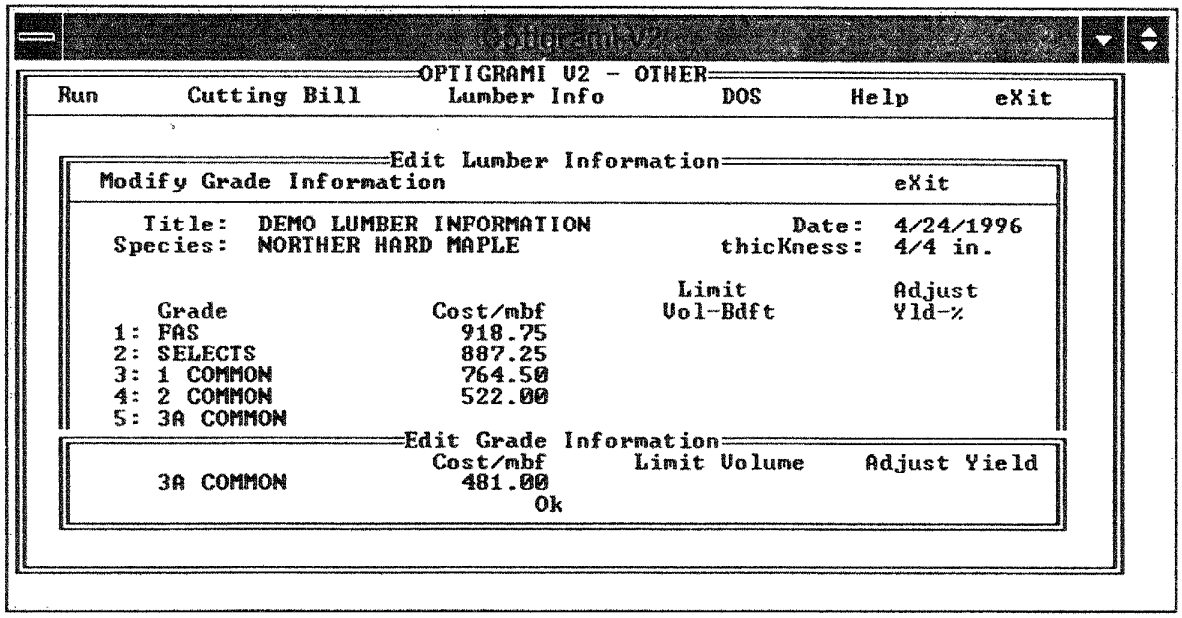

Figure 21. Edit grade information window.

7.2.5 Modifying Grade Information

To modify grade information, click anywhere on a grade information line in the "Edit Lumber Information" window (Fig. 17). Alternatively, click on "**M**odify Grade Information" or type "M"; then enter the grade number at the prompt. As an example, you could type "M" and enter "4" at the prompt to change the cost of NO. 2 COMMON lumber.

As in Figure 21, the "Edit Grade Information" window pops up in the bottom of the "Edit Lumber Information" window. To change the cost, click on "**C**ost/mbf" or the entry in that field. Alternatively, type "C" within the "Edit Grade Information" window. The previous cost is erased and the new cost is entered by the user. To edit volume limitations, click on "Limit **V**olume" or the entry in that field. You also may type "V". To adjust the yield, click on "Adjust **Y**ield" or the entry in that field. Alternatively, type "Y". To accept the edits on the chosen grade, click on "**O**k" or type "O". The "Edit Grade Information" window will close and the new entries for that grade will be displayed on the appropriate grade line in the "Edit Lumber Information" window.

7.2.6 Deleting Grade Information

To delete grade information, begin by clicking anywhere on the grade information line in the "Edit Lumber Information" window (Fig. 17). Optionally, click on "**M**odify Grade Information" or type "M"; then enter the grade number at the prompt. To delete grade information for FAS, you could begin by pressing "M" and then entering "1" at the prompt. As in Figure 21, the "Edit Grade Information" window pops up in the bottom of the "Edit Lumber Information" window. To complete the deletion of FAS information, click on "**C**ost/mbf" or the cost entry. Alternatively, type "C". After the program erases the cost entry, simply press return. The cost, volume limitation, and yield adjustment entries are erased. Click on "**O**k" or type "O" to accept this deletion. When the "Edit Grade Information" window closes, the program erases the grade information from the appropriate grade line in the "Edit Lumber Information" window.

7.2.7 Exiting the Edit Lumber Information Window

After completing all edits, click on "e**X**it" or type "X" in the "Edit Lumber Information" window. To save the changes on the current lumber information, click on "Yes" or type "Y". Please note, OPTIGRAMI V2 saves these changes within the program run. Upon exiting the "Lumber Information" window (Fig. 7), OPTIGRAMI V2 will ask if you want to save all changes to the lumber information file in your working directory.

7.3 Creating New Lumber Information

To create new lumber information, select the "Lumber Info" item from the OPTIGRAMI V2 main menu (Fig. 5). In the "Lumber Information" window (Fig. 15), if you have previously selected lumber information, click on "Lumber Information file:". If "no Lumber Information defined" appears in the "Lumber Information" window, click on this menu item. You may press "L" in either instance. The "Lumber Info File Selection" window (Fig. 22) displays the names of available lumber information files.

Click on "New file" or type "N". Enter the name of the new lumber information file at the prompt. The file name is limited to no more than eight characters. In the example shown in Figure 22, "NEWDEMO" is specified as the name of the new lumber information file.

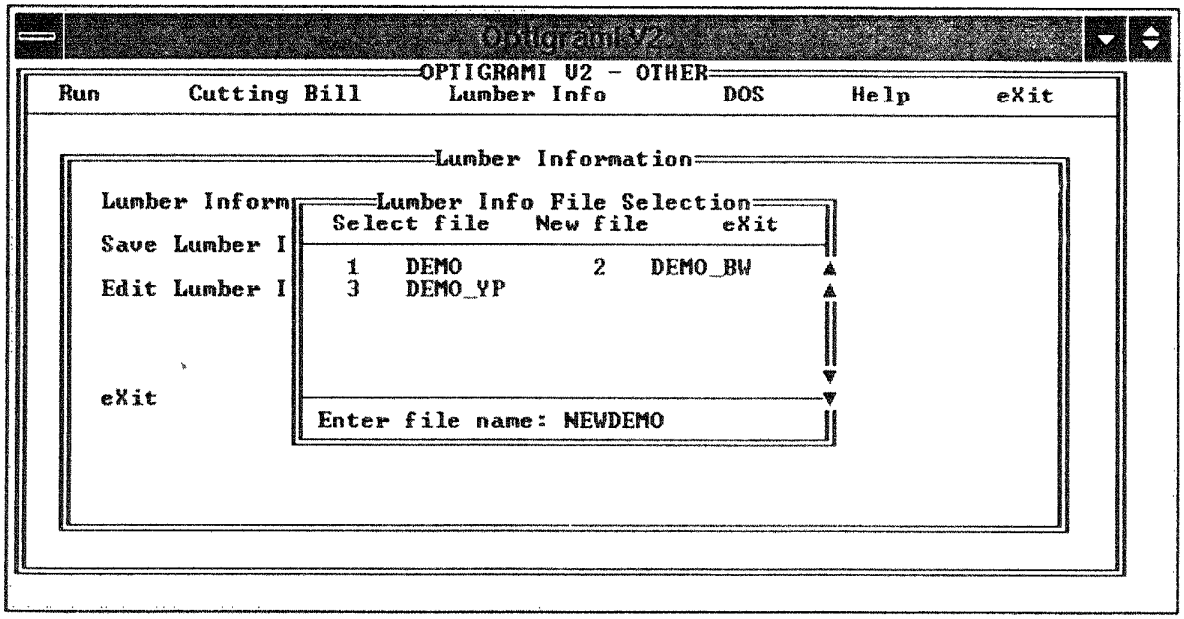

Figure 22. Lumber info file selection window with new file name.

After entering the lumber information name, OPTIGRAMI V2 displays the new lumber information file name in the box at the bottom of the "Lumber Info File Selection" window. OPTIGRAMI V2 will notify you if a lumber information file already exists under the proposed name. Click on "eXit" or type "X" to make the new file the chosen lumber information for the current program run. In the new lumber information file, OPTIGRAMI V2 inserts the chosen species for the program run (yellow-poplar, black walnut, or other) into the species description. The thickness defaults to 4/4 inch and the date is your PC's system date. To validate a new lumber information file, enter information for at least one grade in the new file. To edit the new lumber information, refer to Section 7.2, "Editing Lumber Information".

7.4 Renaming Lumber Information

The "**S**ave Lumber Information As" option creates a copy of the current lumber information under a different name. This option is useful when you want to create a lumber information file that is similar to an existing one. Click on "**S**ave Lumber Information As" or type "S" from the "Lumber Information" window (Fig. 15) to access the "Save Lumber Info File As" window (Fig. 23). Enter the name of the new lumber information file. The file name is limited to no more than eight characters. OPTIGRAMI V2 will notify you if a lumber information file already exists under the proposed name. After the lumber information file is created in the working directory (e.g., C:\OPTI2\MPL_LBR.INF), it becomes the chosen lumber information for the current program run.

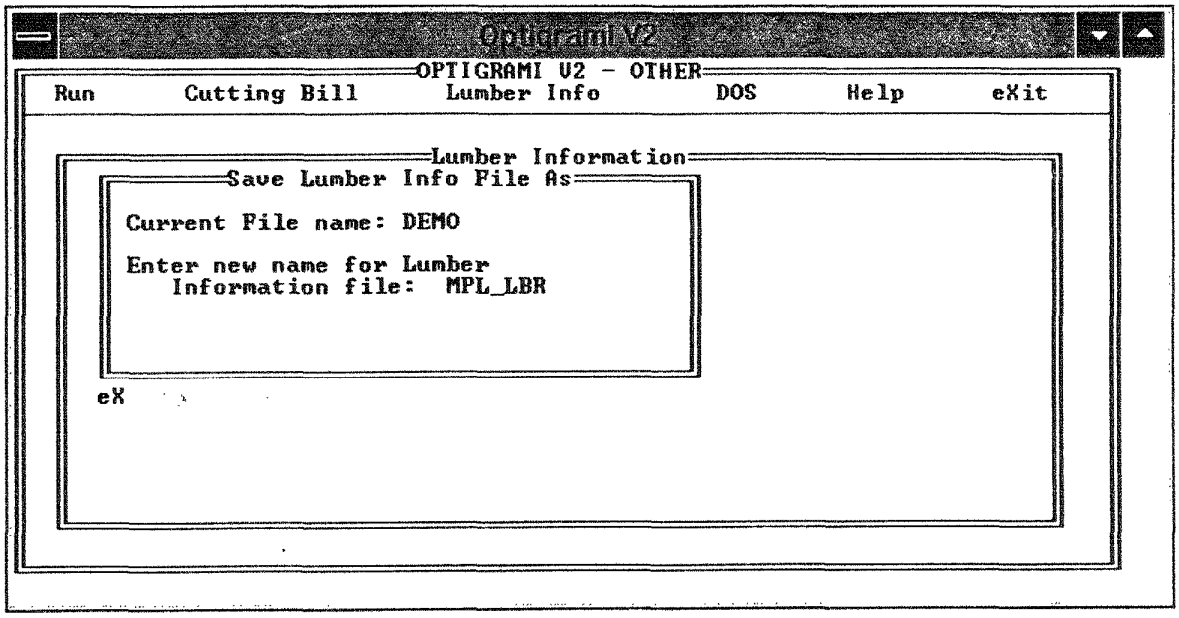

Figure 23. Save lumber info as window.

7.5 Exiting the Lumber Information Window

To exit the "Lumber Information" window (Fig. 15), click on "e**X**it" or type "X". If you have made any changes to the current lumber information, OPTIGRAMI V2 will ask you if you want to save these changes to the lumber information file in the working directory. Click on "Yes" or type "Y" to save the changes to file. In the example in Figure 24, current lumber information would be saved to a file named demo.inf in the working directory (e.g., C:\OPTI2\DEMO.INF). OPTIGRAMI V2 adds the extension, ".INF" to the file name.

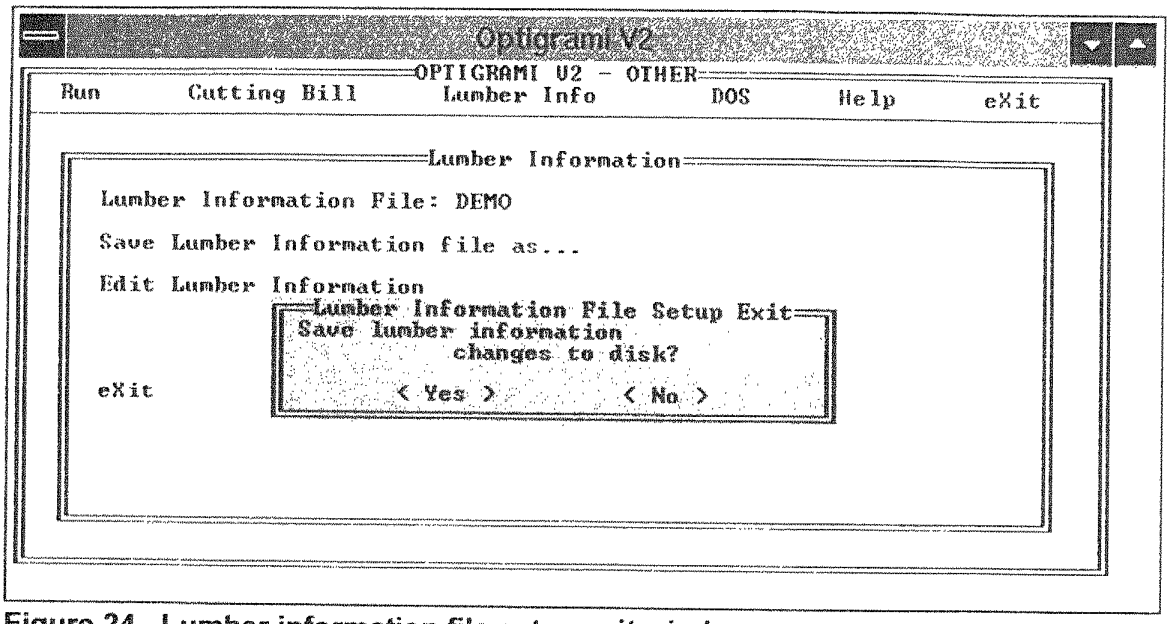

Figure 24. Lumber information file setup exit window.

8. Running the Linear Program

After selecting a cutting bill and lumber information, find the least-cost grade mix by running the linear program. Click on "Run" or type "R" from the main menu in OPTIGRAMI V2 (Fig. 5). If you failed to select any input data, OPTIGRAMI V2 will report an error and ask you to select the missing input.

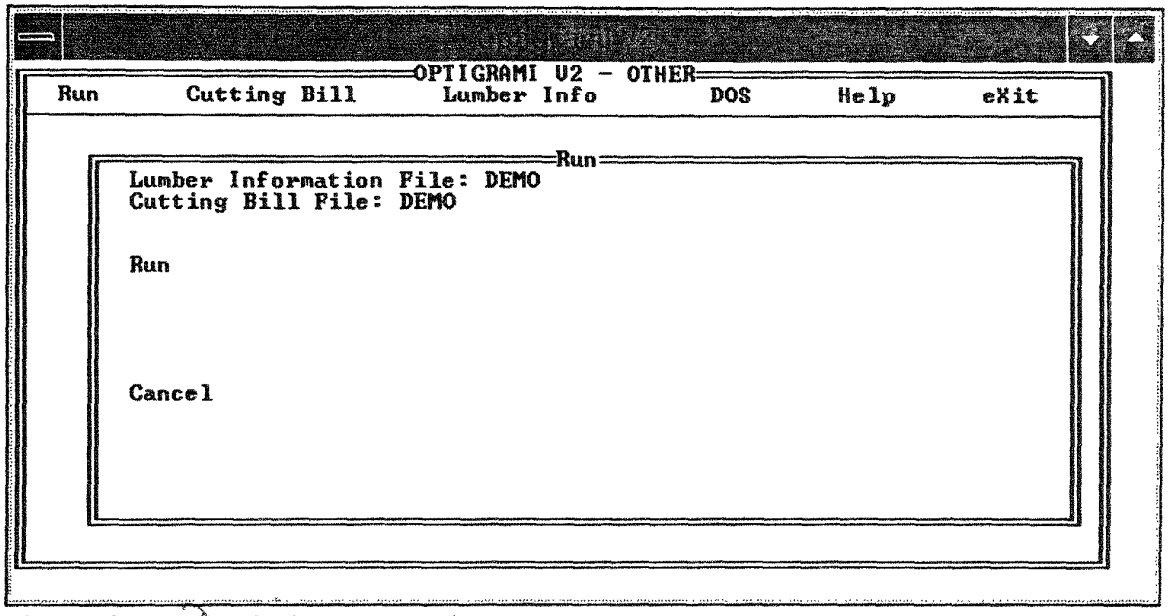

Figure 25. Run window.

After selecting "Run", you will see the "Run" window shown in Figure 25. It will display the lumber information and cutting bill chosen for this program run. To run the linear program, click on "Run" or type "R" in the "Run" window. To cancel the current run, click on "Cancel" or type "C". After selecting "Run", you will see the linear program operations on the screen. This process could take a few seconds or several minutes, depending on your PC equipment configuration and the complexities of the cutting bill being investigated.

9. OPTIGRAMI V2 Results

After running the linear program, OPTIGRAMI V2 prompts you to enter a file name for the detailed report. This file name is limited to no more than eight characters. In the example in Figure 26, the detailed report named DEMO.REP would be placed in the working directory (e.g., C:\OPTI2\DEMO.REP). OPTIGRAMI V2 adds the extension of ".REP" (short for report) to the file name supplied by the user. After entering the report file name, OPTIGRAMI V2 will display a summary of the optimization results.

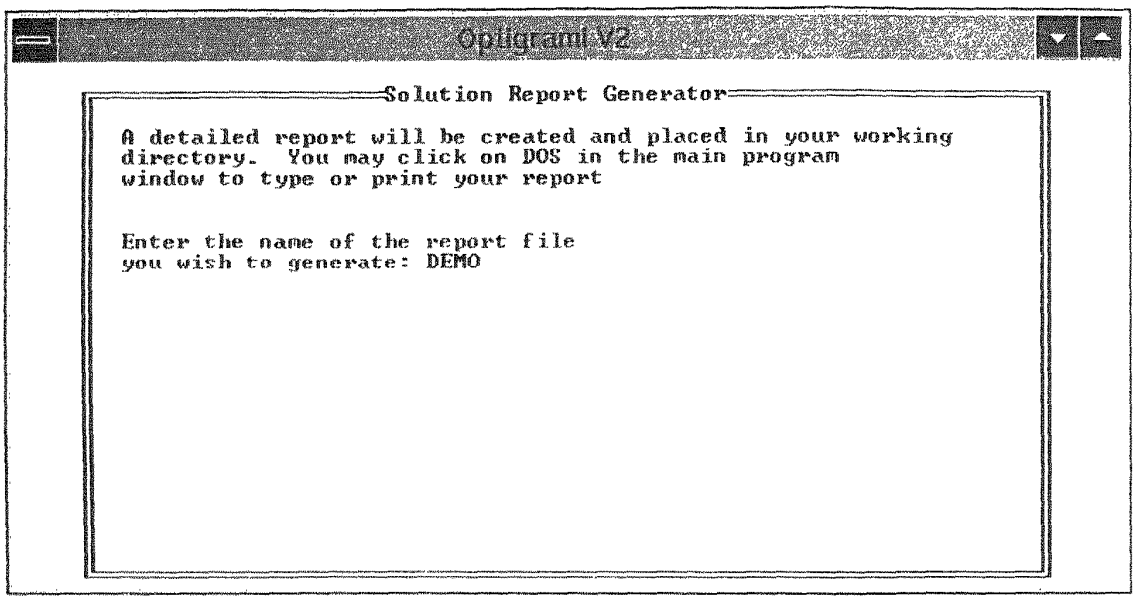

Figure 26. Solution report generator window.

The summary screen as shown in Figure 27 lists grades used for the cutting bill with the following informaton shown per grade:

- user's input cost per thousand board feet
- gross lumber volume in board feet
- estimated production cost
- cuttings volume in board feet
- percent yield

Also displayed are the minimum and maximum cost for each grade for which the given grade mix solution is valid. In the example in Figure 27, if the cost of 2C lumber exceeds $522.66 per thousand board feet, the least-cost grade mix solution will change. To exit the summary screen, press any key or click the right mouse button. OPTIGRAMI V2 will return to the main menu.

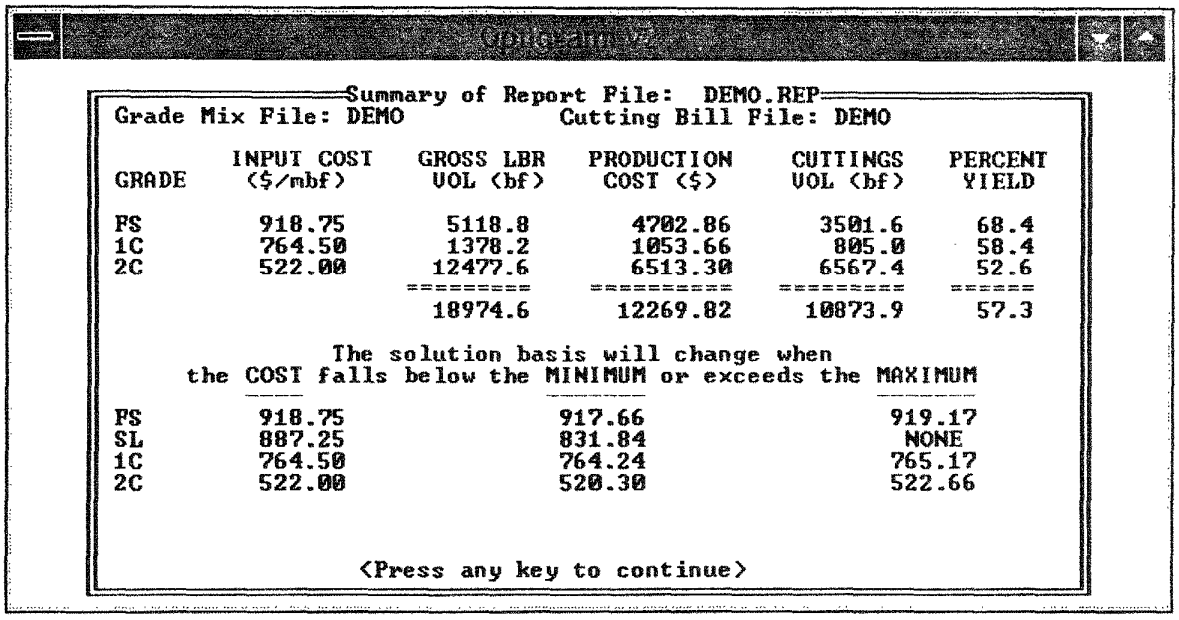

Figure 27. Summary of report file screen.

To view or print the detailed solution report, exit to DOS. Instructions for exiting to DOS are given in Section 10. An example of the detailed report is presented in Appendix II.

Included in the detailed solution report are:

- lumber information
- cutting bill
- number of cuttings of each part obtained from selected grades
- summary information (refer to summary screen description in this section)

10. Exiting to DOS

To exit to DOS from the main menu (Fig.5), click on "DOS" or type "D". This OPTIGRAMI V2 feature makes it easy to print or view the detailed report of the least-cost grade mix solution. To print the detailed solution report, use the DOS command, "print" (e.g., PRINT DEMO.REP). To view the detailed solution report, use the DOS command, "type" (e.g., TYPE DEMO.REP |MORE). To return to OPTIGRAMI V2 from DOS, type "exit". To exit normally from OPTIGRAMI V2, see Section 12, Exiting OPTIGRAMI V2.

11. Help

To view the following window (Fig. 28), simply click on "Help" or type "H" in the main menu (Fig. 5) of OPTIGRAMI V2.

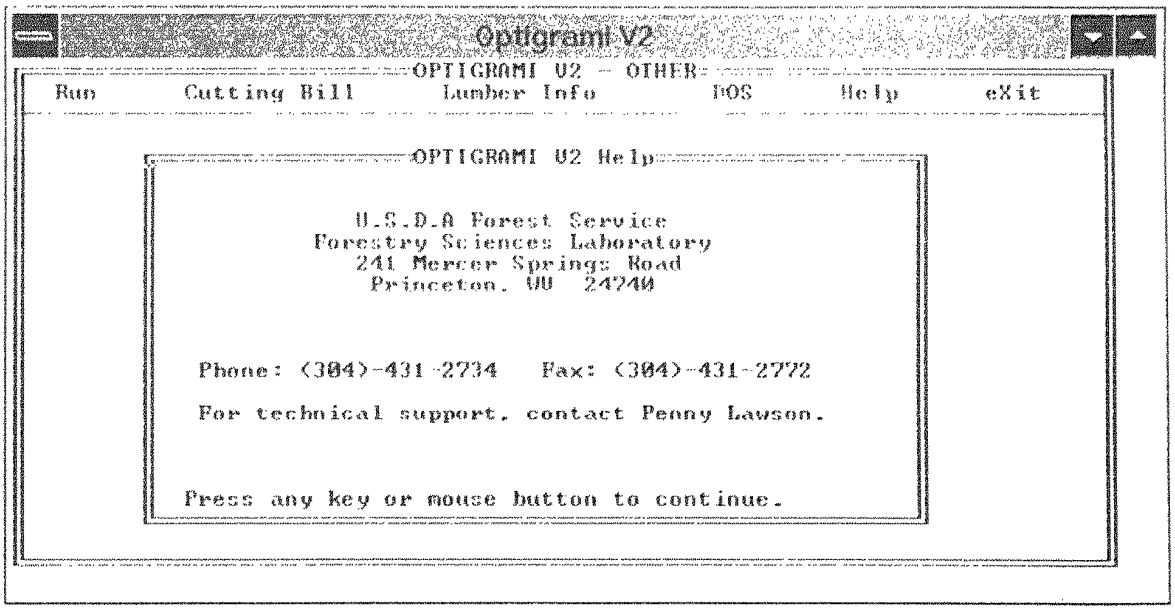

Figure 28. Help window.

12. Exiting OPTIGRAMI V2

To exit OPTIGRAMI V2 from the main menu (Fig. 5), click on "e**X**it" or type "X". The "Choose Species" window (Fig. 4) appears. To run OPTIGRAMI V2 again using another species or species group, click on the lumber species or enter the appropriate highlighted letter (e.g., **Y**, **B**, or **O**). To exit OPTIGRAMI V2, click on "e**X**it" or type "X" and click on "Yes" or type "Y" in the confirmation window.

Acknowledgment

The authors thank Jan Wiedenbeck, Charles Gatchell, Kris Hoff, Dave Martens, and Floyd Timson for their comments and testing of the OPTIGRAMI V2 program. We also would like to thank Cindi West and Bruce Hansen for the opportunity to update OPTIGRAMI for PC's.

Literature Cited

Dunmire, Daniel E., III. 1971. **Predicting yields from Appalachian red oak logs and lumber.** In: Oak symposium proceedings; 1971 August 16-20; Morgantown.WV. Upper Darby, PA: U.S. Department of Agriculture, Forest Service. Northeastern Forest Experiment Station: 94-99.

Englerth, George H.; Schumann, David R. 1969. **Charts for calculating dimension yields from hard maple lumber.** Res. Pap. FPL-118. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 12 p.

Gilmore, Robert C.; Hanover, Stephen J.; Danielson, Jeanne D. 1984. **Dimension yields from yellow-poplar lumber.** Gen. Tech. Rep. FPL-41. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 13 p.

Lucas, Edwin L. 1973. **Long length cuttings from No. 2 Common hardwood lumber.** Res. Pap. NE-248. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 5 p.

Martens, David G. 1986a. **Produce yellow-poplar furniture dimension at minimum cost by using YELLOPOP.** NE-RP-592. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 15 p.

Martens, David G. 1986b. **Reduce dimension costs by using WALNUT.** Res. Pap. NE-586. Broomall, PA: Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 10 p.

Schumann, David R. 1971. **Dimension yields from black walnut lumber.** Res. Pap. FPL-162. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 16 p.

Timson, Floyd G.; Martens, David G. 1990. **OPTIGRAM! for PC's: User's manual (Version 1.0).** Gen. Tech. Rep. NE-143. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 19 p.

Appendix I. Yield Tables

Table 1.-- Predicted yields of random-width, clear 2-face cuttings from yellow-poplar lumber (net board feet per Mbf). The yield values are derived from nomographs developed by Gilmore et al. (1984).

Grade	Length of Cuttings (inches) 10	20	30	40	50	60	70	80	90	100
FAS	753	712	675	640	607	563	508	444	400	332
F1F	635	600	560	515	460	400	335	260	240	240
1 COMMON	615	570	515	460	395	320	235	225		
2A COMMON	525	460	360	250						
2B COMMON	450	375	285	200						

Table 2.-- Reduction values for obtaining predicted yields for cuttings of specified widths from yellow-poplar lumber (net board feet per Mbf)

Grade	Width of Cuttings (inches) 1	2	3	4	5	6
FAS	0	27	60	97	155	215
F1F	0	19	48	85	135	189
1 COMMON	0	16	48	96	158	240
2A COMMON	0	28	68	118	175	243
2B COMMON	0	29	62	105	150	194

Table 3.-- Predicted yields of random-width, clear 1-face cuttings from black walnut lumber (net board feet per Mbf). The yield values are derived from nomographs developed by Schumann (1971).

Grade	Length of Cuttings (inches) 10	20	30	40	50	60	70	80	90	100
FAS	758	730	684	652	618	572	482	360	280	113
SELECTS	702	662	610	556	490	414	306	194	144	
1 COMMON	650	600	526	434	338	238	140	86		
2 COMMON	546	482	386	270	162	80	50			

Table 4.-- Reduction values for obtaining predicted yields for cuttings of specified widths from black walnut lumber (net board feet per Mbf)

Grade	Width of Cuttings (inches) 1	2	3	4	5	6
FAS	0	10	22	30	168	284
SELECTS	0	6	26	80	152	220
1 COMMON	0	5	32	98	138	154
2 COMMON	0	14	50	78	84	92

Table 5.-- Predicted yields of random-width, clear 1-face cuttings from other hardwood lumber graded under standard NHLA rules (net board feet per Mbf). The yield values are derived from nomographs developed by Englerth and Schumann (1969) and yield data developed by Lucas (1973).

Grade	Length of Cuttings (inches) 10	20	30	40	50	60	70	80	90	100
FAS	779	753	728	692	653	615	559	504	487	467
SELECTS	754	730	698	662	617	568	510	435	407	379
1 COMMON	718	681	626	567	496	410	315	276	245	
2 COMMON	632	568	469	354	247	171	109	65		
3A COMMON	440	355	235							

Table 6.-- Reduction values for obtaining predicted yields for cuttings of specified widths from other hardwood lumber graded under standard NHLA rules (net board feet per Mbf)

Grade	Width of Cuttings (inches) 1	2	3	4	5	6
FAS	0	24	48	87	124	225
SELECTS	0	40	81	120	175	264
1 COMMON	0	25	60	109	175	242
2 COMMON	0	34	64	139	217	277
3A COMMON	0	36	84	156	214	232

Appendix II. Example of Detailed Report of Optimization Run

OPTIGRAMI V2- INPUT INFORMATION
9/7/1995
DEMO LUMBER INFORMATION
NORTHERN HARD MAPLE
LUMBER THICKNESS 4/4 in.

GRADE	COST ($/mbf)	VOLUME CONSTRAINTS(bf)	YIELD ADJUSTMENT(%)
FAS	918.75	None	100.00
SELECTS	887.25	None	100.00
1 COMMON	764.50	None	100.00
2 COMMON	522.00	None	100.00

INPUT CUTTING ORDER
DEMO CUTTING BILL

CUTTING SIZE LENGTH (inches)	WIDTH	TYPE OF CUTTING RANDOM (R) OR FIXED (F)	NUMBER OF CUTTINGS	NET BF
87.7500	2.2500	F	406	556.66
80.3750	2.2500	F	200	251.17
64.3750	2.2500	F	200	201.17
56.0000	3.2500	F	1850	2338.19
48.2500	20.0000	R	360	2412.50
33.1250	4.1250	F	844	800.87
30.0000	19.0000	R	608	2406.67
28.2500	3.0000	F	130	76.51
23.5000	4.0000	F	1850	1207.64
22.7500	2.2500	F	300	106.64
21.0000	4.2500	F	550	340.89
19.5000	2.7500	F	470	175.03
10.0000	12.0000	R	100	83.33
			7868	10957.27

OPTIMUM SOLUTION CUTTING INFORMATION
9/7/1995
DEMO LUMBER INFORMATION
NORTHERN HARD MAPLE
LUMBER THICKNESS 4/4 in.

SELECTED GRADES	CUTTING SIZE LENGTH	WIDTH	TYPE OF CUTTING	NUMBER OF CUTTINGS	NET BF
FAS	87.75	2.25	F	406	556.7
FAS	56.00	3.25	F	1850	2338.2
FAS	33.12	4.12	F	461	437.7
FAS	21.00	4.25	F	243	150.6
FAS	19.50	2.75	F	49	18.4
				3009	3501.6
1 COMMON	80.38	2.25	F	200	251.2
1 COMMON	64.38	2.25	F	200	201.2
1 COMMON	33.12	4.12	F	280	266.0
1 COMMON	23.50	4.00	F	64	41.8
1 COMMON	21.00	4.25	F	57	35.5
1 COMMON	19.50	2.75	F	25	9.4
				826	805.0
2 COMMON	48.25	20.00	R	360	2412.5
2 COMMON	33.12	4.12	F	102	97.2
2 COMMON	30.00	19.00	R	608	2406.7
2 COMMON	28.25	3.00	F	130	76.5
2 COMMON	23.50	4.00	F	1786	1165.8
2 COMMON	22.75	2.25	F	300	106.6
2 COMMON	21.00	4.25	F	250	154.8
2 COMMON	19.50	2.75	F	396	147.3
2 COMMON	10.00	12.00	R	100	83.3
				4032	6650.7
				7867	10957.3

LEAST-COST GRADE MIX SOLUTION
9/7/1995
DEMO LUMBER INFORMATION
NORTHERN HARD MAPLE
LUMBER THICKNESS 4/4 in.
SUMMARY BY GRADE

SELECTED GRADES	INPUT COST ($/mbf)	GROSS LBR VOL (bf)	PRODUCTION COST ($)	CUTTINGS VOL (bf)	PERCENT YIELD
FAS	918.75	5118.8	4702.86	3501.6	68.4
1 COMMON	764.50	1378.2	1053.66	805.0	58.4
2 COMMON	522.00	12477.6	6513.30	6650.7	53.3
		18974.6	12269.82	10957.3	57.7

The solution basis will change when
the COST falls below the MINIMUM or exceeds the MAXIMUM

FAS	918.75	917.66	919.17
SELECTS	887.25	831.84	NONE
1 COMMON	764.50	764.24	765.17
2 COMMON	522.00	520.30	522.66