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## MICROCOMPUTER APPLICATIONS AND SEED

Gary A. Reusche<sup>1</sup>

### Introduction

Every seedsman has heard of the microcomputer and its potential for farming and business. A person would almost have to live on another planet to have missed the onslaught of this new technology. But just what can the microcomputer do for the seed industry?

The microcomputer can be adapted to a wide range of uses. Uses such as record keeping and quality assurance, seed laboratory management, dynamic conductivity analyses, and weather records and emergence modeling are possible. But these applications are just the beginning. Other applications will be coming. For example, microcomputers can control drying by switching on fans and burners depending on climatic factors. Research in Virginia on peanuts has shown that by using microcomputer-assisted drying you can decrease drying costs by 25% with a minimal increase in drying time (10%).

If the user buys a modem and communications software he can tap in to extensive databases that provide extension information, marketing information, the New York Times, and much more. This trend is going to increase. Already users can make their own airline reservations and do their banking by microcomputers. Soon mail-order houses will get into the act, and spare parts, equipment and the like will be available quickly and at a competitive advantage for the microcomputer user.

It is my opinion that every seedsman will have a microcomputer within ten years. A common recommendation to potential users of microcomputers is to first select the software that makes the computer work, and then pick a computer/printer (hardware) that will run the software.

There are many sources of software for microcomputers. The most important is the commercial vendor, who deals with software designed for the large markets. This includes software for business, such as spreadsheets, databases, and programs for specific applications.

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Spreadsheets

An electronic spreadsheet doesn't do anything that can't be done with a pencil and a piece of accounting paper, but it does it so fast and so conveniently that it is one of the most widely used software packages. Lotus 1-2-3, Symphony, SuperCalc, CalcStar, VisiCalc, and Multiplan are all examples of spreadsheets. Information is organized in rows and columns on the computer screen, just like on a piece of paper. This can be visualized by a simple example (Figure 1).

Figure 1. Example of Simple Spreadsheet

	<u>C O L U M N S</u>		
	<u>A</u>	<u>B</u>	<u>C</u>
Row 1	# bags	cost/bag	total
Row 2	25	10.75	a2*b2
Row 3			

In the example there are nine cells. It is a "spreadsheet" with three columns and three rows. Each cell can be identified by the column/row intersection. In the cell "a1", column A has been labeled "# bags". Likewise, in the cell "b1", column is B shown as "cost/ bag". Finally column C has been labeled "total".

The example shows "25" in the cell a2 and "10.75" in the cell b2 and finally "a2\*b2" in the cell c2. The two numbers, 25 and 10.75, refer to the number of bags and cost per bag respectively. The entry in c2 is a formula, instructing the computer to take the value in cell a2 and multiply it by the value in b2. The user indicates the formula, but it is not displayed on the screen. the actual value that is calculated by the formula is shown on the screen (in the example, 268.75 would appear in c2).

From the brief example, it should become apparent that there are many different applications for a spreadsheet. Some examples are crop

budgets, lease vs. buy analysis, costs associated with storing grain, drying costs, simple payrolls, inventories, and more. Many spreadsheets will work in concert with database management programs to extend the possibilities many fold.

### Databases

Database management programs can organize and access large amounts of information. One good way to grasp the basics of a database is to think of a 3" x 5" card system that is used to keep up with card addresses. On each 3" x 5" card is listed the name, street, city, state and zip code of an individual.

In the jargon of the database, each 3" x 5" card is a "record". Within each record, the user defines a number of "fields". For example, one field could be for name, another for street, yet another for city, and so forth (Figure 2).

Figure 2. Simple Database for Addresses

	field	field	field	field	field
Record 1	Name	Street	City	State	Zip
Record 2	Name	Street	City	State	Zip
Record 3	Name	Street	City	State	Zip
Record 4	Name	Street	City	State	Zip
Record 5	Name	Street	City	State	Zip

After all the names and addresses are entered into this example, the user can begin to access the database. He can use the database to print address labels. He can use the database to print form letters (often in coordination with a word processor) for each person in the database. He can sort all the records by state, by zip code and by last name. He can instruct the computer to find the record for a particular name, or find all records for a specified state. The ways to access the database are numerous.

Spreadsheets and databases can be customized by the user to keep records on whatever is desired. There are limitations as to what can be done with spreadsheets and databases, and software for specific applications will sometimes be required.

### Business Software

In general, software is widely available for business purposes. Much of it is excellent, but the user must choose wisely. Many different versions of software are available for payrolls, accounts receivable, inventories, and the like. If the user finds a package that fits his needs, then this is the software route to take. It is probably a good idea to take as long as six months to make a decision about the particular software that will be bought. One recommendation is to visit somebody that has been using the software for at least 6-12 months and will take the time to show you the system. Software salesmen will make their product sound very good but the final proof is in the working environment. Many times, the user cannot anticipate all the software features that he will eventually require. Only actual usage over a significant period of time will test the software and its merits.

### Cost/Benefit

A comment needs to be made concerning the cost of a microcomputer system, and the expected benefits. Improved technologies must pay off. In the case of a microcomputer, the cost of a good business-oriented microcomputer, printer, software, modem, information system, and service agreement is in the range of \$10,000 over a five-year period. Ten thousand dollars can buy a new valve-pack bagger, or can be used in other ways. Perhaps a "bargain" can be found for less money, but it may be a false economy to cut corners on hardware of software.

If \$10,000 is assumed to be a good estimate of cost over a five year period of time, this means that in rough terms (not counting tax benefits, interest costs, etc.) the monthly cost is on the order of \$167. What are the benefits to be gained from this investment?

The benefits resulting from the use of a microcomputer are difficult to value. Quality assurance has been said to be record keeping, record keeping, record keeping. If the microcomputer increases product quality or eliminates costly mistakes, how much is it worth? If the microcomputer provides more accurate data upon which decisions can be made, how can that be priced? Even though these are difficult questions to answer precisely, they have to be addressed when considering the investment to computerize.

## QSeed

University professionals write software to fill some perceived gap in the availability of computer programs that will serve their clientele, or design innovative programs through research and development efforts. One such project is the development of a set of computer programs entitled "QSeed" for "Quality Seed".

QSeed has been under development since May, 1983, and has been tested in North Carolina at three different sites since early 1985. It is essentially complete, in terms of design and features.

QSeed is designed for a small to medium-sized seed business, and may be used without modifications if the user's record keeping and quality assurance needs are satisfied by the programs. QSeed is an integrated set of programs that operate as a single unit. Information entered in one program is often required before another program will run.

The development of a single set of programs such as QUALIFY that would fit the needs of all seedsmen is not a practical goal. The BASIC language source code for QSeed is freely accessed for review and modification, and such modifications are anticipated. This is different from most commercially available software which cannot be changed due to copyright protection. A competent programmer will be able to modify and customize the original QSeed design to make changes specific to a particular business need. Or, if a company desires to engage a programmer to write custom software, a study of the features and design of QSeed could save thousands of dollars in development costs and help ensure that expectations of the user are satisfied by the programmer.

QSeed runs on the IBM-PC/XT/AT family of microcomputers and nearly all IBM compatibles that run a version of GWBASIC. QSeed requires 256 K of RAM (Random Access Memory) and at least two disk drives, each storing at least 360 K of data. Lastly, for printed output, a dot matrix printer of nearly any manufacture is necessary. The use of a hard disk drive considerably speeds up the programs, as does the more powerful IBM computer.

## QSeed Features

An overview of QSeed features is presented below. For more detailed information, a User's Guide and a technical publication are available.

QSeed is password protected. As the user initially enters the program, the computer prompts for a user ID and password. A valid entry loads the master menu (Figure 3) and permits the user to select an

option. Otherwise, the non-authorized user is denied access. A record of the time each user spends logged-in to QSeed is maintained.

Figure 3. QSeed Master Menu

- A - Crops & Varieties
- B - Grower & Buyer Addresses
- C - Production Field & Grower Information
- D - Bin Allocation & Bulk Storage
- E - Conditioning Plant Records
- F - Seed Testing Information
- G - Inventory Control
- H - Invoice Processing
- I - List Buyers Of A Specific Lot
- J - Swap Data Disks
- K - Log Off System

Each variety of seed for which records are to be maintained by QSeed is defined. Eighty different varieties can be defined for each data diskette. The eighty varieties are divided into four groups, each group identified as a different crop. If a floppy disk system is used, the user can access an unlimited number of data diskettes by selecting an option from the master menu that permits the swapping of data diskettes.

One QSeed program defines all seed growers and buyers. A full address including the telephone number is entered for each grower and buyer record. Up to 999 growers and 999 buyers can be defined. A number is assigned to each grower and buyer, and this number is entered throughout the set of programs when the computer prompts for the grower or buyer name. Printed output includes an alphabetized telephone listing and mailing labels.

Production field records are maintained by QSeed. Each grower can have up to 20 seed production fields, and a separate record is maintained for each production field. The information stored includes such items as the source of the planting seed, the previous cropping history for the field, the date inspections are made, harvest records and the like. Within seconds the user can select a grower and then review a production field summary for that grower. Or, the entire record of a specific field can be selected for review and/or update.

Seed harvest and bulk storage is a complex set of operations that is closely followed by QSeed. Up to 126 bulk storage locations can be defined by QSeed, and separate records are maintained for each fill of a given bulk storage location. A bin, for example, can be loaded and emptied nine different times, and the contents of each fill are recorded and maintained for review.

As seed are received for bulk storage, the user enters a scale report that consists of the weight of the seed, the class, the grower, a grade analysis, pricing information (if priced at receipt otherwise pricing can be added later), and other related information. The user then indicates the bulk storage location where the load is dumped. The contents of each bulk storage location or bin can be reviewed on the screen, or a printed output can be requested. Thus, a bulk seed inventory, based on scale reports for all seed receipts, is maintained.

As seed are removed from bins for conditioning and bagging, the user indicates that a bin is being dumped. The contents of dumped bins are then split up into lots, based on the number of bags that are conditioned from the bin. The break-up of the bin contents into different lots creates a computer record for each lot and the beginning inventory for bagged seed. Each lot record indicates the number of bags in the lot, the use of tags, whether or not the seed has been treated and what treatments were applied, and other similar information. Finally, the bagged seed location of each lot of seed is entered as a two digit code representing a location in the warehouse. QSeed can show bagged seed to be stored in up to 120 different warehouse locations.

The maximum number of lots that QSeed allows for a given variety is 126. Assuming 800 bags per lot and each bag valued at \$10, the value of 126 lots is approximately \$1 million. If a user sells more than \$1 million of a single variety, indicating that the 126 lots is too few, then the variety can be sub-divided into logical groups. For example, the variety definition can also indicate class. If two classes of seed are grown and this method of sub-division is utilized, then 252 lots can be defined. The maximum number of lots for each data diskette is 1,040. (Using the same figures as above, this represents a gross seed sales of more than \$8 million per data diskette.) The lot is the unit upon which all seed testing, quality assurance, bagged seed inventory and sales is based.

Seed testing records are divided into two categories: bin records (or bulked seed records) and lot records. In both categories, the information entered is identical and includes the detailed data from purity testing, standard germination testing, vigor testing, and the like. In the case of a bin seed test record, the user identifies the bulk storage location and then enters, reviews or updates the record. In the case of a lot seed test record, the user selects the lot number of the test result and enters the information. One seed testing result is entered for a bin analysis, and up to five different test results can

be entered for each lot of seed. Since the computer stores the originating bulk storage location for each lot of seed, the user can view a histogram summary of all seed testing information for a given lot of seed, and this summary will show the trend over time from the bin analysis to the most recent lot analysis.

A printed output of the bagged seed inventory can be requested. The inventory listing shows the starting inventory quantity, the number of bags broken, the number of bags booked for sale, and the number of bags sold. The listing also includes seed testing information, the warehouse code where the bagged seed are located, and other related information

Seed sales using QSeed are based on up-to-date lot inventory records. When seed are sold, the user indicates whether the invoice is an actual sale, or an indication to buy ("booking" the seed). The process starts by identifying the buyer and entering background information about the sale. Then the variety is selected and the computer displays the inventory and quality information for the indicated variety. The user then selects one or more lots for the sale, and indicates the number of bags and selling price. All invoices automatically adjust the bagged seed inventory. At any time the user can make changes to an invoice, switch it from booked to sold, or call it up for review. The user can also request a listing of all buyers for a particular lot of seed.

#### Quality Assurance Features

Excellent, complete records for all stages of seed production, conditioning, and testing are in themselves the essential feature of a quality assurance program. Having these records available, in an organized and presentable fashion, for timely review, is a major benefit from the QSeed family of programs.

The QSeed programs allow the user to trace a lot of seed from the buyer all the way back to the bulk storage location from which the lot was constituted. The user can view all the truck loads that were dumped into each bin, and identify the growers whose seed were loaded into the bin.

QSeed allows the user to rapidly view seed testing information over time. Trends, instead of one test value, can be viewed. Lots not storing well can be identified, or the homogeneity of the lots originating from a single bin can be assessed.

QSeed permits the sale of seed from up-to-date inventory records. The inventory records indicate the latest seed testing information, and a statistical summary of all the seed tests for a given lot of seed is displayed. This allows the user to have a great deal of

information available to him at the moment of sale, and the appropriate choice of lots for a customer is facilitated.

In the case that the user needs to contact the buyers of a particular lot of seed, a listing can be requested that indicates not only the buyers and the number of bags bought by each buyer from the lot in question, but also the telephone number for each buyer. This permits the user to track down problem lots in a very rapid fashion.

### Seedlab

Another program that is currently under development at N.C. State University and that will be released this summer is called SEEDLAB. SEEDLAB is designed for a quality control laboratory and performs the following functions:

- logs samples as they are received
- records background information about sample
- allows user to designate analyses to be performed on sample
- allows user to enter results for each analysis performed
- calculates totals, averages and tolerances for the analyses
- prints a report for each analysis
- maintains database on samples and analyses for information retrieval
- permits user to generate hardcopy summaries of database

One of the criteria for the design of SEEDLAB was to develop a system that could form the basis for a multi-user network of computers in a larger seed laboratory.

### CASAS

Microcomputers can be interfaced to equipment and control many different kinds of operations. Already mentioned is the possibility to control drying fans and burners. At N. C. State University, Dr. Robert Keys has developed the interfacing and software to run a dynamic conductivity analysis on a number of samples simultaneously. At one minute intervals the computer reads the conductivity of a series of chambers where the seeds are immersed in water. (Seeds when placed in water will "leak" electrolytes. The greater the quality of electrolytes in solution, the lower the seed quality. The conductivity measures the electrolytes that have been leaked.)

Seed conductivity analyses are not new. However, the dynamic nature of the analysis is new (the normal procedure is to take one reading at the end of a certain number of hours soaking). One exciting result of this new procedure is that it may be possible to shorten the duration of the conductivity analysis to two to three hours for many crops. Many seed companies would be interested in a three hour seed test that could be performed on-site with the aid of their microcomputer.

### Modeling

Another use of the microcomputer is to accumulate data on the weather, or seedbed conditions, and interpret this data to predict seed quality or emergence. At NCSU, a commercially manufactured battery-powered datalogger is interfaced to nine sensors (soil and air temperature thermistors, soil moisture tensiometer, soil moisture block, relative humidity, solar pyranometer, rainfall gauge, and wind speed anemometer) to allow in-the-field monitoring of seedbed environmental factors relating to seed germination and seedling emergence, permitting an accurate and quantitative description of the environment for vigor studies and the development of emergence models.

Software that has been developed for the microcomputer to automatically input, convert, and plot the accumulated environmental data on a weekly or continuous basis. Data gathered at one-minute intervals and summarized on the hour is also tabulated for maximum/minimum and mean values on a daily and weekly basis.

### Summary

The use of microcomputers is an exciting new field. The applications are many, ranging from electronic communications and controlling equipment, to payrolls and quality assurance operations. The key to the use of the microcomputer is software. The decision to purchase software should be carefully studied. The investment in a microcomputer must be considered in terms of the expected benefits.