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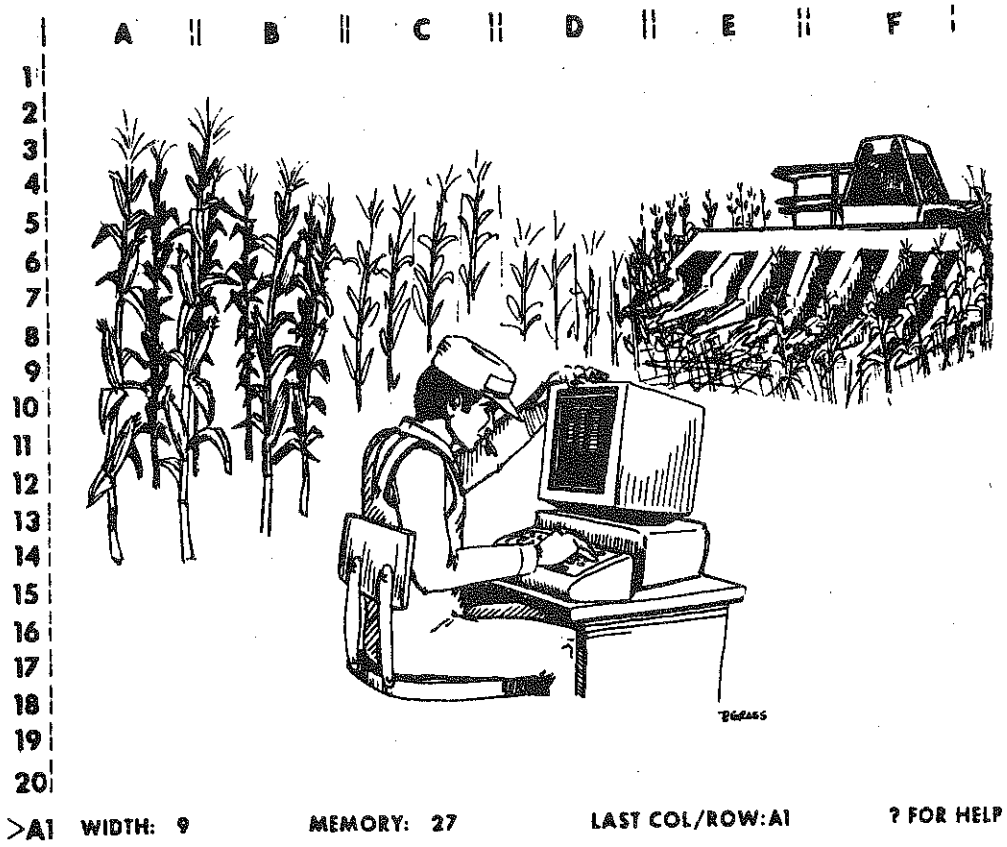
CROP BUDGET AND MACHINERY COST CALCULATOR FOR ELECTRONIC SPREADSHEETS



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Crop Budget and Machinery Cost Calculator for Electronic Spreadsheets

Budgets of crop enterprise costs and returns are useful sources of information to a crop producer and those working with him for such purposes as selecting crops, calculating input needs and projecting costs and returns. Ideally, budgets should be tailor-made for each specific situation and for each change being considered, such as a change in crop acres, fertilizer rates or machines. Budgeting with a pencil and paper or a hand calculator can be time-consuming and tedious. Decisions are therefore often made without any budgeting or with budgets for only one or two of the most promising choices. Microcomputers can reduce greatly the time required for calculating budgets.

Accurate estimates of machinery ownership and operating costs are essential for budgeting crop enterprise costs and returns, making machinery purchase decisions, evaluating crop acreage adjustments and setting custom rates.

Even with a microcomputer to do the calculations, machinery cost calculations require much input data that must be arranged in a logical order and checked. The time required to estimate machinery costs for a crop budget for the first time will be measured in hours, not minutes. Revising the original figures is much faster, however with programs that allow the original data set to be saved and revised. Then, only the changes need to be typed in.

PURPOSE

This paper presents a method for calculating a set of crop enterprise budgets for up to five crops grown using a specified set of farm machinery. Machinery ownership costs, operating costs and labor requirements are calculated. A set of templates for the Supercalc brand of electronic spreadsheet, version 1.12, on an Osborne 1 microcomputer is used. [1]

The templates are intended for use in teaching Extension staff and advanced farm managers about crop enterprise budgeting, economics of crop production and machinery management. They are also intended as an applied research tool and as an aid for Extension staff in counseling farmers.

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[1]This paper discusses one of many applications of an electronic spreadsheet. It is not intended to teach how to use the electronic spreadsheet itself. Readers are referred to H. Willson, Personal and Desktop Computing: A Short Course in Computer Literacy, "Lesson II, Spread Sheet Programs and Lesson III, Program Operation," Cooperative Extension, College of Agriculture and Life Sciences, Cornell University, 1982, or to the tutorial section of the spreadsheet manual for that purpose.

The paper is organized as follows: First, the concepts of an electronic spreadsheet and template are introduced. Hardware and software requirements are then listed. A general overview describing the organization of cost information on the spreadsheets is next, followed by a discussion of the methods used to calculate various budget items. The next section is a user's guide, providing step-by-step instructions for first-time users. Printouts of the templates, their formulas and formats, along with sample output and worksheets are included in the appendices.

DEFINITIONS

An electronic spreadsheet is a popular type of microcomputer software for business and agricultural applications. The name comes from similarity to a paper spreadsheet on which calculating tasks are set up as tables of columns and rows of figures. These rows and columns are titled, cross referenced and manipulated mathematically. An electronic spreadsheet arranges the computer's memory as an "electronic sheet". The computer's screen becomes a "window" which looks at a part of the spreadsheet. A template is a set of spreadsheet instructions to perform a specific task. The instructions are made up of labels, values and formulas. An execute file is a file containing a sequence of spreadsheet commands which are executed when the file name is entered as part of an "execute" command. Execute files are used to simplify use of large and multiple templates.

WHAT YOU NEED TO USE THE CALCULATOR

The task of calculating crop enterprise budgets including machinery ownership and operating costs is a relatively complex one to do on a microcomputer and electronic spreadsheet. There are many commercially available microcomputers, and as of the spring of 1983 there were reportedly about 60 different brands of electronic spreadsheets on the market. No attempt will be made here to evaluate the features of even the major brands and how suitable they would be for a specific application like calculating crop enterprise budgets.

The templates are discussed as they are set up on one specific spreadsheet and microcomputer for illustrations only. The potential user can type the templates into other spreadsheets using the printouts provided in the appendix.

To use a diskette copy of the set of templates discussed in this paper you will need:

1. An Osborne 1 microcomputer, double density version;

2. A printer for producing paper copies. The diskette is set up for printing in compressed type on a dot-matrix (Epson MX-80) printer connected to the parallel (Centronics) port.

3. A Supercalc version 1.12 electronic spreadsheet source program diskette and user manual. This version provides an execute (X) command not included in the earlier version 1.05.

4. At least two blank diskettes for storing completed budgets (one for the original and one as a backup).

OBTAINING A DISKETTE COPY OF THE TEMPLATE

A 5 1/4" diskette copy of the templates can be obtained for use with Supercalc version 1.12, on the Osborne 1. Contact your county Extension agent or William F. Lazarus, Department of Agricultural Economics, Cornell University, Ithaca, N.Y., 14853, for details on obtaining a diskette copy.

CROP BUDGET AND MACHINERY COST CALCULATOR: OVERVIEW

The crop budget and machinery cost calculator is a series of seven spreadsheet templates and ten execute files. Operating and ownership costs for tractors and other machines are calculated with the first five templates. Each of these templates are designed to accommodate a single tractor and all machinery and equipment operated with that tractor. The procedures for entering data and making cost calculations are repeated for each tractor owned and its associated machinery. The types of input data needed to set up the template include: purchase price and list price if different from purchase price; width of machine; average operation speed; field efficiency; age of machine at purchase and years owned; salvage value; interest, insurance and storage rates; fuel price; acreage of each crop; and number of times over the field by each machine for each crop. A self-propelled machine such as a combine is accommodated by entering the power unit in place of a tractor and entering the header attachments in place of pull-type machines. Refer to Table A2 in the appendix for a sample worksheet used for organizing the required input data.

The sixth template calculates operating and ownership costs for a single truck. Inputs for this template are similar to those required for machinery, with the exception that miles operated per year, average miles per hour and average miles per gallon, are required. A sample input worksheet is shown in Table A6.

The last template calculates costs and returns per acre for each of up to five crop enterprises, using the machinery operating and ownership costs calculated previously.

The templates provide information on:

1. Fuel costs per acre by machine and crop.

2. Repair and maintenance costs per acre for each machine on each crop as well as a total for all machines.

3. Labor hours per acre for each machine and crop.

4. Hours use per year for each machine as well as accumulated hours over the estimated life.

5. Proportion of hourly machine use by crop.

6. Crop enterprise costs and returns.

Sample template results are provided in Appendix tables: A1, for machinery operating costs, A5 for truck operating costs and A9 for crop enterprise costs and returns.

METHODS USED TO ESTIMATE COSTS

The "economic engineering" approach is used to calculate machinery ownership and operating costs and hours of machine operating labor per acre. In this approach, engineering formulas are used to calculate hours required to cover an acre for each machine based on width, speed and field efficiency. Other formulas are used to estimate fuel use and repair costs on an hourly and per acre basis.

Field Capacity

The time required to cover an acre is the first calculation for each machine. This is called its "field capacity". The field capacity of a machine is a function of the machine capacity, field efficiency and operating speed. Machine capacity is the width of the machine. For example, with a grain combine, it is the width of the grain head. For a corn planter, machine width is the number of rows times the row spacing.

Field efficiency is the percentage of the theoretical field work accomplished after deducting for losses resulting from failure to use the full width of the machines, turning and idle travel at the ends, clogging, filling and adjusting seed, fertilizer and spray materials, unloading harvested crops, machine adjustments and minor repairs, lubrication, and other minor interruptions. It excludes waiting for supplies, wagons or trucks, major breakdowns, and daily service activities. Field efficiency for a particular machine varies with the size and shape of the field, field obstructions, pattern of the field operation, crop yield, moisture and crop conditions. The size of the machine also influences the field efficiency. Efficiency is reduced as larger machines are used. For example, the efficiency of corn planters and corn tillage tools is reduced about one percent for each row added, discs about one percent for each 30 inches of added width and moldboard plows about two percent per bottom added.

The speed of the implement is influenced by the size of power unit, the draft of the implement, the physical characteristics of the land, and the dexterity of the operator. Generally, the effective speed of the implement determines the rate of travel.

The time required to cover an acre is computed by using the following formula:

$$\text{Hours/acre} = \frac{8.25 \times \text{times over the field}}{\text{width (ft.)} \times \text{speed (m.p.h.)} \times \text{field efficiency (decimal)}}$$

Typical speeds and field efficiencies are shown in Table 1.

Operating and Ownership Costs

Costs of using new or used machinery can be categorized into two groups, operating or variable costs and ownership or fixed costs. Operating costs include fuel and lubrication, repairs and labor. Ownership costs include depreciation, interest, taxes, insurance and housing.

Operating Costs

Accumulated repair costs for different types of machines at any point in their useful lives is estimated in a formula. Years owned are first multiplied by annual hours of use to give accumulated hours of use. List price of the machine is used to relate repair cost to the cost of the machine. The formula is:

$$\text{accumulated repair cost} = 0.01 \times P \times a \times \left(\frac{H \times 100}{u}\right)^b$$

P = List price
H = Accumulated hours of use
u = Estimated wearout life in hours (from Table 1)
a = Repair coefficient 1 (from Table 2)
b = Repair coefficient 2 (from Table 2)

For used machines, repair cost over years owned is calculated by subtracting accumulated repairs at purchase from accumulated repairs at end of years owned. The repair cost over years owned is then divided by hours of use to get an average repair cost per hour. Values for Repair 1 and Repair 2 are given in Table 2 for different types of machines.

Fuel and lubrication costs depend on the nature of the job being performed, the size of the unit, and the type of fuel used. Average annual fuel consumption in gallons per hour, based on University of Nebraska tractor test data, was estimated as follows (Sprague, et al.):

gasoline = 0.06 x maximum p.t.o.h.p.
diesel fuel = 0.0438 x maximum p.t.o.h.p.
L.P. gas = 0.072 x maximum p.t.o.h.p.

For individual operations, fuel consumption may vary considerably from the average. For plowing the consumption may be increased by about one-third. Costs of oil, lubricants, and oil filters approach about 15 percent of the fuel cost.

Table 1. Farm Machinery Characteristics

	Speed (mph)	Field Efficiency (decimal)	Estimated Life (hours)
Moldboard or disc plow	3.5-6.0	0.70-0.90	2,500
Chisel plow	4.0-6.5	0.70-0.90	2,500
Subsoiler	3.0-5.0	0.70-0.90	
Land plane			2,500
Powered rotary tiller			
3-4 inch increment of cut	1.0-5.0	0.70-0.90	2,500
Harrow, single disc	3.0-6.0	0.70-0.90	2,500
Harrow, tandem disc	3.0-6.0	0.70-0.90	2,500
Harrow, offset or heavy tandem disc	3.0-6.0	0.70-0.90	2,500
Harrow, spring tooth	3.0-6.0	0.70-0.90	2,500
Harrow, spike tooth	3.0-6.0	0.70-0.90	2,500
Cultipacker	4.5-7.5	0.70-0.90	2,500
Rotary hoe	5.0-10	0.70-0.85	2,500
Rod weeder	4.0-6.0	0.70-0.90	2,500
Field cultivator	3.0-8.0	0.70-0.90	2,500
Field cultivator - heavy clay	3.0-8.0	0.70-0.90	2,500
Row crop cultivator	3.0-6.0	0.70-0.90	2,500
Fertilizer spreader			
Pull type	3.0-5.0	0.60-0.75	1,200
Anhydrous ammonia applicator	3.0-6.0	0.60-0.75	
Field sprayer	3.0-5.0	0.50-0.80	
Manure spreader, beaters			2,500
Manure spreader, chain flails			2,500
Manure spreader, liquid			2,500
Corn or soybean planter,			
drilling seed only	3.0-6.0	0.50-0.85	1,200
Corn or soybean planter			
with all attachments	3.0-6.0	0.50-0.85	1,200
No-till corn planter	3.0-5.0	0.50-0.75	1,200
Grain drill	2.5-6.0	0.65-0.85	1,000
Mower	5.0-7.0	0.75-0.85	2,500
Mower-conditioner			
(cutterbar)	4.0-6.0	0.60-0.85	2,000
Mower-conditioner (flail)	4.0-6.0	0.60-0.85	2,000
S.P. mower-conditioner	3.0-6.0	0.55-0.85	2,500
Rotary mower; horizontal blade	3.0-8.0	0.75-0.85	2,000
Conditioner only	5.0-7.0	0.75-0.85	2,500
Side Delivery Rake	4.0-5.0	0.70-0.85	2,500
Baler, pto	2.0-4.0	0.60-0.85	2,500

Table 1. Farm Machinery Characteristics (cont.)

	Speed (mph)	Field Efficiency (decimal)	Estimated Life (hours)
Flail type forage harvester in green forage	2-4.5	0.50-0.75	2,000
Forage harvester (pull-type)			2,000
Green forage	2-4.5	0.50-0.75	
Wilted forage	2-4.5	0.50-0.75	
Dry Hay	2-4.5	0.50-0.75	
Corn silage	2-4.5	0.50-0.85	
Recutter & wilted forage	2-4.5	0.50-0.75	
S.P. forage harvester windrower, small grain	5-7	0.75-0.85	2,000
PTO combine, wheat	2-4	0.65-0.80	2,000
S.P. Combine	2-4	0.65-0.80	2,000
Corn head			2,000
Corn Picker			2,000
1-row trailed	2-4	0.60-0.80	
2-row trailed	2-4	0.60-0.80	
Beet Topper	2-3	0.60-0.80	2,000
Sugar beet harvester	3-5	0.60-0.80	2,500
Forage blower			2,000
wilted hay crop	20-30T/hr.		
corn or grass silage	20-50T/hr.		
Tractor, 2-wheel drive			12,000
Tractor, 4-wheel drive			12,000
Tractor, crawler			12,000
Truck, farm			2,000
Truck, pickup			2,000
Front end loader			2,500
Wagon and box			5,000
Wagon, feed			2,500

SOURCE: P. R. Sprague, W. A. Knoblauch, and R. A. Milligan. Profitable Combinations of Cash Crop Enterprises - Objectives and Procedures of a Sequential School Extension Program. A.E. Extension 80-7, Department of Agricultural Economics, Cornell University, March 1980, and American Society of Agricultural Engineers, 1975. Agricultural Engineers Yearbook, pp. 347-54, St. Joseph, Michigan.

Table 2. Repair and Maintenance Cost Coefficients for Farm Machinery

Repair Group #	Machine	Repair 1	Repair 2
1	2-Wheel Drive Tractors	.120	1.5
2	4-Wheel Drive & Crawler Tractors	.100	1.5
3	Tillage Tools, Rotary Hoe, Cutterbar, Mower, Cultivator, Cultipacker	.301	1.3
4	Fertilizer Equipment	.191	1.4
5	Self-Propelled Combine, Self-Propelled Forage Harvester, Pickup Truck, Manure Spreader, Front End Loader	.096	1.4
6	P.T.O. Baler, Corn Picker, Forage Blower, Sprayer, Pull Type Forage Harvester	.127	1.4
7	Corn Planter, Grain Drill, Mower Conditioner, Rake, Wagon	.159	1.4

SOURCE: American Society of Agricultural Engineers, 1975 Agricultural Engineers Yearbook, pp. 347-54. St. Joseph, Michigan.

The costs of fuel, oil and lubricants per hour are calculated as follows:

fuel and lubricants = fuel coefficient x maximum p.t.o.h.p. x fuel cost x fuel multiplier

where the fuel coefficient is entered for the type of fuel used by the tractor or self-propelled power unit and the fuel multiplier is used to adjust fuel consumption up or down for a particular operation. Estimated fuel coefficients based on the Nebraska data and the 15 percent allowance for lubricants are:

gasoline and lubricants	0.0690
diesel fuel and lubricants	0.0504
L.P. gas and lubricants	0.0828

Suppose a diesel tractor is used for plowing, planting corn and raking hay. Enter a fuel coefficient of 0.0504 for the tractor. To increase fuel consumption for plowing, enter 1.33 as a fuel multiplier for the plow. Enter a fuel multiplier of 1.0 for normal fuel use in planting corn. To decrease fuel consumption for raking hay, enter a multiplier less than 1.0, such as 0.67.

Truck Operating Costs

Many of the calculations for estimating truck operating costs are the same as those used for figuring machinery costs. Hours of use and fuel usage are different in that these costs are based on miles driven per year, typical speed in miles per hour and the average rating of miles per gallon. Truck ownership expenses are allocated among various crops based on crop acreage. Fuel cost, repair and maintenance expense and labor are divided equally among crops and between growing and harvesting periods.

The following formulas are used for these items:

$$\text{hours per acre} = \frac{\text{miles per year}}{\text{miles per hour x acres}}$$

$$\text{fuel cost per acre} = \frac{\text{miles per year x fuel price}}{\text{miles per gallon x acres}}$$

Ownership Costs

Depreciation is the decline in value over the life of the machine. For tax purposes depreciation can be computed by the straight line method, the sum of digits method or the declining balance method. Assuming a reasonable salvage value, which method of depreciation will give the greatest amount of depreciation over the life of the machine? Each method will give the same amount of depreciation for the life of the machine. Furthermore, if a farmer depreciates a machine to a very low salvage value and then trades for another machine, the new machine will have a lower cost to be depreciated over its life. However, the actual total depreciation can never be known until the machine is sold or traded. With recent price increases for new machinery, many used items sell for prices greater than their original purchase price. Straight-line depreciation is the method used in the template.

Interest on investment is the annual interest charge on the undepreciated value of machinery. Many farmers do not think of interest as a cost unless they borrow money to purchase a machine. Even though money is not borrowed, interest charges should be considered because funds could be invested elsewhere and earn a return.

Insurance must be included as a cost of operation. Liability coverage should be included because tractors and other machinery may be involved in accidents resulting in liability claims. There may also be losses as a result of fire or high winds. Generally farmers do not insure individual machines, but have a blanket policy. A common rate is $5 per $1000 valuation or 0.5 percent of the remaining value at the beginning of each year.

Housing is another cost of using machinery. Some machinery repair indicate that housing may increase the life of the machine, which in turn

may be reflected in the trade-in value. Typical housing costs are 1.5% of the beginning yearly value.

Taxes are levied against personal property in some states. New York does not have a personal property tax.

A WORD OF CAUTION

Electronic spreadsheets, like other computerized decision aids, perform calculations. They do not eliminate the need for the user to check the results carefully to make sure that the data has been entered correctly and the operations performed in the proper order. Use common sense, print out the results, and spot-check with a calculator occasionally.

Care is in order especially when the user modifies the formulas to suit his or her problem. Most of the formulas have been protected from accidental changes, but this protection can be overriden. The user bears responsibility for seeing that any changes are done properly.

TEMPLATE USER'S GUIDE

The machinery cost calculator is a set of seven templates and ten execute files stored on a 5 1/4" diskette.

Templates	Execute Files
MACH1	T1
MACH2	T2
MACH3	P1
MACH4	P2
MACH5	P3
TRUCK	P4
CROP	P5
	PT
	PC
	PALL

The templates require most of a 5 1/4" double density, single sided diskette for storage. It works best to use one diskette per set of budgets. Be sure to label the diskette appropriately. The first five templates, MACH1, MACH2, MACH3, MACH4 and MACH5, each calculates field capacity and operating and ownership costs for up to nine machines used with each of five tractors. Data for one tractor and its machines are entered in MACH1, the second tractor and machines in MACH2, etc. The sixth template, TRUCK, calculates costs for a truck. Ownership costs are allocated to up to five crops on the basis of hours of use. The names MACH1, etc. and TRUCK are the file names under which the templates are saved on diskettes.

The first step in using the machinery cost templates is to organize the input data. Worksheets have been set up for this purpose and are included in the Appendix. For now, refer to the completed set of sample worksheets provided in Tables A2, A5 and A8 in the Appendix.

The second step is to make a backup copy of the diskette, using the CP/M COPY program. Keep the original diskette for later use. Enter your data in the backup templates, replacing the example entries.

After organizing your data and making a backup diskette, you are ready to enter the data into the templates. Load the Supercalc source diskette into drive A and your backup copy of the templates in drive B, and load Supercalc. When the display of rows and columns appears, load MACH1 by typing

```
/LB:MACH1,A
```

.

In transferring data from MACH1, etc. to CROP, the execute files look for data in a specified part of the template. Don't insert or delete rows or columns in MACH1, MACH2, MACH3, MACH4, MACH5 or TRUCK. Doing so will cause errors.

Machinery Costs - MACH1

The upper left portion of MACH1, shown as Table A1 in the Appendix, will appear on the screen. For illustration, MACH1 has been filled in with the entries shown on the sample worksheet. To use the template, type in your own machine information in place of the sample entries. The Supercalc automatic recalculation feature has been turned off on all templates to avoid excessive calculation time. After entering new data and before saving a template, type an exclamation point ! to recalculate.

All data for a machine is grouped in a single column. Rows 7-24 are for input data. Enter the machine name in rows 6 and 7, abbreviated to no more than 8 spaces. The purchase price, used in calculating ownership costs is entered in row 8. The list price if different than purchase price should be entered in row 9 and is used for calculating repair cost. Width, speed and field efficiency go in rows 10-12. The fuel multiplier in row 13 should be 1.00 for a machine which uses an average amount of fuel. Increase the fuel multiplier for operations such as plowing which use fuel at a higher rate, or reduce it to reduce calculated fuel use. Enter the repair group number from Table 2 in row 14. LOOKUP tables are used to provide repair coefficients 1 and 2. The LOOKUP tables are stored in columns Q and R. Enter the estimated life in hours from Table 1 in row 17. If the machine was purchased used, enter the age at purchase in row 18. Enter in row 19 the number of years the machine is expected to be owned. Enter the expected salvage value of the machine, as a proportion of the list price, in line 20. Elements D22 to D24 are for an interest rate charged on the average investment in the machine over its useful life, and for an insurance and storage cost rate charged on the purchase price. Enter these rates as decimals, not percentages.

The ownership costs, depreciation, interest on investment, insurance and storage are calculated on a yearly basis for each machine and summed to get total ownership cost per year for the farm. This total annual figure is useful for partial budgeting of machinery purchase decisions. For some uses such as calculating total production costs per acre for a

crop, it is useful to allocate ownership costs among crops. MACH1 allocates total annual ownership cost for each machine to each of up to five crops based on the proportion of total annual hours of use used on that crop.

The templates are set up to calculate costs for a farm with up to five crops, with operations divided into growing and harvesting. Enter the number of times each machine covers the field per year in rows 30-39. Example: the 1.00 in D32 indicates that the plow is used once in growing corn. A four-year hay stand is plowed only once every four years which works out to 0.25 trips per year.

Enter the acres of each crop in column A, rows 30-38, in the rows for growing operations. These acres times hours per acre give total annual hours of use for each machine. Make sure you enter the acres only once for each crop. Zeros have been entered in rows 31, 33, 35, 37 and 39 to prevent double-entering acres.

You may have noticed that some of the template entries are brighter than others. The darker entries are headings and calculated values, protected against overwriting by the

/P

command to prevent you from accidentally erasing them.

The MACH1 spreadsheet has sample data for a corn planter, forage harvester, plow, disc harrow, and a 90 horsepower tractor. The tractor data is in column N. The rest of the columns, I-L are titled (blank) and are left for the user to enter the data for additional machines.

The tractor input data is slightly different from that for the other machines. Row 10 is for the tractor horsepower. Enter the fuel price per gallon in row 11. Row 12 is blank. The fuel coefficient in row 13 should be entered for the type of fuel used by the tractor.

Let's return to the columns headed (blank) for a moment. These columns have a set of input data which was selected to give calculated costs of zero for these columns. The first thought is to simply enter zeros as input data. Entering all zeros will give errors. Some input items are used as divisors and dividing by zero results in errors in all later calculations.

To use the template, enter your own data by typing over the sample data. Start from the left and use as many columns as you need up to the maximum of 9. To recalculate and save the data you have entered, type

! /SB:MACH1,OA.

Note: Be sure to zap the current screen,

/ZY,

between templates, after saving the current copy back into the file and before loading the next.

Supercalc allows data to be transferred from one spreadsheet to another. This feature is used to transfer calculated costs from MACH1, etc. and TRUCK to CROP where operating and ownership costs are summed for all tractors and trucks and transferred into the crop enterprise budgets.[2]

The execute command in Supercalc allows you to execute a series of commands with a single command. All of the commands needed to carry out a specific task, such as transferring parts of templates or printing several pages of output, are stored in the execute file. When the execute command is typed in with a filename, all the commands in that file are performed sequentially as if they were actually being typed from the keyboard. The execute commands to transfer costs for the tractors, machinery and truck into the crop budget template and to print the output are described below.

Changing Common Machine Data (Optional)

Crop acreage and interest and storage cost rates should usually be the same in each template MACH1,...,MACH5 and TRUCK. Insurance rates should usually also be the same for MACH1,...,MACH5. It would be convenient to enter these numbers only once and have it be transferred to the other templates. The first execute command is used to do this. First, enter the data in MACH1 and save it with

```
/SB:MACH1,OA
```

.

Then type the execute command

```
/XB:T1
```

.

The computer will take a few minutes to complete this step since it is loading and saving five files and recalculating each.

Other Tractors - MACH2, ..., MACH5

The MACH2 through MACH5 templates are identical to MACH1, except that all columns used for machine entries are 'blank', i.e., sample entries are not included.

These templates are provided for recording data for additional tractors or power units and their machinery complements using the same procedures and commands as with MACH1.

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[2]The transfers are needed because the calculations in MACH1, etc., TRUCK, and CROP will not all fit in 64K of memory. For machines with sufficient memory, combine the calculations into one spreadsheet.

Truck Operating Costs - TRUCK

Referring to the sample worksheet for TRUCK, Table A6, you can see that many of the items required as inputs are the same as those for machinery. The items that are different are those used for figuring hours of use, total fuel usage and insurance. Miles travelled per year is recorded in line 8, followed by average miles per gallon in line 9. The price of fuel is required in line 10 and the average speed in miles per hour goes in line 13. Insurance is entered in line 17 in dollars per year.

Acres of each crop are entered in column A and are used for allocating the truck ownership costs among crops.

Load the truck template now by typing

```
/LB:TRUCK,A
```

and examine the full template. A sample output is also shown in Table A5. Substitute your own values in the input rows described above by typing over the sample data. The repair coefficients and the estimated life have been provided based on the information shown in Table 2 for a pickup truck. A repair group number is not required as an input item for the truck as it is for machinery since it will always be the same.

If you don't want to include a truck in the machinery set, enter zeros for purchase price, list price and fuel price. Enter a one for miles/year, not zero, because this is used as a divisor in the calculations. Recalculate and save your truck input data with the command

```
!  /SB:TRUCK,OA .
```

Crop Enterprise Income and Expense Budget-CROP

The crop budget template, CROP, uses this information on machinery expenses for calculating total variable and fixed expenses for up to five crops. Load the crop budget template by typing the command

```
/LB:CROP,A .
```

The upper left portion of CROP, shown as Table A9, in the Appendix, will appear on the screen.

An example corn silage budget is shown. Make any necessary changes by typing the new values over the old. Now you will need to use the second of the execute commands to transfer the machinery cost data into CROP. Do this by typing the command

```
/XB:T2 .
```

When the job is completed, you should be able to scroll across the top of CROP and see the operating and ownership cost totals that you had calculated in MACH1, etc. and TRUCK.

CROP is a template for up to five crop budgets. The first is made up of columns for item descriptions, units of measurement, price per unit, quantity per acre and total expense or income per acre. This information takes up rows in columns N to S. The remaining four budgets are identical, and are located in columns U to AQ.

The enterprise budget information is provided in the following five categories:

VARIABLE EXPENSES
FIXED EXPENSES
CROP VALUE
NET RETURN
BREAKEVEN PRICES

The VARIABLE EXPENSES are separated into growing, harvesting, selling, interest on operating expenses and family and hired labor. Growing expenses include the input costs and variable costs associated with tillage. Harvesting costs include the variable costs associated with harvest and the variable costs associated with moving feed crops from the field. Interest on operating expenses is the charge for the use of the capital required for growing, harvesting and selling the crop. The template calculates interest on total growing and harvesting expenses, rather than trying to keep track of purchase dates for individual items. The figure which appears in the quantity column for interest on operating expenses is the sum of growing and harvesting expenses. The annual interest rate entered in the price column is adjusted for the fraction of a year represented by the number of months specified.

The final variable expense is labor. Labor costs are difficult to allocate since they are both fixed and variable; however, for enterprise budgeting, they are best included as a variable cost. Labor hours are calculated as a proportion of tractor and truck hours. The number in L34, presently 2.0, sets labor hours to twice tractor and truck hours. This value can be adjusted up or down for specific situations.

The FIXED EXPENSES section includes the usual fixed costs associated with owning land, buildings and machinery. All of the machinery ownership costs are charged to the crop enterprises.

TOTAL VARIABLE AND FIXED EXPENSES is simply the sum of total variable expenses and total fixed expenses. This figure represents the total cost of producing one acre of the crop at the indicated yield under the specific conditions. The only expense item that is not charged is management.

In the CROP VALUE section, total income is yield per acre times price. Two lines are provided to allow space for a primary crop product, in row 96, and a by-product, in row 97.

The two profitability measures presented in the NET RETURN section are net return over variable expenses and return to management. Return over variable expenses is income minus variable expenses including labor and interest on operating expenses. Return to management is income minus

total expenses, including variable expenses, machinery ownership costs, a land charge and property taxes.

The BREAKEVEN section gives prices for the primary crop product at which variable expenses, row 84, and total variable and fixed expenses, row 93, are covered. Value of the by-product in row 97, if any, is subtracted from expenses before calculating breakeven prices.

BLANK WORKSHEETS

Tables A4, A8, and A12 in the Appendix are blank worksheets for organizing your own data.

PRINTING OUTPUT

Seven additional execute files have been set up for printing each of the templates described above. Printer controls for lining up the printer and printing the correct lines per page are contained in these files.

Save the template you are working on to the diskette before using the print files below. Each print file must load the tempate to be printed so any template already there is erased first.

The execute commands for printing each of the templates individually are:

/XB:P1	to print MACH1
/XB:P2	to print MACH2
/XB:P3	to print MACH3
/XB:P4	to print MACH4
/XB:P5	to print MACH5
/XB:PT	to print TRUCK
/XB:PC	to print CROP

Alternatively, if you wish to print all the templates at once, type

/XB:PALL.

This execute command simply issues each of the commands above in sequence to print the entire set of output.

Appendix Table A13 is a printout of execute files T1 and T2 and a typed version of P1. P1 and the other print files cannot be printed because of the print commands they contain, but can be viewed using a word processing package.

REFERENCES

American Society of Agricultural Engineers, 1975 Agricultural Engineers Yearbook, St. Joseph, Michigan, pp. 347-54.

Sprague, Philip, Wayne Knoblauch and Robert Milligan. Profitable Combinations of Cash Crop Enterprises - Objectives and Procedures of a Sequential School Extension Program. A.E. Ext. 80-7, Department of Agricultural Economics, Cornell University, March 1980.

Appendix Table A1.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	MACH1: MACHINERY COST AND LABOR TEMPLATE							CAPACITY: 9 MACHINES						
2	FOR A TRACTOR OR OTHER POWER UNIT							COL. A IS FOR ACRES BY CROP						
3	AND MACHINES USED WITH IT													
4														
5	INPUT VARIABLES													
6	FOR EACH MACHINE:			disc	corn	forage								90 hp
7	Machine Name			plow	harrow	planter	harvest	blank	blank	blank	blank	blank	tractors	tractor
8	Purchase Price			5300.00	4400.00	6950.00	13300.00	.00	.00	.00	.00	.00		26400.00
9	List Price			5300.00	4400.00	6950.00	13300.00	.00	.00	.00	.00	.00		26400.00
10	Width in Feet			5.33	12.00	12.00	6.00	99999.00	99999.00	99999.00	99999.00	99999.00	PTO HP	90.00
11	Speed in MPH			4.75	4.50	4.50	3.25	5.00	5.00	5.00	5.00	5.00	Fuel pr	1.31
12	Field Efficiency			.80	.80	.67	.67	.73	.73	.73	.73	.73		
13	Fuel Multiplier			1.33	1.00	1.00	1.33	1.00	1.00	1.00	1.00	1.00	Fuel co	.0504
14	Repair Group #			3	3	7	6	0	0	0	0	0		1
15	repair coef 1			.301	.301	.159	.127	.01	.01	.01	.01	.01		.12
16	repair coef 2			1.3	1.3	1.4	1.4	.00001	.00001	.00001	.00001	.00001		1.5
17	Estim life (hrs)			2500	2500	1200	2000	.01	.01	.01	.01	.01		12000
18	Years Old at Purch			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
19	Years Owned			9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00		9.00
20	Salvage Rate			.10	.10	.10	.10	.10	.10	.10	.10	.10		.10
21	FOR ALL MACHINES:													
22	Interest Rate			.15										
23	Insurance Rate			.015										
24	Storage Rate			.005										
25														
26	HOURS PER ACRE PER TRIP													
27	Hrs/A			.41	.19	.23	.63	.00	.00	.00	.00	.00		
28														
29	=ACRES= INSERT TIMES OVER FIELD BY CROP													
30	120.00	Crop 1 Grow		1.00	1.00	1.00		.01	.01	.01	.01	.01		
31	.00	Crop 1 Harv					1.00							
32	150.00	Crop 2 Grow		.25	.25			.00	.00	.00	.00	.00		
33	.00	Crop 2 Harv					1.00	.00	.00	.00	.00	.00		
34	30.00	Crop 3 Grow		.10	.10			.00	.00	.00	.00	.00		
35	.00	Crop 3 Harv												
36	.00	Crop 4 Grow												
37	.00	Crop 4 Harv												
38	.00	Crop 5 Grow												
39	.00	Crop 5 Harv												
40	300.00	total												
41														
42	HOURS PER ACRE BY CROP													
43	Crop 1 Grow			.41	.19	.23	.00	.00	.00	.00	.00	.00		.83
44	Crop 1 Harv			.00	.00	.00	.63	.00	.00	.00	.00	.00		.63
45	Crop 2 Grow			.10	.05	.00	.00	.00	.00	.00	.00	.00		.15
46	Crop 2 Harv			.00	.00	.00	.63	.00	.00	.00	.00	.00		.63
47	Crop 3 Grow			.04	.02	.00	.00	.00	.00	.00	.00	.00		.06
48	Crop 3 Harv			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
49	Crop 4 Grow			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
50	Crop 4 Harv			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
51	Crop 5 Grow			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
52	Crop 5 Harv			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
53														
54	SUMMARY DATA													
55	Hours use per yr			65.38	30.65	27.36	170.49	.00	.00	.00	.00	.00		293.88
56	Accum Hrs at Purch			.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
57	Accum Hrs Over Lif			588.38	275.86	246.27	1534.44	.00	.00	.00	.00	.00		2644.96
58	R&M Cost/Hr-% of P			.0310558	.0247429	.0443718	.0360365	40.68458	40.68458	40.68458	40.68458	40.68458		.0046948
59	R&M Cost/Hr			1.65	1.09	3.08	4.79	.00	.00	.00	.00	.00		1.24
60														

Appendix Table A1 (cont.)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
61		FUEL COST PER ACRE												
62		Crop 1 Grow		3.22	1.13	1.35	.00	.00	.00	.00	.00	.00		
63		Crop 1 Harv		.00	.00	.00	4.99	.00	.00	.00	.00	.00		
64		Crop 2 Grow		.80	.28	.00	.00	.00	.00	.00	.00	.00		
65		Crop 2 Harv		.00	.00	.00	4.99	.00	.00	.00	.00	.00		
66		Crop 3 Grow		.32	.11	.00	.00	.00	.00	.00	.00	.00		
67		Crop 3 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		
68		Crop 4 Grow		.00	.00	.00	.00	.00	.00	.00	.00	.00		
69		Crop 4 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		
70		Crop 5 Grow		.00	.00	.00	.00	.00	.00	.00	.00	.00		
71		Crop 5 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		
72														
73		R&M COST PER ACRE												
74		Crop 1 Grow		.67	.21	.70	.00	.00	.00	.00	.00	.00		1.02
75		Crop 1 Harv		.00	.00	.00	3.03	.00	.00	.00	.00	.00		.78
76		Crop 2 Grow		.17	.05	.00	.00	.00	.00	.00	.00	.00		.19
77		Crop 2 Harv		.00	.00	.00	3.03	.00	.00	.00	.00	.00		.78
78		Crop 3 Grow		.07	.02	.00	.00	.00	.00	.00	.00	.00		.07
79		Crop 3 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
80		Crop 4 Grow		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
81		Crop 4 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
82		Crop 5 Grow		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
83		Crop 5 Harv		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
84														
85		PROPORTION OF HOURLY USE BY CROP												
86		Crop 1		.75	.75	1.00	.44	1.00	1.00	1.00	1.00	1.00		.60
87		Crop 2		.23	.23	.00	.56	.00	.00	.00	.00	.00		.40
88		Crop 3		.02	.02	.00	.00	.00	.00	.00	.00	.00		.01
89		Crop 4		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
90		Crop 5		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
91														
92		TOTAL OWNERSHIP COSTS												
93		% OF PRICE		.2025	.2025	.2025	.2025	.2025	.2025	.2025	.2025	.2025		.2025
94														
95		OWNERSHIP COST BY CROP												
96		Crop 1		802.43	666.17	1407.38	1197.00	.00	.00	.00	.00	.00		3182.20
97		Crop 2		250.76	208.18	.00	1496.25	.00	.00	.00	.00	.00		2131.15
98		Crop 3		20.06	16.65	.00	.00	.00	.00	.00	.00	.00		32.65
99		Crop 4		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00
100		Crop 5		.00	.00	.00	.00	.00	.00	.00	.00	.00		.00

Appendix Table A1 (cont.)

	O	P	Q	R	S	T
1						
2						
3						
4			MACHINERY REPAIR			
5			COEFFICIENTS			
6						
7			0	.01		
8			1	.12		
9			2	.1		
10			3	.301		
11			4	.191		
12			5	.096		
13			6	.127		
14			7	.159		
15						
16			0	.00001		
17			1	1.5		
18			2	1.5		
19			3	1.3		
20			4	1.4		
21			5	1.4		
22			6	1.4		
23			7	1.4		
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
59	Total 1					
60						

Appendix Table A1 (cont.)

	O	P
59	Total 1	
60		
61	-FUEL-	
62		5.71
63		4.99
64		1.09
65		4.99
66		.44
67		.00
68		.00
69		.00
70		.00
71		.00
72		
73	-R&M-	
74		2.605725
75		3.809132
76		.4049757
77		3.809132
78		.1619903
79		0
80		0
81		0
82		0
83		0
84		
85	-LABOR-	
86		1.46
87		.78
88		.06
89		.00
90		.00
91		
92		
93		
94		
95	-TOT OWN	
96		7255.17
97		4086.33
98		69.37
99		.00
100		.00

Appendix Table A2.

MACH1-5 WORKSHEET

MACHINERY COST AND LABOR TEMPLATE — CAPACITY: 9 MACHINES

FOR A TRACTOR OR OTHER POWER UNIT AND MACHINES USED WITH IT — COL. A IS FOR ACRES BY CROP

INPUT VARIABLES

		FOR EACH MACHINE:		disc	corn	forage							
		Machine Name	plow	harrow	planter	harv.						tractors	tractor
		Purchase Price	5300	4400	6950	13300							26400
		List Price											
	(1)	Width in Feet	5.33	12	12	6						PTO HP	90
	(1)	Speed in MPH	4.75	4.5	4.5	3.25						Fuel pric	1.31
	(1)	Field Efficiency	.8	.8	.67	.67							
		Fuel Multiplier	1.33	1	1	1.33						Fuel coef	.0504
	(2)	Repair Group #	3	3	7	6							1
		repair coef 1	(From LOOKUP)										
		repair coef 2	"	"									
		Estim Life (hrs)	2500	2500	1200	2000							12000
		Years Old at Purch	0	0	0	0							0
		Years Owned	9	9	9	9							9
		Salvage Rate	.1	.1	.1	.1							.1

FOR ALL MACHINES:

Interest Rate	.15
Insurance Rate	.015
Storage Rate	.005

(1) Refer to Table 1. (2) Refer to Table 2.

=ACRES=	INSERT TIMES OVER FIELD BY CROP										
120	Crop 1 Grow corn	1	1	1							
0	Crop 1 Harv				1						
150	Crop 2 Grow hay	.25	.25								
0	Crop 2 Harv				1						
30	Crop 3 Grow pasture	.1	.1								
0	Crop 3 Harv										
	Crop 4 Grow										
0	Crop 4 Harv										
	Crop 5 Grow										
0	Crop 5 Harv										

Appendix Table A3.

	A	B	C
1	MACH1: MACHINERY COST AND LABOR TEMPLATE		
2	FOR A TRACTOR OR OTHER POWER UNIT		
3	AND MACHINES USED WITH IT		
4			
5	INPUT VARIABLES		
6	FOR EACH MACHINE:		
7		Machine Name	plow
8		Purchase Price	5300
9		List Price	D8
10		Width in Feet	5.33
11		Speed in MPH	4.75
12		Field Efficiency	.8
13		Fuel Multiplier	1.33
14		Repair Group #	3
15		repair coef 1	LOOKUP(D14,G7:G14)
16		repair coef 2	LOOKUP(D14,G16:G23)
17		Estim life (hrs)	2500
18		Years Old at Purch	0
19		Years Owned	9
20		Salvage Rate	.1
21	FOR ALL MACHINES:		
22		Interest Rate	.15
23		Insurance Rate	.015
24		Storage Rate	.005
25			
26		HOURS PER ACRE PER TRIP	
27		Hrs/A	8.25/(D10*D11*D12)
28			
29	=ACRES=	INSERT TIMES OVER FIELD BY CROP	
30	120	Crop 1 Grow	1
31	0	Crop 1 Harv	
32	150	Crop 2 Grow	.25
33	0	Crop 2 Harv	
34	30	Crop 3 Grow	.1
35	0	Crop 3 Harv	
36	0	Crop 4 Grow	
37	0	Crop 4 Harv	
38	0	Crop 5 Grow	
39	0	Crop 5 Harv	
40	SUM(A30:total		
41			
42		HOURS PER ACRE BY CROP	
43		Crop 1 Grow	D27*D30
44		Crop 1 Harv	D27*D31
45		Crop 2 Grow	D27*D32
46		Crop 2 Harv	D27*D33
47		Crop 3 Grow	D27*D34
48		Crop 3 Harv	D27*D35
49		Crop 4 Grow	D27*D36
50		Crop 4 Harv	D27*D37
51		Crop 5 Grow	D27*D38
52		Crop 5 Harv	D27*D39
53			
54		SUMMARY DATA	
55		Hours use per yr	A30*(D43+D44)+A32*(D45+D46)+A34*(D47+D48)+A36*(D49+D50)+A38*(D51+D52)
56		Accum Hrs at Purch	D18*D55
57		Accum Hrs Over Lif	D55*(D18+D19)
58		R&M Cost/Hr-% of P	((D15*((100*D57/D17)^D16))-(D15*((100*D56/D17)^D16)))/(D55*D19)
59		R&M Cost/Hr	D8*D58/100
60			

Appendix Table A3 (cont.)

	A	B	C	D
61		FUEL COST PER ACRE		
62		Crop 1 Grow	N10*N11*N13*D13*D43	
63		Crop 1 Harv	N10*N11*N13*D13*D44	
64		Crop 2 Grow	N10*N11*N13*D13*D45	
65		Crop 2 Harv	N10*N11*N13*D13*D46	
66		Crop 3 Grow	N10*N11*N13*D13*D47	
67		Crop 3 Harv	N10*N11*N13*D13*D48	
68		Crop 4 Grow	N10*N11*N13*D13*D49	
69		Crop 4 Harv	N10*N11*N13*D13*D50	
70		Crop 5 Grow	N10*N11*N13*D13*D51	
71		Crop 5 Harv	N10*N11*N13*D13*D52	
72				
73		R&M COST PER ACRE		
74		Crop 1 Grow	D59*D43	
75		Crop 1 Harv	D59*D44	
76		Crop 2 Grow	D59*D45	
77		Crop 2 Harv	D59*D46	
78		Crop 3 Grow	D59*D47	
79		Crop 3 Harv	D59*D48	
80		Crop 4 Grow	D59*D49	
81		Crop 4 Harv	D59*D50	
82		Crop 5 Grow	D59*D51	
83		Crop 5 Harv	D59*D52	
84				
85		PROPORTION OF HOURLY USE BY CROP		
86		Crop 1	A30*(D43+D44)/D55	
87		Crop 2	A32*(D45+D46)/D55	
88		Crop 3	A34*(D47+D48)/D55	
89		Crop 4	A36*(D49+D50)/D55	
90		Crop 5	A38*(D51+D52)/D55	
91				
92		TOTAL OWNERSHIP COSTS		
93		% OF PRICE	D23+D24+(1+D20)*D22/2+(1-D20)/D19	
94				
95		OWNERSHIP COST BY CROP		
96		Crop 1	D8*D86*D93	
97		Crop 2	D8*D87*D93	
98		Crop 3	D8*D88*D93	
99		Crop 4	D8*D89*D93	
100		Crop 5	D8*D90*D93	

Appendix Table A4.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	MACH1-5 WORKSHEET													
2	MACHINERY COST AND LABOR TEMPLATE										CAPACITY: 9 MACHINES			
3	FOR A TRACTOR OR OTHER POWER UNIT AND MACHINES USED WITH IT										COL. A IS FOR ACRES BY CROP			
4														
5	INPUT VARIABLES													
6	FOR EACH MACHINE:													
7		Machine Name											tractors	
8		Purchase Price												
9		List Price												
10	(1)	Width in Feet											PTO HP	
11	(1)	Speed in MPH											Fuel pric	
12	(1)	Field Efficiency												
13		Fuel Multiplier											Fuel coef	
14	(2)	Repair Group #												
15		repair coef 1	(From LOOKUP)											
16		repair coef 2	"	"										
17		Estim Life (hrs)												
18		Years Old at Purch												
19		Years Owned												
20		Salvage Rate												
21	FOR ALL MACHINES:													
22		Interest Rate												
23		Insurance Rate												
24		Storage Rate												
25														
26		(1) Refer to Table 1.			(2) Refer to Table 2.									
27														
28														
29	=ACRES=	INSERT TIMES OVER FIELD BY CROP												
30		Crop 1 Grow												
31		0Crop 1 Harv												
32		Crop 2 Grow												
33		0Crop 2 Harv												
34		Crop 3 Grow												
35		0Crop 3 Harv												
36		Crop 4 Grow												
37		0Crop 4 Harv												
38		Crop 5 Grow												
39		0Crop 5 Harv												

Appendix Table A5.

	A	B	C	D	E	F	G	H	I	J	K	L
1	TRUCK: TRUCK COST TEMPLATE											
2												
3		INPUT VARIABLES			truck							
4		Purchase Price			7400							
5		List Price			7400							
6		Miles/yr			6000							
7		MPG			15							
8		Fuel price			1.32							
9		Miles/Hr			35							
10		Repair Coef 1			.096							
11		Repair Coef 2			1.4							
12		Estim Life (hrs)			2000							
13		Years Old at Purchase			0							
14		Years Owned			9							
15		Salvage Rate			.1							
16		Interest Rate			.15							
17		Insurance Cost ($/yr)			242							
18		Storage Rate			.015							
19												
20	=ACRES=	CROP ACREAGE ALLOCATIONS						FUEL COST PER ACRE				
21	120	Crop 1 Grow			.01			Crop 1 Grow			.88	
22	0	Crop 1 Harv						Crop 1 Harv			.88	
23	150	Crop 2 Grow						Crop 2 Grow			.88	
24	0	Crop 2 Harv						Crop 2 Harv			.88	
25	30	Crop 3 Grow						Crop 3 Grow			.88	
26	0	Crop 3 Harv						Crop 3 Harv			.88	
27	0	Crop 4 Grow						Crop 4 Grow			.88	
28	0	Crop 4 Harv						Crop 4 Harv			.88	
29	0	Crop 5 Grow						Crop 5 Grow			.88	
30	0	Crop 5 Harv						Crop 5 Harv			.88	
31	300											
32		HOURS PER ACRE BY CROP						R&M COST PER ACRE				
33		Crop 1 Grow			.29			Crop 1 Grow			.58	
34		Crop 1 Harv			.29			Crop 1 Harv			.58	
35		Crop 2 Grow			.29			Crop 2 Grow			.58	
36		Crop 2 Harv			.29			Crop 2 Harv			.58	
37		Crop 3 Grow			.29			Crop 3 Grow			.58	
38		Crop 3 Harv			.29			Crop 3 Harv			.58	
39		Crop 4 Grow			.29			Crop 4 Grow			.58	
40		Crop 4 Harv			.29			Crop 4 Harv			.58	
41		Crop 5 Grow			.29			Crop 5 Grow			.58	
42		Crop 5 Harv			.29			Crop 5 Harv			.58	
43												
44		SUMMARY DATA						LABOR HOURS BY CROP				
45		Hours use per yr			171.43			Crop 1			.57	
46		Accum Hrs at Purch			.00			Crop 2			.57	
47		Accum Hrs Over Life			1542.86			Crop 3			.57	
48		R&M Cost/Hr-% of Price			.0272998			Crop 4			.57	
49		R&M Cost/Hr			2.02			Crop 5			.57	
50												
51		PROPORTION OF HOURLY USE BY CROP						TOTAL OWNERSHIP COSTS				
52		Crop 1			.40			% OF PRICE			.23	
53		Crop 2			.50							
54		Crop 3			.10			OWNERSHIP COST BY CROP				
55		Crop 4			.00			Crop 1			681.40	
56		Crop 5			.00			Crop 2			851.75	
57								Crop 3			170.35	
58								Crop 4			.00	
59								Crop 5			.00	
60												

Appendix Table A6.

	A	B	C	D	E	F
1	TRUCK WORKSHEET					
2						
3		INPUT VARIABLES			truck	
4		Purchase Price			7400	
5		List Price			7400	
6		Miles/yr			6000	
7		MPG			15	
8		Fuel price			1.32	
9		Miles/Hr			35	
10		Repair Coef 1			.096	
11		Repair Coef 2			1.4	
12		Estim Life (hrs)			2000	
13		Years Old at Purchase			0	
14		Years Owned			9	
15		Salvage Rate			.1	
16		Interest Rate			.15	
17		Insurance Cost ($/yr)			242	
18		Storage Rate			.015	
19						
20	=ACRES=	CROP ACREAGE ALLOCATIONS				
21	120	Crop 1 Grow				
22		Crop 1 Harv				
23	150	Crop 2 Grow				
24		Crop 2 Harv				
25	30	Crop 3 Grow				
26		Crop 3 Harv				
27		Crop 4 Grow				
28		Crop 4 Harv				
29		Crop 5 Grow				
30		Crop 5 Harv				

Appendix Table A7.

	A	B	C	D	E
1	TRUCK: TRUCK COST TEMPLATE				
2					
3		INPUT VARIABLES			truck
4			Purchase Price		7400
5			List Price		7400
6			Miles/yr		6000
7			MPG		15
8			Fuel price		1.32
9			Miles/Hr		35
10			Repair Coef 1		.096
11			Repair Coef 2		1.4
12			Estim Life (hrs)		2000
13			Years Old at Purchase		0
14			Years Owned		9
15			Salvage Rate		.1
16			Interest Rate		.15
17			Insurance Cost ($/yr)		242
18			Storage Rate		.015
19					
20	=ACRES=	CROP ACREAGE ALLOCATIONS			
21	120		Crop 1 Grow		.01
22	0		Crop 1 Harv		
23	150		Crop 2 Grow		
24	0		Crop 2 Harv		
25	30		Crop 3 Grow		
26	0		Crop 3 Harv		
27	0		Crop 4 Grow		
28	0		Crop 4 Harv		
29	0		Crop 5 Grow		
30	0		Crop 5 Harv		
31	SUM(A21:A30)				
32			HOURS PER ACRE BY CROP		
33			Crop 1 Grow		E6*.5/(E9*A31)
34			Crop 1 Harv		E6*.5/(E9*A31)
35			Crop 2 Grow		E6*.5/(E9*A31)
36			Crop 2 Harv		E6*.5/(E9*A31)
37			Crop 3 Grow		E6*.5/(E9*A31)
38			Crop 3 Harv		E6*.5/(E9*A31)
39			Crop 4 Grow		E6*.5/(E9*A31)
40			Crop 4 Harv		E6*.5/(E9*A31)
41			Crop 5 Grow		E6*.5/(E9*A31)
42			Crop 5 Harv		E6*.5/(E9*A31)
43					
44			SUMMARY DATA		
45			Hours use per yr		A21*(E33+E34)+A23*(E35+E36)+A25*(E37+E38)+A27*(E39+E40)+A29*(E41+E42)
46			Accum Hrs at Purch		0
47			Accum Hrs Over Life		E45*(E13+E14)
48			R&M Cost/Hr-% of Price		((E10*((100*E47/E12)^E11))-(E10*((100*E46/E12)^E11)))/(E45*E14)
49			R&M Cost/Hr		E5*E48/100
50					
51			PROPORTION OF HOURLY USE BY CROP		
52			Crop 1		A21*(E33+E34)/E45
53			Crop 2		A23*(E35+E36)/E45
54			Crop 3		A25*(E37+E38)/E45
55			Crop 4		A27*(E39+E40)/E45
56			Crop 5		A29*(E41+E42)/E45

Appendix Table A7 (cont.)

	H	I	J	K	L	M	N	O
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20	FUEL COST PER ACRE							
21	Crop 1 Grow			E6*E8*.5/(E7*A31)				
22	Crop 1 Harv			E6*E8*.5/(E7*A31)				
23	Crop 2 Grow			E6*E8*.5/(E7*A31)				
24	Crop 2 Harv			E6*E8*.5/(E7*A31)				
25	Crop 3 Grow			E6*E8*.5/(E7*A31)				
26	Crop 3 Harv			E6*E8*.5/(E7*A31)				
27	Crop 4 Grow			E6*E8*.5/(E7*A31)				
28	Crop 4 Harv			E6*E8*.5/(E7*A31)				
29	Crop 5 Grow			E6*E8*.5/(E7*A31)				
30	Crop 5 Harv			E6*E8*.5/(E7*A31)				
31								
32	R&M COST PER ACRE							
33	Crop 1 Grow			E49*E33				
34	Crop 1 Harv			E49*E34				
35	Crop 2 Grow			E49*E35				
36	Crop 2 Harv			E49*E36				
37	Crop 3 Grow			E49*E37				
38	Crop 3 Harv			E49*E38				
39	Crop 4 Grow			E49*E39				
40	Crop 4 Harv			E49*E40				
41	Crop 5 Grow			E49*E41				
42	Crop 5 Harv			E49*E42				
43								
44	LABOR HOURS BY CROP							
45	Crop 1			E33+E34				
46	Crop 2			E35+E36				
47	Crop 3			E37+E38				
48	Crop 4			E39+E40				
49	Crop 5			E41+E42				
50								
51	TOTAL OWNERSHIP COSTS							
52	% OF PRICE			(E17/E4)+E18+(1+E15)*E16/2+(1-E13)/E14				
53								
54	OWNERSHIP COST BY CROP							
55	Crop 1			E4*E52*K52				
56	Crop 2			E4*E53*K52				
57	Crop 3			E4*E54*K52				
58	Crop 4			E4*E55*K52				
59	Crop 5			E4*E56*K52				

Appendix Table A8.

	A	B	C	D	E	F
1	TRUCK WORKSHEET					
2						
3		INPUT VARIABLES			truck	
4		Purchase Price				
5		List Price				
6		Miles/yr				
7		MPG				
8		Fuel price				
9		Miles/Hr				
10		Repair Coef 1			.096	
11		Repair Coef 2			1.4	
12		Estim Life (hrs)			2000	
13		Years Old at Purchase				
14		Years Owned				
15		Salvage Rate				
16		Interest Rate				
17		Insurance Cost ($/yr)				
18		Storage Rate				
19						
20	=ACRES=	CROP ACREAGE ALLOCATIONS				
21		Crop 1 Grow				
22		Crop 1 Harv				
23		Crop 2 Grow				
24		Crop 2 Harv				
25		Crop 3 Grow				
26		Crop 3 Harv				
27		Crop 4 Grow				
28		Crop 4 Harv				
29		Crop 5 Grow				
30		Crop 5 Harv				

Appendix Table A9.

	N	O	P	Q	R	S	T	U	V	W	X	Y
46												
47	CROP BUDGET TEMPLATE,CROP 1 CORN SILAGE,7/11/83											
48				==========								
49			UNIT	QUAN	PRICE	COST/ACRE						
50	VARIABLE EXPENSES											
51	GROWING											
52	Seed											
53	Corn		Kern	25000.00	.000624	15.60						
54						.00						
55	Fertilizer											
56	Nitrogen		Lbs.	100.00	.32	32.00						
57	Phosphorus		Lbs.	50.00	.28	14.00						
58	Potassium		Lbs.	50.00	.16	8.00						
59	Lime		Tons	.50	22.50	11.25						
60	Chemicals											
61	Lasso		Qts.	2.50	4.82	12.05						
62	Atrazine		Qts.	1.00	3.08	3.08						
63	Furadan		Lbs.	10.00	1.05	10.50						
64						.00						
65	Power,equip											
66	Fuel,oil					6.59						
67	Repair,main.					3.18						
68	Other					2.00						
69	TOTAL GROWING					118.25						
70												
71	HARVESTING											
72	Power,equip.											
73	Fuel.oil					5.87						
74	Repair,main.					4.39						
75	Drying					.00						
76	Twine					.00						
77	Other					7.00						
78	TOTAL HARVESTING					17.26						
79												
80	INTEREST,OPER.	$		135.51	Rate/yr							
81	MONTHS			6	.13	8.81						
82	LABOR		Hour	4.06	4.00	16.23						
83												
84	TOTAL VARIABLE					160.55						
85												
86	FIXED EXPENSES											
87	Power,equip.					66.14						
88	Land					24.00						
89	Taxes					.00						
90												
91	TOTAL FIXED					90.14						
92												
93	TOTAL EXPENSES					250.69						
94												
95	CROP VALUE											
96	Silage		Tons	18.00	20.00	360.00						
97	Bedding		Tons			.00						
98	TOTAL VALUE					360.00						
99												
100	NET OVER VAR		$/Acre			199.45						
101	EXPENSES											
102	RETURN TO		$/Acre			109.31						
103	MANAGEMENT											
104	BREAKEVEN,VAR		$/Ton			8.92						
105												
106	BREAKEVEN,ALL		$/Ton			13.93						

	CROP 2		
	==========		
	QUAN	PRICE	COST/ACRE
GROWING			
Seed			
Corn			.00
			.00
Fertilizer			
Nitrogen-lbs			.00
Phosphorus-lbs			.00
Potassium-lbs			.00
Lime -tons			.00
Chemicals			
Lasso			.00
Atrazine			.00
Furadan			.00
			.00
Power,equip			
Fuel,oil			1.97
Repair,main.			.98
Other			.00
TOTAL GROWING			2.95
HARVESTING			
Power,equip.			
Fuel.oil			5.87
Repair,main.			4.39
Drying			.00
Twine			.00
Other			.00
TOTAL HARVESTING			10.26
INTEREST,OPER.	13.21	Rate/yr	
MONTHS	6	.13	.86
LABOR	2.70		.00
TOTAL VARIABLE			14.07
FIXED EXPENSES			
Power,equip.			32.92
Land			.00
Taxes			.00
TOTAL FIXED			32.92
TOTAL EXPENSES			46.99
CROP VALUE			
Silage	1.00		.00
Bedding			.00
TOTAL VALUE			.00
NET OVER VAR			-14.07
EXPENSES			
RETURN TO			-46.99
MANAGEMENT			
BREAKEVEN,VAR			14.07
BREAKEVEN,ALL			46.99

Appendix Table A9 (cont.)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	TRACTOR AND MACHINERY EXPENSES												
2													
3													
4					Total 1	Total 2	Total 3	Total 4	Total 5	Truck	ALL MACHINES		
5													
6	=ACRES=	FUEL COST PER ACRE			-FUEL-	-FUEL-	-FUEL-	-FUEL-	-FUEL-		TOTAL FUEL EXP		
7	120.00	Crop 1 Grow			5.71	.00	.00	.00	.00	.88	6.59		
8	.00	Crop 1 Harv			4.99	.00	.00	.00	.00	.88	5.87		
9	150.00	Crop 2 Grow			1.09	.00	.00	.00	.00	.88	1.97		
10	.00	Crop 2 Harv			4.99	.00	.00	.00	.00	.88	5.87		
11	30.00	Crop 3 Grow			.44	.00	.00	.00	.00	.88	1.32		
12	.00	Crop 3 Harv			.00	.00	.00	.00	.00	.88	.88		
13	.00	Crop 4 Grow			.00	.00	.00	.00	.00	.88	.88		
14	.00	Crop 4 Harv			.00	.00	.00	.00	.00	.88	.88		
15	.00	Crop 5 Grow			.00	.00	.00	.00	.00	.88	.88		
16	.00	Crop 5 Harv			.00	.00	.00	.00	.00	.88	.88		
17													
18		R&M COST PER ACRE			-R&M-	-R&M-	-R&M-	-R&M-	-R&M-		TOTAL R&M EXP		
19		Crop 1 Grow			2.61	.00	.00	.00	.00	.58	3.18		
20		Crop 1 Harv			3.81	.00	.00	.00	.00	.58	4.39		
21		Crop 2 Grow			.40	.00	.00	.00	.00	.58	.98		
22		Crop 2 Harv			3.81	.00	.00	.00	.00	.58	4.39		
23		Crop 3 Grow			.16	.00	.00	.00	.00	.58	.74		
24		Crop 3 Harv			.00	.00	.00	.00	.00	.58	.58		
25		Crop 4 Grow			.00	.00	.00	.00	.00	.58	.58		
26		Crop 4 Harv			.00	.00	.00	.00	.00	.58	.58		
27		Crop 5 Grow			.00	.00	.00	.00	.00	.58	.58		
28		Crop 5 Harv			.00	.00	.00	.00	.00	.58	.58		
29													
30		LABOR HOURS PER ACRE			-LABOR-	-LABOR-	-LABOR-	-LABOR-	-LABOR-		TOTAL LABOR HOURS		
31		Crop 1			1.46	.00	.00	.00	.00	.57	2.03		
32		Crop 2			.78	.00	.00	.00	.00	.57	1.35	Labor	
33		Crop 3			.06	.00	.00	.00	.00	.57	.63	Multiplier	
34		Crop 4			.00	.00	.00	.00	.00	.57	.57	2.00	
35		Crop 5			.00	.00	.00	.00	.00	.57	.57		
36													
37		TOTAL OWNERSHIP COSTS											
38		% OF PRICE								.23			
39													
40		OWNERSHIP COST BY CROP			-TOT OWN	-TOT OWN	-TOT OWN	-TOT OWN	-TOT OWN-		OWNERSHIP EXPENSES		
41		Crop 1			7255.17	.00	.00	.00	.00	681.40	7936.57		
42		Crop 2			4086.33	.00	.00	.00	.00	851.75	4938.08		
43		Crop 3			69.37	.00	.00	.00	.00	170.35	239.72		
44		Crop 4			.00	.00	.00	.00	.00	.00	.00		
45		Crop 5			.00	.00	.00	.00	.00	.00	.00		

Appendix Table A10.

	A	B	C	D	E	F
1	CROP BUDGET WORKSHEET			CROP 1 Corn Silage		
2						
3			UNITS	QUAN	PRICE	COST/ACRE
4	VARIABLE EXPENSES					
5	GROWING					
6	Seed					
7	corn		Kernels	25000	49.92/80,000	0
8						0
9	Fertilizer					
10	Nitrogen		Lbs.	100	.32	0
11	Phosphorus		Lbs.	50	.28	0
12	Potassium		Lbs.	50	.16	0
13	Lime		Tons	.5	22.50	0
14	Chemicals					
15	Lasso		Qts	2.50	4.82	0
16	Atrazine		Qts	1.00	3.08	0
17	Furadan		Lbs	10	1.05	0
18						0
19	Power, equip					
20	Fuel, oil					
21	Repair, main.					
22	Other					2.00
23	TOTAL GROWING					0
24						
25	HARVESTING					
26	Power, equip.					
27	Fuel. oil					0
28	Repair, main.					0
29	Drying					0
30	Twine					0
31	Other					7.00
32	TOTAL HARVESTING					0
33						
34	INTEREST, OPER.		$		Rate/yr	
35	MONTHS			6	.13	0
36	LABOR		$	per hour:	4	0
37						
38	TOTAL VARIABLE					0
39						
40	FIXED EXPENSES					
41	Power, equip.					0
42	Land					24
43	Taxes					0
44						
45	TOTAL FIXED					0
46						
47	TOTAL EXPENSES					0
48						
49	CROP VALUE					
50	Silage		tons	18	20	0
51						0
52	TOTAL VALUE					0

Appendix Table A11.

	N	O	P	Q	R	S	T	U	V	W	X	Y
46												
47	CROP BUDGET TEMPLATE,CROP 1 CORN SILAGE,7/11/83										CROP 2	
48				==========							==========	
49			UNIT	QUAN	PRICE	COST/ACRE				QUAN	PRICE	COST/ACRE
50	VARIABLE EXPENSES											
51	GROWING									GROWING		
52	Seed									Seed		
53	Corn		Kern	25000	.000624	Q53*R53				Corn		W53*X53
54						Q54*R54						W54*X54
55	Fertilizer									Fertilizer		
56	Nitrogen		Lbs.	100	.32	Q56*R56				Nitrogen-lbs		W56*X56
57	Phosphorus		Lbs.	50	.28	Q57*R57				Phosphorus-lbs		W57*X57
58	Potassium		Lbs.	50	.16	Q58*R58				Potassium-lbs		W58*X58
59	Lime		Tons	.5	22.5	Q59*R59				Lime -tons		W59*X59
60	Chemicals									Chemicals		
61	Lasso		Qts.	2.5	4.82	Q61*R61				Lasso		W61*X61
62	Atrazine		Qts.	1	3.08	Q62*R62				Atrazine		W62*X62
63	Furadan		Lbs.	10	1.05	Q63*R63				Furadan		W63*X63
64						Q64*R64						W64*X64
65	Power,equip									Power,equip		
66	Fuel,oil					K7				Fuel,oil		K9
67	Repair,main.					K19				Repair,main.		K21
68	Other					2				Other		0
69	TOTAL GROWING					SUM(S53:S68)				TOTAL GROWING		SUM(Y53:Y68)
70												
71	HARVESTING									HARVESTING		
72	Power,equip.									Power,equip.		
73	Fuel.oil					K8				Fuel.oil		K10
74	Repair,main.					K20				Repair,main.		K22
75	Drying					0				Drying		0
76	Twine					0				Twine		0
77	Other					7				Other		0
78	TOTAL HARVESTING					SUM(S73:S77)				TOTAL HARVESTING		SUM(Y73:Y77)
79												
80	INTEREST,OPER.	$	S69+S78		Rate/yr					INTEREST,OPER.	Y69+Y78	Rate/yr
81	MONTHS		6		.13	Q80*(R81*(Q81/12))				MONTHS	6	.13
82	LABOR		Hour	K31*L34	4	Q82*R82				LABOR	K32*L34	W82*X82
83												
84	TOTAL VARIABLE					S69+S78+S81+S82				TOTAL VARIABLE		Y69+Y78+Y81+Y82
85												
86	FIXED EXPENSES									FIXED EXPENSES		
87	Power,equip.					K41/(A7+.00001)				Power,equip.		K42/(A9+.00001)
88	Land					24				Land		0
89	Taxes					0				Taxes		0
90												
91	TOTAL FIXED					SUM(S87:S90)				TOTAL FIXED		SUM(Y87:Y90)
92												
93	TOTAL EXPENSES					S84+S91				TOTAL EXPENSES		Y84+Y91
94												
95	CROP VALUE									CROP VALUE		
96	Silage		Tons	18	20	Q96*R96				Silage	1	0
97	Bedding		Tons			Q97*R97				Bedding		W97*X97
98	TOTAL VALUE					SUM(S96:S97)				TOTAL VALUE		SUM(Y96:Y97)
99												
100	NET OVER VAR		$/Acre			S98-S84				NET OVER VAR		Y98-Y84
101	EXPENSES									EXPENSES		
102	RETURN TO		$/Acre			S98-S93				RETURN TO		Y98-Y93
103	MANAGEMENT									MANAGEMENT		
104	BREAKEVEN,VAR		$/Ton			SUM(S84-S97)/Q96				BREAKEVEN,VAR		SUM(Y84-Y97)/W96
105												
106	BREAKEVEN,ALL		$/Ton			SUM(S93-S97)/Q96				BREAKEVEN,ALL		SUM(Y93-Y97)/W96

Appendix Table A12.

	A	B	C	D	E	F
1	CROP BUDGET WORKSHEET			CROP _____		
2						
3			UNITS	QUAN	PRICE	COST/ACRE
4	VARIABLE EXPENSES					
5	GROWING					
6	Seed					
7	_____		_____	_____	_____	0
8	_____		_____	_____	_____	0
9	Fertilizer					
10	Nitrogen		Lbs.	_____	_____	0
11	Phosphorus		Lbs.	_____	_____	0
12	Potassium		Lbs.	_____	_____	0
13	Lime		Tons	_____	_____	0
14	Chemicals					
15	_____		_____	_____	_____	0
16	_____		_____	_____	_____	0
17	_____		_____	_____	_____	0
18	_____		_____	_____	_____	0
19	Power,equip					
20	Fuel,oil					
21	Repair,main.					
22	Other					_____
23	TOTAL GROWING					0
24						
25	HARVESTING					
26	Power,equip.					
27	Fuel.oil					0
28	Repair,main.					0
29	Drying					_____
30	Twine					_____
31	Other					_____
32	TOTAL HARVESTING					0
33						
34	INTEREST,OPER.		$		Rate/yr	
35	MONTHS			_____	_____	0
36	LABOR		$	per hour:	_____	0
37						
38	TOTAL VARIABLE					0
39						
40	FIXED EXPENSES					
41	Power,equip.					0
42	Land					_____
43	Taxes					_____
44						
45	TOTAL FIXED					0
46						
47	TOTAL EXPENSES					0
48						
49	CROP VALUE					
50	_____		_____	_____	_____	0
51	_____		_____	_____	_____	0
52	TOTAL VALUE					0

Appendix Table A13.

T1: Execute file to transfer data from MACH1 to MACH2-5 and TRUCK

```
/zy
/lb:mach1,pd22:d24,d22,v
/lb:mach1,pa30:a39,a30,v
/sb:tfile,oa
/zy
/lb:mach2,a
/lb:tfile,a
=a1
/sb:mach2,oa
/zy
/lb:mach3,a
/lb:tfile,a
=a1
/sb:mach3,oa
/zy
/lb:mach4,a
/lb:tfile,a
=a1
/sb:mach4,oa
/zy
/lb:mach5,a
/lb:tfile,a
=a1
/sb:mach5,oa
/zy
/lb:truck,a
/lb:tfile,pd22,e16,v
/lb:tfile,pd24,e18,v
/lb:tfile,pa30:a39,a21,v
=a1
/sb:truck,oa
/zy
```

T2: Execute file to transfer data from MACH1-5 and TRUCK to CROP

```
/ua7:j45
/lb:mach1,pp59:p100,e4,v
/lb:mach1,pa30:a39,a7,v
/lb:mach2,pp59:p100,f4,v
/lb:mach3,pp59:p100,g4,v
/lb:mach4,pp59:p100,h4,v
/lb:mach5,pp59:p100,i4,v
/lb:truck,pk21:k59,j7,v
!
```

P1: Execute file to print MACH1

```
/zy
/lb:mach1,a
/oda1:n60,ss^0^L
p
/oda61:n100,ss^L
p
```