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The Potential for Microcomputer Use in Agriculture

by

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ABSTRACT

A survey of farmers shows substantial interest in microcomputers. Many want microcomputers to store and analyze their financial, production, and marketing data. These applications will require enormous software development efforts. An educational effort is needed to promote understanding of computers so that farmers can make good decisions concerning computer use.

THE POTENTIAL FOR MICROCOMPUTER USE IN AGRICULTURE

Interest in using computers in agriculture has spread rapidly in recent years. Of particular interest to farmers and small agribusiness enterprises has been the development of microcomputers (small personal computers). Several land-grant universities are developing software (programs) for microcomputers [1, 2, 3, 4, 5]. And a few commercial firms have ventured into the production of farm-oriented software. Unfortunately, the availability of hardware far exceeds that of the software needed to make microcomputers useful to farmers.

This paper reports on a survey undertaken to:

1) Develop a profile of farmers most interested in using computers, and examine plans they have for purchasing microcomputers,
2) Determine the computing tools farmers have used, their rating of the tools, and functions the tools performed, and
3) Define functions farmers want a microcomputer to provide.

We also comment on the feasibility of providing and using the functions farmers desire.

A list of 146 farmers consisting of 92 college-educated farmers, 28 farmers interested in microcomputers, and 26 farmers chosen at random was developed; 71 of the 146 surveys are summarized here. The study is not based on a statistical sample of farmers because both the restraints of the 1974 Privacy Act and our time limitations precluded that.

Potential User Profile

To develop a profile of the potential microcomputer user, we sorted the respondents into categories based on their answers to a question

concerning their plans to purchase a microcomputer. Three groups were formed: 1) OWNER (already have one), 2) YES, I plan to purchase a microcomputer, and 3) NO, I do not plan to purchase one. The OWNER group was comprised of 12 respondents, the YES group of 38, and the NO group of 21.

To develop a profile of potential users, we compared the YES and NO groups. The commodities produced by surveyed farmers indicated that those with more complex operations like feedlots and irrigated acreages tended to be more interested in using a computer [6], as did farmers with more tillable acres than others.

The educational backgrounds of the two groups also were analyzed. Table 1 presents a summary of the farmers that received instruction in seven subject areas. In general a higher percentage of the YES group have had formal instruction except in computer programming. Thirteen (34%) of the YES group compared with ten (48%) of the NO group had had instruction in computer programming, a slight indication of higher interest in computers by those who have had no programming instruction on which to base decisions.

Individuals who have had programming training may have more realistic views of computer capabilities than individuals without that experience. It is extremely important that educational programs objectively outlining the potential of computers in agriculture be developed. Perhaps extension programs could provide basic computer processing techniques and provide a perspective on computer capabilities.

YES respondents were asked to estimate when they planned to purchase a microcomputer. One (03%) checked this year, ten (27%), one to two years; and 26 (70%), three years or more. Several were waiting for lower priced computers or developments to make them more useful.

Table 1. Numbers and Percentage of Farmers Receiving Instruction in Indicated Subjects.

SUBJECT	YES		NO	
	No.	%	No.	%
Record Keeping	34	90	10	48
Enterprise Analysis	20	53	6	29
Tax Planning	19	50	10	48
Estate Planning	24	63	11	52
Computer Programming	13	34	10	48
Programmable Calculators	8	21	2	10
Marketing	31	82	12	57

Use of Computing Tools

Farmers also were asked to indicate which computing tools they had used. Table 2 lists the numbers and percentages of respondents using each tool. While exposure has been fairly low, the YES group, of course, has used computing tools more than the NO group. Most frequent use by the YES group has been through the extension service and commercial computing services. Both services involve trained professionals.

Table 2. Numbers of Farmers and Percentages of Farm Groups Who Have Used Indicated Computing Tools.

COMPUTING TOOLS	YES		NO		OWNER	
	No.	%	No.	%	No.	%
Programmable Calculator (PC)	10	26	3	14	6	50
Microcomputer (MC)	3	08	-	-	12	100
Extension Computing (EXT)	14	37	6	27	4	33
Commercial Computing (COMM)	14	37	2	10	3	25

The OWNER group had used the hands-on tools, programmable calculators, and home computers more frequently than any other tool. While these results show that the YES group had more experience with computers than the NO group, the YES group had less programming instruction than the NO group. This may indicate that it is easy to impress individuals with a computer even though they understand little about programming, data, and assumptions that make computers work.

The farmers were asked to rate the computing tools they had used on a scale of 1 (very low) to 10 (very high). The characteristics rated were: 1) confidence in results, 2) degree to which the computer's performance matched your expectations (adequacy), 3) understandability of procedures and instructions, desire to use it again (repeatability), 4) reliability (freedom from program or mechanical errors). The mean rating was calculated for each tool's factors based on the entire survey group (Figure 1).

The most significant observation is what we call the "repeatability phenomenon." Regardless of how low understandability was rated, repeatability was high. That was especially evident with the hands-on equipment. Programmable calculators and microcomputers exhibit relatively low understandability but very high repeatability. The understandability of hands-on tools is essential for successful use, which again points to a tremendous need for education concerning computer use and capabilities.

It appears that farmers are willing to keep trying the tools regardless of how little they understand. Confidence in results was rated relatively high in all categories even though understandability was still low. Such blind use of results provides a potentially dangerous atmosphere. We expected programmable calculators and microcomputers to be rated lower than the other services for the Adequacy factor. Just the opposite was true,

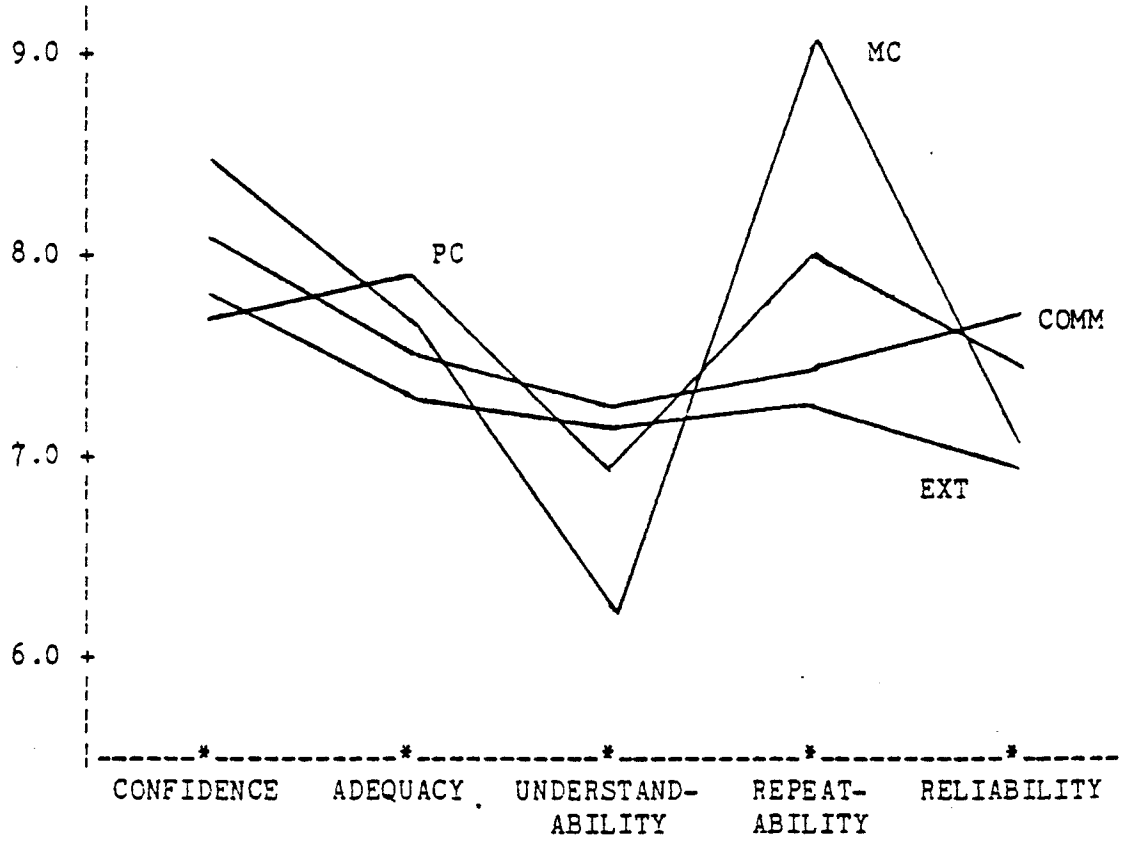

Figure 1. Graph of Mean Ratings for Microcomputers, Programmable Calculators, Commercial Computers, and Extension Computers.

although the range was small.

Commercial services were rated most reliable; the extension service, lowest for Adequacy. Farm computer users have a strong desire to use computing tools in spite of the many difficulties.

Farmers were asked to indicate the uses they had made of computing tools. Table 3 shows that financial analysis is the most frequently used function followed by break-even analysis and production record keeping. Ration formulation also was used frequently.

Table 3. Functions Performed by Computing Tools.

FUNCTION	OWNER		YES		NO	
	No.	%	No.	%	No.	%
Financial Record Keeping	10	83	15	58	4	40
Break-Even Analysis	8	67	15	58	5	50
Production Record Keeping	7	58	13	50	6	60
Ration Formulation	5	42	9	35	4	40
Market Analysis	2	17	2	08	1	10
Estate Planning	1	08	5	19	3	30
Equip. Maintenance Records	1	08	-	-	-	-
Purebred Cattle Marketing	1	08	-	-	-	-
Cow Herd Breeding Eval.	-	-	1	04	-	-
Energy & Insulation Eval.	-	-	1	04	-	-
Linear Programming	-	-	-	-	1	10

Functions Desired by Farmers

The final objective of the survey was to determine the functions farmers want a microcomputer to perform. Nineteen 'survey' functions were listed on the questionnaire. From the respondents' comments, thirteen 'additional' applications were defined.

The farmers were asked to check and/or enumerate functions they want a microcomputer to perform for them. Table 4 lists their preferences in decreasing order. The ranking was determined by combining OWNER and YES groups into one group referred to as users. The table then shows the number of requests and percentages of individuals in those two groups who requested each function. Table 5 lists the additional functions farmers requested.

Table 4. Functions Desired by Farmers Ranked in Descending Order of Preference.

FUNCTION	REQUESTS		FUNCTION	REQUESTS	
	No.	%		No.	%
Financial Record Keeping	47	94	Least-cost-ration Formulation	29	58
Balance Sheet, Income, Cash Flow Statements	42	84	Maintaining Records of Commodity Prices	27	54
Break-even Analysis of Individual Enterprises	39	78	Harvest Records (lbs., bu., moisture, rent share, etc.)	27	54
Crop Production Records by Fields	37	74	Nutrient Analysis of Rations	23	46
Depreciation Scheduling	34	68	Income Tax Preparation	20	40
Analysis of Proj. Budgets vs. Actual Expenditures	33	66	Calculation of Chemical and Fertilizer Application Rates	20	40
Livestock Production Records	33	66	Payroll	14	28
Budget Preparation	32	64	Calculation of Grain Storage Costs	14	28
Periodic Summary Reports of Production	30	60	Calculation of Planting Rates	13	26
			Calc. of Various Weights Measures, Conv. to Metric	13	26

Table 5. Functions Requested by Farmers.

FUNCTION	REQUESTS		FUNCTION	REQUESTS	
	No.	%		No.	%
Equipment Maintenance Records	5	10	Irrigation-pump monitoring	2	04
Market Analysis, Charting Prices	5	10	Evaluation of own Marketing Performance	2	04
Records of Personal Futures Trading Activity	4	08	Livestock Lineage Records	1	02
Calendar - Diary, Future Events	3	06	Family Living Expense Records	1	02
Feedlot Records, Livestock Location	2	04	Lease, Buy, Custom Hire Machinery Analysis	1	02
Automatic Weather Records	2	04	Performance Rating of Cow Herd	1	02
			Inventory of Parts, Feed and Seed	1	02

Financial record keeping is the most requested. At least three-fourths of the farmers also requested balance, income, and cash flow statements; break-even analysis; and crop production record keeping. The value attached to financial planning is indicated by about two-thirds of the USER's requesting budget preparation and analysis. Some USER's also want to be better informed about markets. Maintenance and trend analysis of commodity prices are given in Tables 4 and 5.

Comparing Tables 4 and 5 with Table 3 shows that software development has basicly been directed toward functions farmers want, except for budget preparation and comparisons of budgets with actual expenditures.

Feasibility of Implementation

In this report, feasibility refers to the technical aspects and the practicality of implementing microcomputer functions that farmers want, as

listed in Tables 4 and 5. Technical feasibility is rapidly becoming a question of the past. Most of the functions in Tables 4 and 5 are feasible unless complex analyses requiring statistical packages and an extensive data base are attempted. Even production-record keeping could become very complex, depending on the details a farmer desires. The limiting factor may be the time a farmer wants to spend keying in production data. Also he may be limited by disk storage space for many of the lower-cost microcomputers. His clerical skills and patience will probably be overloaded before the machine's capabilities are exceeded. Increasing the burden on clerical skills and patience still is a system to check for accuracy (either by machine or additional manual records).

A microcomputer with adequate auxiliary storage would provide most of the functions. The important consideration is costs versus benefits received. Benefits will depend largely on the frequency of use of the function.

Historically, computers have worked most efficiently when "number crunching." Digesting mass quantities of numbers and equations is what they originally were designed to do. Except for least-cost ration formulation involving linear programming, a farm operation has little need for complex, lengthy calculations. Computers also are very fast at sorting and searching for information, but the data-entry problems become formidable and tedious for many of these farm applications. Farmers may find that as much time is required to key stroke data into a computer as was needed to record it by pencil. Many farmers surveyed commented that although they keep good records, they don't have the time to 'massage' it into useful information. This is the area a computer could provide valuable assistance and thus prove "feasible."

Farm computing is basically at the same infancy stage, where business was several years ago. But farmers differ from other businessmen. Most businesses that use a computer have at least one department or one person to handle electronic data processing (EDP). Management very seldom interacts with a computer but communicates ideas or wishes to a member of the DP staff. A farmer does not have a DP department nor a clerical staff (other than his wife in some instances).

The farm manager who purchased the computer or his wife probably will do the data entry and try to follow those ofttimes confusing instructions. Human-computer interactions often are difficult and frustrating. So farm computers should be designed around the concept of a "friendly user interface." The notion of files, I/O device numbers, and complex operating system commands will need to consider the "friendly user" concept. And that imposes substantial demands on software development. The concept of 'peaceful' interaction suggests developing a data base management system for farm microcomputers. That is, a data processing technique like the one now used by many large businesses [7].

Conclusions

A microcomputer is a potential tool for use in agriculture. Many farmers sense the potential, as indicated by the sixty-four percent of nonowners surveyed who said they plan to purchase a microcomputer. Although not a random sample of farmers, it indicates substantial interest in computer use. Large-acreage farmers and those who have had instruction in record keeping are the most likely users. But a farm microcomputer must endure the same cost/benefit analysis as all farm tools. And it must be simple to operate.

Farmers must realize that software is nearly synonymous with simplicity of use. Well designed software aimed at being 'operator proof' that catches some data entry errors and gives simple instructions for corrections and continued operation contributes substantially to the simplicity of using a computer. An educational effort is needed to promote understanding of computers so individuals can make good decisions concerning computer use.

Farmers want microcomputers to store their financial, production, and marketing data and to retrieve the data for analysis and reporting. The input of data will be tedious and time consuming, and few farmers have a clerical support staff to assume this burden. So a friendly user interface is needed. The development of a friendly interface between man and machine can be greatly enhanced by a data-base management system and an accompanying query-language and report-writing facility, which places a heavy burden on software developers.

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