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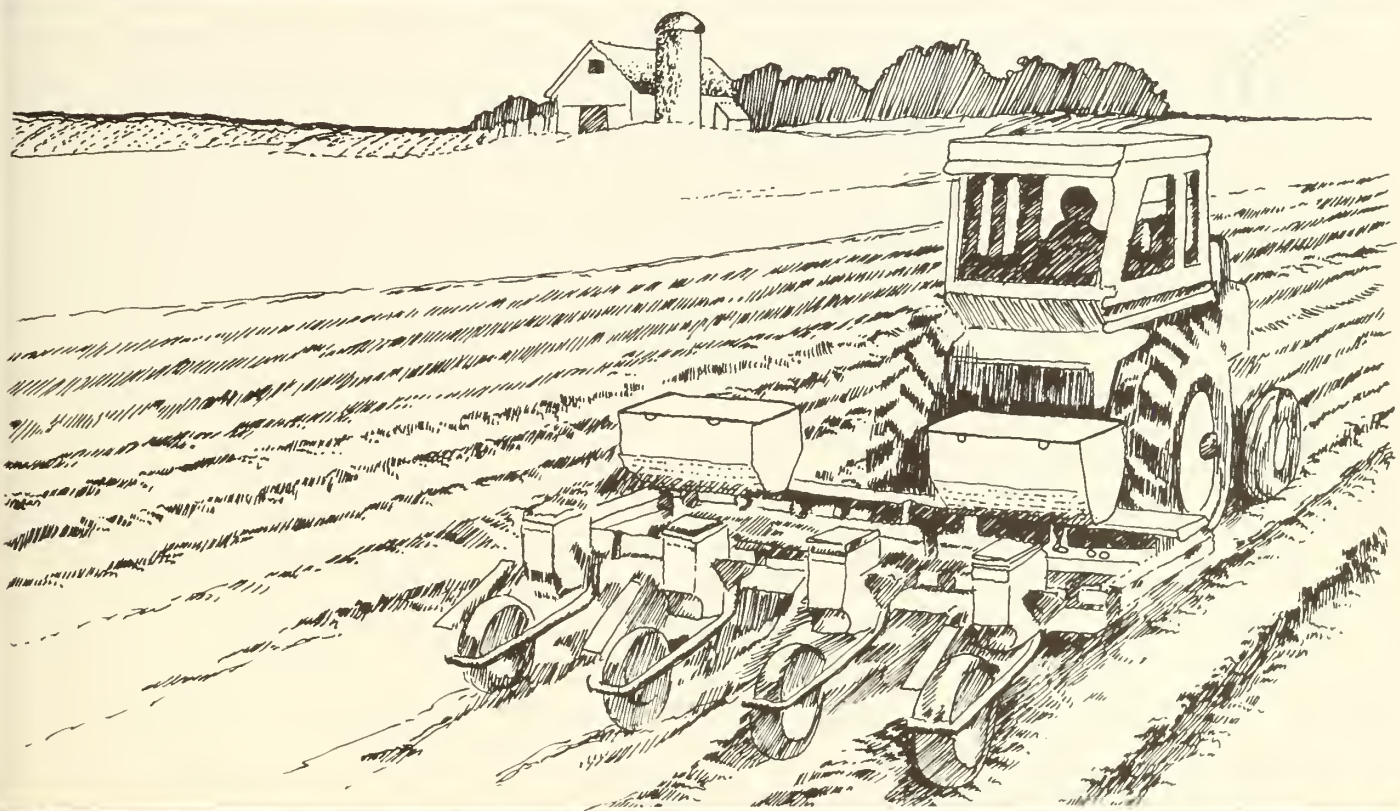
Fuel-Consumption and Fuel-Cost Prediction Model

for Agricultural Crop Production

For Apple II Plus, IBM PC and Radio Shack TRS-80



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FUEL-CONSUMPTION AND FUEL-COST PREDICTION MODEL FOR AGRICULTURAL CROP PRODUCTION for APPLE II PLUS, IBM PC and RADIO SHACK TRS-80*

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*Anyone interested in using this program may obtain a copy of the disk for their computer by sending a request, along with the appropriate blank diskette(s) to

Dr. Fred L. Shuman, Jr.
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Mississippi State, MS 39762

Content

FUEL-CONSUMPTION AND FUEL-COST PREDICTION MODEL FOR AGRICULTURAL CROP PRODUCTION for APPLE II PLUS, IBM PC and RADIO SHACK TRS-80

The primary concern of farmers when acquiring equipment in the past was whether the equipment could do the job and not how efficiently the job could be done. This lack of concern for efficiency has left the agricultural industry with little practical information to draw from now that the need for minimizing fuel consumption has become increasingly apparent.

Our review of the information available (1,2,4,5,6) revealed no convenient method for accurately predicting fuel requirements for crop production. A method of calculation tailored to the needs of individual farmers operating under unique conditions is needed. Therefore, efforts were initiated in the Agricultural and Biological Engineering Department to develop processes for calculating the consumption and costs of fuel for crop production.

We developed a computer model that provides practical information for use by farmers in selecting the proper equipment, estimating operating costs and following least-cost procedures for soybean production. The model can be used for making the same estimates for production of other crops if the implements selected are from those listed in the computer program.

The initial model was based on a number of typical sizes of John Deere tractors that were then in use. The model now includes other tractors, and the tractors for which the model will predict performance are contained in the file "Tractors" on the computer disk that contains the program.

Tractor information is taken from Nebraska Tractor Test data (3). The model computes implement draft, drawbar power, axle power, maximum available power-take-off power, percent load, percent slip, tractive efficiency, desired no-load forward speed, fuel efficiency for each operation, fuel consumption per unit of land area, fuel cost per unit of land area, total fuel consumed, total fuel cost and overall fuel efficiency.

One of our major concerns in developing the initial model was the fact that most previous attempts at predicting energy input were based on average tractor and implement sizes, or on the assumption that a tractor of any size would be used to pull an implement of only one size. Our model has the flexibility to include tractors of any size, implements of any size and combinations of tractors and implements of different sizes. Also, other methods assume "usual conventional input practices", but our model permits the user to adapt operations to unique situations (e.g., different soil types or conditions).

The major purpose of our model is to present options to help farmers reduce their costs of production by minimizing the amount of fuel used. However, it has additional applications; e.g., the development of estimates of production costs to be used when applying for production credit.

PROGRAM DEVELOPMENT

This program was developed initially for a microcomputer system (Tektronix 4051 microcomputer terminal, Tektronix 4907 disk drive and Digitax Dekwriter III printer). It was obvious at the outset that a limited number of Mississippi farmers would be expected to own or have access to this particular system. The Tektronix equipment was available during the development phase of the model; therefore, it was used as the primary system. However, farmers do use a variety of computer systems, so, to maximize the use of the computer model, it has been programmed for the Apple II Plus, IBM Personal Computer, Radio Shack TRS-80 Model III, Tektronix 4051 and UNIVAC 1100/80.

Some close comparisons of model results have been made with actual costs of soybean production, but the information obtained through use of the computer model is dependent on choices of variables made by the user. Therefore, the values obtained are to be considered only as approximations to the quantities and costs of fuel used in actual operations.

Specific instructions for running the program on the Apple II Plus, the IBM PC and the Radio Shack TRS-80 microcomputers are presented in the following sections.

Fuel-Consumption and Fuel-Cost Predicti Model for Agricultural Crop Production

APPLE II Version

NOTE: The operating procedure was developed for the use of the Apple II Microcomputer with a sing drive system and a printer. The printer must be connected to slot number 1 of the computer.

OPERATING PROCEDURE

The Fuel-Consumption and Fuel-Cost Prediction Model for Agricultural Crop Production is stored on a 5 1/4-inch floppy diskette. A DOS 3.3 System Master diskette is required for use of the program diskette. The model was developed for the convenience of the inexperienced user and may be run by performing the following steps:

1. Power up the disk drive unit, monitor and printer.
2. Place the flexible disk containing the DOS 3.3 System Master in the Disk Drive.
3. Enter PR#6 on the keyboard. This stores the DOS in High Memory.
4. Remove the System Master diskette and replace it with the program diskette.
5. Enter LOAD PROGRAM
6. Enter RUN

The program is now ready to run. The fuel-consumption and fuel-cost model is a user-directed type that is "menu" oriented, in that program flow is controlled by selections from a list that is printed out upon completion of each job. Initially, the model also provided an automatic or "hands-off" version that required very little interaction from the user. However, this version, though easier to use, proved to be too restrictive and was eliminated.

PROGRAM EXECUTION

Program execution begins when the user enters RUN on the keyboard. The title of the model is displayed at the top of the screen, and the user must answer several questions, as they are asked, by entering a make and model of tractor; the number of acres to be worked and the price of diesel fuel or the price of gasoline (or both). NOTE: (A decimal number in the form X.XX i entered, but no dollar sign is used.)

The present method of running the fuel-consumptio and fuel-cost model is the "User-Interactive" mode. Thi process allows the user to control the program flow Fuel consumption will be predicted only for the opera tions desired. To run the program in this mode, the use must enter RUN on the keyboard. This action will cause all of the variables to be initialized and will allow program execution to begin.

Several options are given in the user-interactive mode that allow the user either to choose input data from a range displayed for each implement or to use pre-programmed values, which are average values of the range for the implement.

Next, the user chooses the type of tractor selected to perform the operations. The tractor test data, such as maximum horsepower, static rear-axle force and drawbar height are supplied by the user (from the Nebraska Test data on the disk) as needed during the interactive session.

After the options for using the model have been given, instructions for running the program are displayed on the screen. When the list of possible operations is displayed, the user must enter the number corresponding to the desired job. When a particular operation is completed, the list of possible operations (shown on page 5) is again displayed, allowing the user to make another choice. This process will continue until Item number 12 (STOP PROGRAM EXECUTION) is chosen from the list.

The user is allowed to choose the operations to be performed and the number of times for each. Comparisons may be made between several runs of a single operation; e.g., if Item number 2, DISK HARROW, were chosen, the computer would display OPERATION: DISK HARROW on the screen and then ask for the

umber of times the operation is to be performed. All uestions are to be answered by the user as they are sked. When the user enters the Nebraska tractor test ata the program will give the option of using the same actor for each run, or using different tractors. The actor name is entered along with the type of fuel, aximum horsepower, the static rear axle force, rawbar height, wheelbase, horizontal distance to the enter of gravity and vertical distance to the center of ravity.

Next, a soil condition is chosen for each run, and the peed and implement widths are selected. After these alues are entered, the computer asks if a hard copy f the results is desired. When the user selects the appropriate option, the screen is cleared, tractor performance and fuel consumption data are displayed on the creen and are printed out for each run.

The questions encountered for all of the operations re similar, except for the combine operation. If this em is chosen from the list, the computer will give the ser the option of choosing the approximate percent f maximum power required to perform the job, or of sing a pre-programmed value of 85%. Depending on eld conditions, this value could vary greatly between uns. If the user enters N, the value of 85% is used.

Next, the user is prompted to enter the number of uns, the speed for each run, header width, maximum orsepower and fuel type. Machine performance and uel consumption data then are displayed on the screen nd printed by the printer.

All fuel consumption data obtained from the individual operations are saved in memory to be displayed in the summary, if desired, unless the user uns through an operation more than once (by choosing that operation from the list of possible operations more than once). Then only the data for the final run will be saved for the summary.

To view all previous fuel requirements for the operations (except as noted above), the user must choose Item number 11 (SUMMARY FOR ALL OPERATIONS). NOTE: The summary is not printed by the printer, because the same information was printed as it was being calculated for each opertion). The data for each operation are displayed.

Data Display Example

Chisel Plow No. 1
Fuel Consumed/Unit Area..1.90 Gal/Ac (17.76 L/Ha)
Fuel Cost/Unit Area $2.37/AC ($5.86/HA)
Fuel Needed. .....379.65 Gal (1437 L)
Cost of Operation. $474.56

To view total fuel consumption and fuel cost of all operations, Item number 10 (TOTAL OF ALL OPERATIONS) must be chosen from the list. The following is an example of the type of data displayed. A hard copy of the total will be generated as well.

Total for Diesel for all Operations*

Total Fuel/Unit Area. ....1.90 GAL/A (17.76 L/HA)
Total Fuel Cost/Unit Area. $2.37/A ($5.86/HA)
Total Fuel Required. .....379.65 GAL (1437 L)
Total Fuel Cost. $474.56

Where
GAL = U. S. Gallons
A = Acre
L = Liters
HA = Hectare

If desired, the user may change the input parameters (such as, the tractor and the implement width) and may rerun the program to make comparisons for purposes of determining the least-cost combination for accomplishing the desired operations.

When the work is completed, remove the disk and turn off the system.

**These data are totals for the one chisel plow operation shown above.*

Fuel-Consumption and Fuel-Cost Predictio Model for Agricultural Crop Production

IBM Version

NOTE: The operating procedure was developed for use of the IBM Personal Computer and IBM or EPSON printer. 62 k bytes of memory are required.

OPERATING PROCEDURE

The Fuel-Consumption and Fuel-Cost Prediction Model for Agricultural Crop Production is stored on a 5 1/4-inch floppy diskette. The model was developed for the convenience of the inexperienced user and may be run by performing the following steps:

1. Place the flexible disk in the Disk Drive.
2. Power up by turning on the disk drive unit, monitor and printer.
3. Enter date and time.
4. Enter BASIC
5. Press the function key [F3], then enter CPFUEL
6. Press [F2].

The program is now ready to run. The IBM versio of the fuel-consumption and fuel-cost model also is user-interactive type that is "menu" oriented, in tha program flow is controlled by selections from a list tha is printed out upon completion of each job.

Program execution is virtually the same as for th Apple II microcomputer (as given in that section unde the heading "Program Execution"). To run the progran the user can enter RUN or press the [F2] key.

When the work is completed, remove the disk an turn off the system.

TRS-80 Version

NOTE: The operating procedure was developed for the use of the Radio Shack TRS-80 Model III Microcomputer.

OPERATING PROCEDURE

The Fuel-Consumption and Fuel-Cost Prediction Model for Agricultural Crop Production is stored on a 5 1/4-inch floppy diskette. The model was developed for the convenience of the inexperienced user and may be run by performing the following steps:

1. Power up by turning on the microcomputer and printer.
2. Place the flexible disk in the Disk Drive.
3. Enter the date and time.
4. Enter BASIC
5. Enter LOAD"CPFUEL"
6. Enter RUN

The program is now ready to run. The fuel-consumption and fuel-cost model also is a user-interactive type that is "menu" oriented, in that program flow is controlled by selections from a list that is printed out upon completion of each job.

Program execution is the same as for the Apple II microcomputer (as given in that section under the heading "Program Execution").

When the work is completed, remove the disk and turn off the system.

LIST OF POSSIBLE OPERATIONS

NUMBER	NAME	FUNCTION
1.	CHISEL PLOW	The model prompts the user to input necessary data for chisel plow operation.
2.	DISK HARROW	The model prompts the user to input data for the disk harrow operation.
3.	DISK AND INCORP	Prompts the user to input data for the disk and incorporate operation.
4.	FIELD CULTIVATE	Prompts the user to input data for the field cultivate operation.
5.	HARROW	Prompts the user to input data for the harrow operation.
6.	GRAIN DRILL	Prompts the user to input data for the grain drill operation.
7.	ROW PLANT	Prompts the user to input data for the planting operation.
8.	CULTIVATE	Prompts the user to input data for the cultivate operation.
9.	COMBINE	Prompts the user to input data for the combine operation.
10.	TOTAL OF ALL OPERATIONS	Displays total fuel consumption and fuel cost requirements for all operations run from the time the user enters RUN until the time Item number 10 is chosen.
11.	CHANGE INPUT PARAMETERS	Allows the user to re-input program options necessary to run the "user-interactive" version. Brief instructions also are given.
12.	STOP PROGRAM EXECUTION	When this item is chosen, program execution is halted.

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