The Computer
A New Farm Management Tool

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The Computer
A New Farm Management Tool

Each year more farmers are using the computer to assist in the management of their farms. This is prompted by the development of new programs and greater computer availability. It has resulted in a new language among farmers using the computer and in extensive new farm management technology.

The computer and new farm management uses of the computer are explained here so farmers will better understand this new technology and its potential.

Computer Hardware and Software

Hardware

Hardware refers to the physical parts of the computer, such as the central processing unit to do the arithmetic, punch card or tape readers to read information and disc, magnetic tape or cell storage machines to “memorize” and store information. Other hardware includes card and tape punch machines to transform data from written to punch form, verifiers to check accuracy, and reader-printers to transform data from punch to written form. Related pieces of hardware, such as sorting machines, optical scanners, and remote consoles, make the computer easier to use, but they are not necessary for its operation.

Software

Instructions or programs telling the computer exactly what to do are called software.

Since the computer must have instructions in order to operate usefully, developing the instructions (“writing a program”) is the most important part of computer technology. Every exception and “what if?” must be anticipated, and instructions for handling them must be provided to the computer. Once a program is written and all exceptions and “what if’s?” are taken care of, errors will result if there are errors in the data it has to work with. This is known as the “gigo” principle—garbage in; garbage out.

Typical procedures in using the computer as a farm management tool are given in the following section. Remember that the computer cannot do anything that cannot be done by man, but it is able to do these things much faster if the time and dollar investment is made in writing the programs. Probably more important, the computer can be used to do jobs that the farm manager cannot (or will not) take the time to do himself. Therefore, the computer is a management resource as well as a tool.
The Computer as a Farm Management Tool

The computer is used as a farm management tool in four general ways: (1) Accumulation of information; (2) analysis of information; (3) forward planning; and (4) teaching.

**Information systems**

Computerized information systems are called electronic farm records or electronic data processing (EDP). Computerized information systems normally are more complete than other farm records or accounting. Because of the computer, it is practical to gather, process, and store monthly farm receipts and expenses (by enterprise as well as type); man and machine time; quantities of fertilizer, feed, water, and chemicals used and in storage, and so forth.

The farmer's first contact with a computerized information system usually is through the county Extension agent, bank fieldman, or lending agent. When the farmer enrolls, the fieldman will explain how to set up the farm into enterprises, such as Wheat, Beef Feeders, Tractor, and Storage. He will explain the principles and techniques involved in reporting, how to allocate overhead costs, how to identify loans and capital purchases, how to report transfers of expenses and receipts from enterprise to enterprise, how to report transfers of crops into storage, and what to charge for the owner's labor and management. A typical monthly reporting form has columns for the date, enterprise, description, physical quantity, unit, and dollars.

**Typical Monthly Reporting Form**

<table>
<thead>
<tr>
<th>Date</th>
<th>Enterprise</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-11</td>
<td>Strawberries</td>
<td>Spray and wash</td>
<td>2</td>
<td></td>
<td>$ 32.46</td>
</tr>
<tr>
<td>7-18</td>
<td>Turkeys</td>
<td>Feed grain</td>
<td>6</td>
<td>ton</td>
<td>300.00</td>
</tr>
<tr>
<td>7-20</td>
<td>Strawberries</td>
<td>Overhead</td>
<td>1</td>
<td></td>
<td>78.35</td>
</tr>
</tbody>
</table>
The farmer retains a carbon copy of the monthly reporting form in his files and mails the original to the processing center. He may mail man and machine time cards for processing at the same time.

At the processing center, each form is checked for reporting errors such as entries in wrong columns, inconsistency, or unfilled spaces. Alphabetic entries are given a code number and punched into cards or tapes with the numeric entries. The punched cards or tapes are checked again for errors (verified). When computer time becomes available, the previously written instructions or programs are fed into the computer so it will know what to do with the data. The punched data are fed in, additional historical data are called from tape or disc storage, and the necessary arithmetic is performed. The processed data are then printed on special paper and checked for errors. The report is mailed to the farmer 10 to 20 days after the original data were mailed (one carbon stays in the processing center, the other goes to the fieldman). A typical monthly report or print-out is illustrated on page 6.

During the year, the fieldman makes numerous visits and phone calls to assist the farmer in reporting, interpreting the print-out, and analyzing the farm business. Groups of farmers who are using computerized farm management information systems sometimes meet together to discuss common problems and the fieldman assists in analyzing the information and planning for next season’s activities.

Most computerized farm management information systems provide supplemental services such as computing depreciation, listing checks by number and amount, listing charge account transactions, and computing payroll deductions. Important as these may be, the basic farm management information necessary for decision making is found in the dollar and physical inputs and outputs, whether listed by enterprise or by total farm.

Although computers are very expensive machines, most of the farmer’s fee is used to pay for the administrative, supervisory, field, clerical, and programming people. It takes the computer seconds to process the farmer’s monthly report, but it takes people hours to edit, code, and punch the same information.

**Data analysis systems**

Computer programs that compute measures of economic efficiency, physical efficiency, financial success, and financial condition are called data analysis systems. Most of these measures can be computed by hand if the data are available, but it is relatively easy to instruct or program the computer to do the work (mostly division or subtraction). Examples of measures of size, efficiency, and success are shown on page 7.

The best information a farmer can have for increasing efficiency and success is to know how much his income will increase or decrease if he invests just one more dollar in machinery, or fertilizer, or cows, or land, or strawberries, or labor. This is the marginal value product (MVP) of his machinery, fertilizer, cows, and so forth. Profits will be increased when the farmer invests additional dollars where the increase in income will be the greatest (where MVP is the greatest). The farmer who knows the MVP of his machinery, fertilizer, cows, land, strawberries, labor, and other items knows where to invest his money for the most profit.
### Typical Monthly Print-out

#### Computerized Farm Management Information System

**Ira Manager**  
36 16 009  
Planning Route  
Profit, Oregon

**Report for July**  
Page 17

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Dollars</th>
<th><strong>Balance to date</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>06-29</td>
<td>Strawberries Cash receipt</td>
<td>16.8 ton</td>
<td>$ 4,035.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-01</td>
<td>Fruit</td>
<td>2.6 ton</td>
<td>$ 73.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-11</td>
<td>Fruit</td>
<td>2.8 ton</td>
<td>$ 665.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Fruit</td>
<td>22.2 ton</td>
<td>$5,264.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total cash receipt</td>
<td>22.2 ton</td>
<td>$5,264.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-11</td>
<td>Spray and dust</td>
<td></td>
<td></td>
<td>$289.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total spray and dust</td>
<td></td>
<td></td>
<td>$322.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fertiliser</td>
<td></td>
<td></td>
<td>$177.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total cash expense</td>
<td></td>
<td></td>
<td>$499.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-cash expense</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establishment</td>
<td></td>
<td></td>
<td>$670.00</td>
<td></td>
</tr>
<tr>
<td>06-26</td>
<td>Wages</td>
<td></td>
<td></td>
<td>$128.46</td>
<td></td>
</tr>
<tr>
<td>07-10</td>
<td>Wages</td>
<td></td>
<td></td>
<td>$846.23</td>
<td></td>
</tr>
<tr>
<td>07-20</td>
<td>Wages</td>
<td></td>
<td></td>
<td>$30.79</td>
<td></td>
</tr>
<tr>
<td>07-28</td>
<td>Wages</td>
<td></td>
<td></td>
<td>$102.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total wages</td>
<td>740 hrs.</td>
<td>$393.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machinery and equipment</td>
<td></td>
<td></td>
<td>$1,583.59</td>
<td></td>
</tr>
<tr>
<td>07-10</td>
<td>Machinery and equipment</td>
<td></td>
<td></td>
<td>$66.60</td>
<td></td>
</tr>
<tr>
<td>07-20</td>
<td>Machinery and equipment</td>
<td></td>
<td></td>
<td>$47.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total cash and equipment</td>
<td></td>
<td></td>
<td>$128.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overhead</td>
<td></td>
<td></td>
<td>$301.20</td>
<td></td>
</tr>
<tr>
<td>07-20</td>
<td>Overhead</td>
<td></td>
<td></td>
<td>$78.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total overhead</td>
<td></td>
<td></td>
<td>$379.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total non-cash expense</td>
<td></td>
<td></td>
<td>$2,091.86</td>
<td></td>
</tr>
</tbody>
</table>

**Current income** $5,854.76  
**To-date income** $5,264.76

**Current expense** $367.03  
**To-date expense** $2,591.14

**Current net income** $4,997.67  
**To-date net income** $2,673.62

**Turkeys**

- Cash receipt
- Non turkeys BBF
- Total cash receipt
- Non-cash receipt
- Non turkeys BBF
- Total non-cash receipt
- Cash expense
- Feed

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-10</td>
<td>Turkeys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash receipt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non turkeys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total cash receipt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-cash receipt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non turkeys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total non-cash receipt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash expense</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-18</td>
<td>Feed grains</td>
<td></td>
<td>9 ton</td>
<td>$300.00</td>
</tr>
</tbody>
</table>

*BBF is balance brought forward from the previous report. No figure shows for the current month.

**Balance to date is the cumulated total for each major item from the beginning of the enterprise.*
### Examples of Measures of Size, Efficiency, and Success

**Size of business**
- Total acres in farm: 662
- Total crop acres: 590
- Total man equivalent: 4.7
- Average number dairy cows: 0
- Average number poultry: 0
- Average number beef cows: 40.2
- Average number of animal units: 57.9
- Total capital investment: $362,098
  - Land investment: 231,780
  - Building investment: 46,000
  - Machinry investment: 70,300
  - Improvements: 5,179
  - Livestock: 8,000
  - Supplies: 621

**Production values**
- Value of crops produced: $261,000
- Value of livestock produced: 2,800
- Value of livestock products produced: 0
- Total value of production: 263,800

**Economic efficiency**
- Value of production per man: $56,128
- Capital investment per man: 77,033
- Capital investment per crop acre: 624
- Machinery investment per crop acre: 121
- Value of production per crop acre: 455
- Production expense per crop acre: 341
- Machinery expense per crop acre: 87

**Physical efficiency**
- Pounds of beef sold per cow: 409
- Pounds of wheat per acre: 672
- Pounds of strawberries per acre: 22,800

**Financial success**
- Total operating income: $231,600
- Total operating expense: 197,600
- Net operating income: 34,000
- Inventory increase: 9
- Inventory decrease: 7,662
- Return to labor, management, and capital: 53,881
- Ratio of operating income to operating expense: 1.17

**Financial condition**
- Ratio of current assets to current liabilities: 1.86
- Ratio of net worth to total debt: 1.47
- Net worth: $171,009
The computer can determine MVP's for the farmer if the appropriate information is available. Some of this information can be provided by a computerized information system.

**Planning farm programs**

The computer cannot make farm management decisions but can predict the results of decisions the farmer might make. Farmers already do this by "figuring it out" in their heads or budgeting on the back of an envelope. The larger, more important the decision, the more complicated the budgeting. The more complicated the budgeting, the more farmers turn to guesswork, intuition, "rule of thumb," or "do it the way dad did it." Complicated decisions can be efficiently tested on the computer to reduce the guesswork.

**Linear programming** is a budgeting technique adapted to the computer for this purpose. It has been used to determine least-cost routing of trains, trucks, and aircraft, least-cost feed mixes, best industrial plant locations, and best farm organizations. The following example illustrates how a farmer would use linear programming to determine how many acres of berries and/or beans to plant.

The farmer has 15 acres of land and 540 hours of June labor available for berries, beans, or both. It takes .33 acres and 6 hours of June labor to produce 1 ton of berries and .125 acres and 6 hours of June labor to produce 1 ton of beans on this farm. The linear program for solving this problem is fed into the computer as two equations:

\[
15 \text{ acres } = (.33 \times \text{ton berries}) + (.125 \times \text{ton beans})
\]

\[
540 \text{ hours } = (6 \times \text{ton berries}) + (6 \times \text{ton beans})
\]

The expected profit per ton ($60 for berries and $25 for beans) is also fed into the computer as follows:

\[
\text{Profit} = 60 \times \text{ton berries} + 25 \times \text{ton beans}
\]

The computer then figures out the most berries or the most beans that can be grown with 15 acres of land and 540 hours of June labor. The production of 45 tons of berries will use up all the land and 270 hours of June labor:

\[
15 \text{ acres } = .33 \text{ acres per ton } \times 45 \text{ ton berries}
\]

\[
270 \text{ hours } = 6 \text{ hours per ton } \times 45 \text{ ton berries}
\]

The profit is $60 per ton $ \times \ 45 \text{ ton berries } = $2700. The production of 90 tons of beans uses up all the June labor and 11.25 acres of land:

\[
11.25 \text{ acres } = .125 \text{ acres per ton } \times 90 \text{ ton beans}
\]

\[
540 \text{ hours } = 6 \text{ hours per ton } \times 90 \text{ ton beans}
\]

The profit is $25 per ton $ \times 90 \text{ ton } = $2250.

The computer then will combine berries and beans so that all land and all June labor are used. This turns out to be 18 tons of berries and 72 tons of beans and yields a profit of:

\[
($60 \text{ per ton } \times 18 \text{ tons berries}) + ($25 \text{ per ton } \times 72 \text{ tons beans}) = $2280.
\]

Fifteen acres of berries yield $2700 profit; 11.25 acres of beans (there is not enough labor to grow 15 acres) yield $2250 profit; and 6 acres of berries plus 9 acres of beans yield $2880 profit. Most problems are not as simple as the above example, and as the number of enterprises and variables increases, the efficiency and practicality of the computer increases.
Computerized teaching aids

The computer also can be used to reproduce or simulate (pretend) each step in the operation of an actual or make-believe farm business. This makes it possible for the farmer to have a “trial run” at managing his farm on the computer before actually committing his resources. It also gives the classroom student management experience without “getting his shoes muddy.” When a specific farm is studied and the program is used to find weaknesses in the farm’s management, it is called simulation. When the student gains management experience on a representative farm simulation, it is called a farm management game.

A flow chart for simulating a dairy herd replacement management process is illustrated on page 10. Students would have to decide what quality, how many, what price, and when to buy or raise replacement dairy cows over a period of years with varying milk and feed prices and herd-production levels. Likewise, a dairyman might provide dairy herd replacement information from his own operation for the simulation and have the experience of managing his herd using his own milk production figures, prices paid, and market conditions. He may learn whether he will be broke or rich five years hence! Whichever the case, he will be forewarned of some of the decisions to be made and their results.

Future Prospects

One of the first farmers in Oregon to use the computer (a computerized information system) wrote that, “The farmer who doesn’t use the computer in managing his farm will be as bad off as the farmer who doesn’t use fertilizer.” As farmers learn more about the computer and as new programs are developed and tested, farm applications of the computer will become as common as current applications of fertilizer.
Flow Chart for Simulation of a Dairy Replacement Problem

Start

Read and store data describing situation

Compute net returns for each cow

Determine number and quality of replacements available this year

Compute net returns for each replacement

Determine casualty and old-age culls

Compute herd net returns and herd average production

Is this last year to be simulated?

No

Simulate passage of year's time

Estimate net returns next lactation for each cow

Make improvement cullings

Set up for first year of next replication?

Yes

Is this last replication?

No

Analyze and print results

STOP
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