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THE USE AND EFFECTIVENESS OF SATELLITE COMMUNICATIONS
IN THE DISSEMINATION OF AGRICULTURAL INFORMATION
IN MICHIGAN

By

Dennis William Duncan

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ABSTRACT

THE USE AND EFFECTIVENESS OF SATELLITE COMMUNICATIONS IN THE DISSEMINATION OF AGRICULTURAL INFORMATION IN MICHIGAN

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To meet the technological and informational needs of farmers and agricultural firms in Michigan, Michigan State University Extension (MSUE) developed a satellite communications program in cooperation with DTN/FarmDayta that provides timely, useful agriculture-based MSUE and Michigan Agricultural Experiment Station (MAES) information to more than 2,800 Michigan DTN/FarmDayta subscribers.

The researcher had six main purposes in conducting this study. The first was to gather demographic information on farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services. The second was to determine the use, effectiveness, and importance of satellite communications in disseminating agricultural information, specifically MSUE and MAES information, to farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services. Third, the researcher identified other methods of information retrieval that DTN/FarmDayta subscribers used to access MSUE and MAES information, in addition to their satellite systems. Fourth, the researcher identified the number of

DTN/FarmDayta subscribers who owned personal computers and had printers linked to their DTN/FarmDayta systems. The fifth purpose was to identify the number of DTN/FarmDayta subscribers who accessed the Internet to retrieve agricultural information and their use of that information. The sixth purpose was to determine the number of DTN/FarmDayta subscribers who would be willing to pay a fee to receive MSU information on their DTN/FarmDayta systems.

Results indicated that subscribers who responded to the survey ranked crop production, marketing, and weather information categories of greatest importance. Fifty-eight percent of the respondent said they used MSU information for crop production input decisions, and 50% used MSU information for marketing decisions. When accessing Extension information, 82% of the respondents used Extension bulletins, 57% attended Extension meetings, and 51% contacted agents. Thirty-six percent said this satellite communications project had made them more aware of MSUE services and information.

Seventy-eight percent of the respondent owned a personal computer, 14% subscribed to Internet on-line services, and 10% accessed agricultural information from the Internet. Results showed a correlation between respondents' educational level and their ownership of personal computers, ownership of printers linked to their DTN/FarmDayta systems, and access to the Internet.

To my wife, Cathy, who has always supported me throughout
our life together.

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CHAPTER I

INTRODUCTION

Background

In today's agricultural industry, survival often depends on having an edge on information related to the market, efficient allocation of available resources, and use of new or innovative farming practices (Fedale, 1987). To obtain the latest information related to markets and innovative farming practices, Michigan farmers and agricultural firms have for decades looked to Michigan State University Extension (MSUE) as a valuable information resource.

Throughout its history, MSUE has used several methods of disseminating agricultural information. Various methods such as field trips, guest speakers, on-farm demonstrations, printed matter, radio and television, and interactive telecommunications have been advocated. "Interactive electronic systems, videos, satellite dishes and computers are among the latest machines in the market for agricultural information dissemination systems" (Riesenberg & Gor, 1989, p. 7).

With MSUE and other Extension services experiencing a continuing reduction in force due to budget constraints at the federal and state levels, more emphasis is being placed on the use of mass media or electronic methods of disseminating information. To meet the technological and informational needs of farmers and

agricultural firms in Michigan, MSUE developed a satellite communications program, Rapid Response Information Program (RRIP), in cooperation with two commercial satellite information services, Data Transmission Network (DTN) and FarmDayta. DTN and FarmDayta merged in May 1996 to form DTN/FarmDayta.

The main purpose of RRIP is to disseminate high-quality, timely, useful agricultural-based MSUE and Michigan Agricultural Experiment Station (MAES) information to Michigan DTN/FarmDayta subscribers. That information includes weather summaries; integrated pest management (IPM) updates; livestock, dairy, field crop, and vegetable marketing and production information; and Extension resource updates and activities. The program coordinator works as a liaison among Extension specialists, County Extension educators, and MAES researchers, with the main function of gathering and editing timely information from numerous departments and colleges at Michigan State University (MSU): Agricultural Economics, Agricultural Engineering, Animal Science, Botany and Plant Pathology, Crop and Soil Sciences, Entomology, Geography, Outreach Communications, and Veterinary Medicine.

Before RRIP, grassroots demand for MSUE's participation in electronic information dissemination had been growing, as evidenced by its being the number-one priority in a 1994 review by clientele of the Department of Crop and Soil Sciences and a high priority of the Field Crops Agriculture and Natural Resources Committee. Also, there had been numerous communications from farmers,

Extension agents, and specialists recommending the implementation of a program that would provide timely, updated information.

Under the leadership of Maxine Ferris, Outreach Communications; John Ferris, Agricultural Economics; and the present researcher, a graduate student in Agricultural and Extension Education, plans were developed to initiate a satellite communications program in cooperation with DTN and FarmDayta. The partners were enthusiastic and granted eight pages of ASCII text on DTN and three on FarmDayta for 1995. Subsequently, they have allocated seven pages on FarmDayta systems. MSUE information is now being provided to DTN/FarmDayta University Ag Focus subscribers nationwide. University Ag Focus is a section on DTN/FarmDayta that provides subscribers with agricultural information from a number of land-grant universities.

RRIP provides information to approximately 2,800 farmers, agribusiness firms, County Extension offices, and secondary agriscience classrooms via DTN/FarmDayta satellite communications in Michigan. Those Extension offices that are not linked to the system receive a majority of the information through the Cooperative Extension Education Network (CEENET). CEENET is an e-mail server that serves more than 950 MSUE employees.

Approximately 80% of the DTN/FarmDayta subscribers are agricultural producers, representing 67 of the 83 counties in Michigan. In February 1995, the RRIP coordinator conducted a baseline study in which every DTN subscriber in Michigan was surveyed. At the time, the subscribers included 1,625 farmers,

agricultural firms, Extension offices, farm credit agencies, secondary agriscience programs, and other firms associated with agriculture. DTN subscribers were identified as producing or raising the following commodities: 80% of the subscribers were corn producers, 74% were soybean producers, 78% produced wheat and other small grains, 25% were dry-bean producers, and 14% produced sugar beets.

Three areas of livestock contributed to 55% of the total surveys received. Those areas were cattle feeding (22%), swine (21%), and dairy (12%). The study also identified 81% of the respondents as agricultural producers, 14% as farm-input supply firms, and 17.7% as grain and livestock marketing firms.

According to 1996 DTN/FarmDayta subscriber demographics, 35% of the Michigan subscribers owned/rented between 500 and 999 acres of land. Sixty percent produced between 100 and 499 acres of corn, and 69% produced between 100 and 499 acres of soybeans. Sixty-one percent had dairy herds of 50 to 200 cows; 52% marketed between 500 and 3,000 hogs, and 85% marketed between 100 and 500 feeder cattle.

Michigan DTN/FarmDayta subscribers play a major role in the production of agricultural commodities in the state. According to Ferris (1996), DTN/FarmDayta subscribers sell approximately 73% of all cattle on feed and nearly 90% of all hogs sold. They grow approximately 57% of all acres of corn for grain and plant 54% of all soybean acres and 50% of all wheat acres planted. Arguably, then, this group of farmers and agribusiness firms plays a major role in the state's total production of five major commodities: corn, soybeans, wheat, cattle, and hogs. With businesses

of this size and magnitude, it is imperative that managers have instant access to timely marketing information and current pest, disease, and weather reports.

According to national statistics on DTN/FarmDayta subscribers, a significant percentage of the total population is well educated, own or lease computers, operate large farms, and experiment with the latest in agricultural technology (DTN/FarmDayta, 1996). Nationwide DTN/FarmDayta demographics from 1996 identified 68% of their subscribers as owning and/or using computers; 62% had some college education, and 35% were college graduates. Three percent owned a Global Positioning Satellite (GPS) system for production, and 9% planned to purchase such a system. GPS, introduced to agriculture in the early 1990s, provides farmers with new capabilities to map crop yields and to vary seed, fertilizer, and chemical application rates based on specific needs of field locations ("Precision Farming's 'Garden,'" 1995).

Statement of the Problem and Research Questions

On April 10, 1995, RRIP began disseminating information to DTN/FarmDayta subscribers in Michigan. As of January 31, 1997, RRIP had disseminated 792 articles and alerts pertinent to Michigan's agricultural industry. The following questions provided the impetus for this research: Are these articles and alerts important to subscribers? Is the information timely? What informational categories are more important than others? What other information sources are subscribers using to access MSU information? Is there a relationship between characteristics of subscribers and their use of information sources? Are subscribers using MSU

information in making production decisions? Are subscribers willing to pay a fee to receive MSU information on DTN/FarmDayta? Are subscribers using personal computers and printers in conjunction with their DTN/FarmDayta systems? Are subscribers accessing more pertinent information for their operation(s) from the Internet and World Wide Web (WWW) than they are from DTN/FarmDayta? The present study was undertaken in an attempt to answer these questions.

Purpose of the Study

The researcher had six main purposes in conducting this study. The first purpose was to gather demographic information on farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services. The second purpose was to determine the use, effectiveness, and importance of satellite communications in the dissemination of agricultural information, specifically MSUE and MAES information, to farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services.

Third, the researcher sought to identify other methods of information retrieval that DTN/FarmDayta subscribers use to access MSUE and MAES information, in addition to their satellite systems. Fourth, the researcher sought to identify the number of DTN/FarmDayta subscribers who own personal computers and have printers linked to their DTN/FarmDayta systems. The fifth purpose was to identify the number of DTN/FarmDayta subscribers who access the Internet to retrieve agricultural information and their use of that information. The researcher's sixth

purpose was to determine the number of DTN/FarmDayta subscribers who would be willing to pay a fee to receive MSU information on their DTN/FarmDayta systems.

Assumptions

The researcher assumed that the responses to the survey questionnaire were an accurate reflection of the opinions of all Michigan DTN/FarmDayta subscribers. The researcher also assumed that the respondents were able to read and understand all of the questions. It was further assumed that the DTN/FarmDayta subscribers were aware of and using MSUE and MAES information that they retrieved from their DTN/FarmDayta units in making production and management decisions.

Limitations

This study was delimited to 600 randomly selected DTN/FarmDayta subscribers in Michigan who were receiving MSUE and MAES information. The study also was limited by the questionnaire used and the respondents' answers. The data obtained from this study may not be representative of all Michigan farmers and agricultural firms, or of the entire population of DTN/FarmDayta subscribers. The researcher was not able to code the survey instruments or keep a record of subscribers' addresses because of company policy concerning subscriber confidentiality. Therefore, some subscribers might have returned two completed survey instruments. The researcher was unable to follow Dillman's (1978) recommendations for survey mailings because DTN and FarmDayta would not agree

to participate in a second mailing until two to three weeks following the first mailing. The researcher also was unable to survey a small sample of DTN/FarmDayta subscribers to perform a reliability test because DTN/FarmDayta had initially agreed to allow the researcher to send only one survey instrument. Therefore, the researcher performed a post-reliability test.

Definition of Terms

To facilitate an understanding of this dissertation, the following key terms are defined.

Agricultural firm. A private company that provides multiple services, such as buying and selling commodities, selling equipment and agri-chemicals, or conducting financial transactions.

Agriscience educator. An individual who teaches in a secondary agricultural program in Michigan.

Communication. A process by which participants create and share information with one another in order to reach a mutual understanding.

Computer. A machine that accepts data, processes them, and supplies the results of the processing from a given set of instructions (Cardiff, 1985, p. 205).

Cooperative Extension Service. An agency created by federal legislation through the Smith-Lever Act of 1914, which authorized educational programs in agriculture, home economics, and related subjects to be funded by federal, state, and local governments and administered through the same—hence the term

"cooperative." In Michigan, the agency does business under the name Michigan State University Extension (MSUE).

Distance learning. A network that permits interactive instructional or training services to be transmitted from a central site. Educational information is sent via electronic delivery systems that link the central site to any number of other sites. Examples include satellite video teleconferencing, interactive video, and computer courses offered via the Internet (Doyle, 1994).

DTN/FarmDayta. An electronic information and communication service company headquartered in Omaha, Nebraska, that provides its customers with time-sensitive information on agricultural markets, weather, agronomic news, national and international news, and marketing information for a variety of nonagricultural commodities (DTN, 1995, p. 1).

Farmer. An adult who owns or manages a farming operation from which the family receives more than \$40,000 gross income annually.

Global positioning system (GPS). A satellite-based radionavigation system developed and operated by the United States Department of Defense. GPS permits land, sea, and airborne users to determine their three-dimensional position, wind velocity, and time 24 hours a day, anywhere in the world (Lusch, 1996).

Internet. The worldwide "network of networks" that are connected to each other, using the Internet protocol and other similar protocols. The Internet provides file transfer, remote login, electronic mail, news, and other services (Krol, 1994, p. 509).

Ku band. The portion of the electromagnetic spectrum in the 12- to 14-GHz range; used for satellite communication.

Land-grant university. The passage of the Morrill Act of 1862 established guidelines that set aside public lands in each state for the establishment of land-grant colleges offering programs in agriculture, engineering, and home economics, as well as traditional academic subjects and military training.

Michigan Agricultural Experiment Station (MAES). The Hatch Act of 1887 provided federal assistance to state agricultural experiment stations. The MAES plays a vital role in providing new science and technology to support a highly diversified agricultural system that produces food, fiber, and forest products for the nation (MAES, 1994).

Modem. A piece of equipment that connects a computer to a data-transmission line (typically a telephone line of some sort) (Krol, 1994, p. 510).

Satellite. A radio relay in the sky that receives signals from an earth station, changes the frequency of the signals, amplifies the signals, and retransmits the signals to earth stations (Michigan Information Technology Network, 1995).

Subscriber. An individual or company that pays for and receives data and information from DTN/FarmDayta.

Teletext. A system that transmits alphanumeric information for display on a video monitor.

Transponder. A microwave receiver, amplifier, and transmitter in a satellite that amplifies and changes the frequency of a signal from an earth station and retransmits it to earth (Hudson, 1990, p. 314).

Videotext. The generic name for a system that transmits alphanumeric and graphic information for display on a video monitor (Hudson, 1990, p. 315).

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter contains a review of literature related to the study. The chapter is organized into the following sections: distance education via correspondence courses, distance education models in Extension, history and development of satellites, history of teletext and videotext in the dissemination of agricultural information, satellite videoteleconferencing, MSUE's involvement in electronic information dissemination, the DTN/FarmDayta delivery system, advantages of DTN/FarmDayta-type satellite sources, adopters and nonadopters of electronic information technology, and a brief look at international use of satellite programs in agriculture.

Distance Education Via Correspondence Courses

Distance education is not a new approach to teaching; it has been used in the United States and abroad since the early twentieth century. As early as 1915, Pennsylvania State University offered distance education courses through the Pennsylvania Learning Network. Internationally, the Open University of England

started offering courses on television to thousands of students in the United Kingdom in 1969 (OPEN, 1996).

According to Clark and Verduin (1989), distance education "refers to formal study in which teacher and learner are separate throughout the main mode of educational delivery" (p. 24). Rumble and Harry (1982) described distance education as

a generic term that includes the range of teaching/learning activities variously referred to as correspondence education or correspondence study . . . home study or independent study . . . [and] external studies. . . . Distance education has been proposed as the general term for this whole area of education. (p. 11)

Nonconventional modes of delivery are characteristic of distance education. Correspondence by mail was the first mode to be used (Clark & Verduin, 1989). This method involves exchanges of printed materials, audio tapes, and audio and video cassettes. Typical users of distance education are business, industry, military and other governmental agencies, and schools.

Are correspondence courses an effective means of educating students? Are such courses inferior to conventional classroom instruction? Many studies of the academic effectiveness of correspondence courses have been performed. A number of studies that have both supported and criticized correspondence study are highlighted in the following pages.

Clark (1987) compared correspondence courses with conventional higher education courses. He found that "all fourteen American correspondence versus higher education studies showed the distance students achieving as well as their

conventional counterparts" (Clark & Verduin, 1989, p. 25). International studies in his research also indicated no significant differences between the two types of courses.

Williams and Haas (1989) reviewed the development and implementation of a National Forest Recreation Management Correspondence Study course for USDA Forest Service personnel from 1985 to 1989. They found that enrollment had grown steadily since the start of the course. Enrollment for audience credit also increased from 27% in 1985 to 40% in 1989. Increased enrollment for credit indicates that many employees were using the course for college degree credit rather than for continuing education credits. In 1985, the correspondence course was cited as the best new academic course for Region 5 of the National University Continuing Education Association. According to Williams and Haas, "student evaluation has also been quite favorable" (p. 42).

Thomson (1993) reviewed an Extension-based direct mail correspondence course on greenhouse crop disease management that was designed to better support field-based horticulture agents. The course consisted of seven hands-on lessons. A postassessment of 18 participating agents indicated that they thought correspondence-based instruction was viable. "Participants recognized that correspondence instruction avoided scheduling conflicts" (Thomson, 1993, p. 34). Participants also stated that features of the correspondence course that enhanced the likelihood of successful completion of instruction were (a) substantive content appropriate to agents, (b) flexibility to carry out learning according to the agents'

schedules, and (c) hands-on learning, which allowed agents to apply theory and practice through real-life experiences.

In 1993, the College of Forestry and the Extension Service of the University of Minnesota tested a correspondence study course for land owners. The course consisted of six units that were mailed to the participants at two-week intervals. Participants ranked correspondence and written materials higher than meetings and demonstrations. Seventy-eight percent of the participants also stated that the course had influenced them to improve their existing forest, 52% said they would plant trees, and 44% claimed they would prepare a management plan (Birch, 1986).

Correspondence courses can be cost effective when compared to on-site education and can permit larger numbers of students to be enrolled at multiple sites. According to Williams and Haas (1989), a Forest Service assessment indicated that for each dollar spent on development and operating a correspondence study course, equivalent on-site training would cost approximately eight dollars.

Correspondence study is not without valid criticism. William and Haas (1989) stated that "the most significant disadvantage to correspondence study is the lack of face-to-face interaction between instructors and students" (p. 40). Further, Thomas (1993) found that horticulture agents said it was too easy to procrastinate and it was difficult to allocate time to carry out independent learning. Correspondence study also limits group discussion and impromptu planning by teachers and students. These factors and participants' lack of motivation can result in high dropout rates and uncompleted lessons.

Distance Education in Extension

The Cooperative Extension model of distance education dates back to the beginning of Extension programming at the land-grant universities in the early twentieth century. Educators called County Extension agents promoted research-based techniques for improving the productivity of farming operations at the local level (Kiernan, Turgeon, & Hoffman, 1995). University educators in many subject areas supported this work by preparing educational materials, writing newsletters, and systematically traveling to county meetings to give educational presentations that included an opportunity for local farmers to ask questions (Rasmussen, 1989; Vines & Anderson, 1976).

In the early days of Cooperative Extension Service work, trains were a popular method for taking educational materials and programs to rural communities in many states (Whiting, 1988). The automobile eventually took the place of the train as hard-surfaced roads were developed. Radio and television have also played a major role in disseminating Extension information to both urban and rural people. From an international perspective, it can be argued that radio and, to a lesser extent, television, are the critical links between Extension staff and Third World Populations. According to national DTN/FarmDayta (1995) statistics, subscribers spend .94 hours per day watching local television, .92 hours per day at their DTN/FarmDayta unit, and .82 hours per day listening to the radio.

In the past few years, Cooperative Extension has felt the constraint imposed by reductions in funding (Dillman, 1986; Graf, 1993; Whiting, Paulson, & Tucker,

1990). Extension services nationwide are attempting to find various avenues to deliver courses and programs to their clienteles (Bowen & Jackson, 1993). Distance education is a possible solution to reduced budgets and fewer Extension staff members.

According to Hamilton (1989), the Iowa Cooperative Extension Service installed distance education equipment in 1986 to link Extension audiences in all Iowa counties. He indicated that the system had been effective in delivering educational programs. He also found that favorable indicators for distance education included the effective use of small groups, travel savings for staff, and use of visual subject matter.

Bowen and Jackson (1993) argued that agricultural distance education will be successful only if college faculty, Extension educators, and other professionals are dedicated to planning and delivering effective courses and programs. According to Bowen and Jackson, educators require certain incentives to effectively plan and deliver courses and programs. The incentives identified in their study of faculty from 15 colleges of agricultural sciences and 150 Extension educators from 42 universities were divided into two categories: (a) actual inputs required and (b) anticipated outcomes.

Actual inputs were those incentives necessary to begin the course or program; they consisted of institutions' interest in distance learning and clientele demand. "The anticipated outcomes are those incentives that are rewards from

effectively planning and delivering a course or program" (Bowen & Jackson, 1993, p. 152).

Extension educators involved in distance learning need to consider certain issues involved in effectively preparing and implementing a distance education course or program. Bowen and Jackson (1993) stated that unique "planning and delivery behaviors are necessary for providing the course or program participants with valid and useful information that promotes learning" (p. 152). Newcomb (1992) indicated that agricultural distance education will not reach its potential until educators learn to plan and deliver instruction differently, using a variety of methods and techniques—for example, more interactive and participatory learning.

When planning to use telecommunications technology to disseminate information, Extension educators and professionals must develop a model that fits their clientele's needs and preferences, as well as the goals and objectives of the Extension organization. The model should involve the audience in a systematic approach to message design and program development.

The following steps proposed by Mody (1991) constitute a systematic approach to program development that can be applied to distance education in Extension:

1. Learn everything about the topic.
2. Identify the values of the entire audience to help decide how to communicate.

3. Dialogue with the audience concerning what they know and feel about the topic(s).
4. Write down the objective(s): what audience impact should be used to measure whether communication has been achieved.
5. Choose which communication channel and what frequency of exposure is required to reach the objective(s).
6. Design a creative-persuasive strategy to communicate the message(s) using your audience's media habits and information needs as a guide.
7. Write specifications for every message or topic, describing its goal, content, and recommended format.
8. Pretest the communication strategy on a sample of the audience to find out whether the chosen approach is working.
9. Modify the message design or communication strategy according to pretest findings.
10. Monitor physical exposure, attention, and comprehension levels after the message or program begins.
11. Evaluate whether the message or program is achieving its goals.

Brief History of Satellite Development in the United States

The use of satellites for communication in the United States dates back to 1960. The army launched the first experimental satellite in 1960, and in 1962 Telstar I, the first nongovernmental satellite, was launched (Zimmerman, 1983). Early satellites were passive; that is, they received signals sent from an earth station

and reflected them to a receiving one (Zimmerman, 1983). Active satellites replaced passive ones as soon as space-flyable electronics were available. Active satellites use transponders to receive and return signals and employ solar cells and back-up batteries as a power source.

Satellites are launched into space via rocket boosters or United States space shuttles. Satellites can be placed in different orbits, but for this project, only the geosynchronous orbit will be discussed. In geosynchronous orbit, the period of revolution of the satellite is equal to the period of the earth's rotation (Hudson, 1990). Therefore, a satellite with an altitude of 23,000 miles has the potential of covering one-third of the earth's surface. Since the early 1960s, approximately 3,500 satellites have been launched into orbit.

Communication satellites of today have the capacity for programming that can be aimed at specific target audiences anywhere in the world (Hudson, 1990). Satellites are used for television programming of news and sports. They also transmit data for business users: market reports, employee training sessions, and many specialized workshops and seminars. In addition, organizations are increasing their use of satellites for video teleconferencing.

History of Teletext/Videotext in the Dissemination of Agricultural Information

Direct delivery of perishable information in electronic format to farm end-users was explored in the 1981-1982 Green Thumb videotext project, which was implemented for 18 months with 200 farmers in Kentucky (Clearfield & Warner,

1984). In 1982, a teletext project was launched by the United States Department of Agriculture (USDA) in cooperation with public television stations in Florida, North Dakota, Missouri, California, and Colorado. The project, titled "The Farm Market Infodata Service," provided viewers with perishable information via their television sets. Like the Green Thumb project, the teletext pilot project demonstrated the technical viability of electronic information delivery, although it lacked interactive query (Goe & Kenney, 1988).

Agricultural teletext systems transmit electronic signals to farmers by telephone lines, satellite, FM sideband (using extra space on an existing station's band width), or television (using one or more of the blanking intervals on a station's signal) (Chartrand & Seidner, 1984). "The teletext systems consist of continuously scrolling information or a system in which a farmer may select a particular 'page' of interest from a menu" (Abbott, 1989, p. 124).

In the early 1980s, commercial information providers began to seek opportunities for electronic delivery of agricultural information. According to a 1983 article in Agricultural Information Systems, the bulletin of the American Society for Information Science (ASIS), 11 private organizations, including producers' cooperatives such as the Alabama Cattle Market Association and Iowa Beef Processors, Inc., were using electronic delivery of agricultural information (Goe & Kenney, 1988). One of the more progressive companies to enter the agricultural teletext market was Data Transmission Network (DTN).

According to Sesker (1997), DTN's founder wanted a faster way to deliver weather and market information to farmers. In 1984, DTN was the first commercial company to deliver national news and market information into farm homes by computer modem and FM radio signals (Senft, 1995). The early DTN teletext systems, those before 1992, used a "page-based" receiver and monochrome system (DTN, 1995).

In 1989, DTN added Ku satellite-band technology, which provided the ability to reach clientele outside the geographic territory of the FM stations (DTN, 1995). In 1992, DTN introduced a new satellite receiver that enabled subscribers to review color graphics and expanded communication and information services previously not available with the teletext system. DTN subscribers can now view high-resolution color pictures, graphics, and text (DTN, 1995).

DTN's addition of Ku band and receiver technology has increased the number of subscribers. The inclusion of more than 1,000 pages of text and visual satellite and radar weather maps, graphics of plant diseases, insect and weed identification, and other plant-related deficiencies, in addition to the traditional grain and livestock prices, news, and local markets 24 hours a day, has broadened the service's appeal to a wider range of subscribers.

In 1996, DTN purchased a competing satellite communications company, Broadcast Partners, and its FarmDayta information network, which had approximately 32,000 subscribers (McHone-Pierce, 1996). As of July 1996,

DTN/FarmDayta was reaching 115,000 agricultural subscribers in the United States and Canada (Norris, 1996).

Other private organizations have entered the market of agricultural-information dissemination via satellite communication, as well. They also have systems that provide the necessary equipment (satellite dish and receiver, computer monitor, and keyboard) to link farmers to the latest in agricultural markets, weather, news, and production information.

Satellite Video Teleconferencing

Satellites have been used for video teleconferencing in agriculture for more than a decade. Video teleconferencing involves the telecasting of a program over satellite, with viewers having an opportunity to phone in questions while the program is on the air (Whiting, 1988). In some cases, questions are also transmitted via facsimile or sent electronically using an electronic mail service.

"Satellite programs offer adult learners the ability to communicate interactively with specialists; for instance, multiple specialists can be seen via satellite at one location and react live to learners at various locations throughout the state" (Kiernan et al., 1995, p. 37). Satellite programs also may help draw large audiences. Researchers have found that agricultural groups tend to schedule organizational meetings in tandem with satellite programs and thus attract more people (Lane, 1991).

A video teleconference can also involve discussion between or among two or more groups of presenters located at different sites. This is made possible by

accessing telephone lines that are linked to each site. The presenters and the audience can interact with groups at other sites via telephone. Fax machines and computers can also be used to facilitate interactive communications between or among sites.

Some of the early leaders in video teleconferencing were Oklahoma State University (1985); Iowa State University and Kansas State University (1986); and Ohio State University, the University of Maryland, and Virginia Polytechnic Institute and State University (1978).

In 1989, the Agricultural Distance Education Consortium (A*DEC; formerly AG*SAT) was created so that land-grant colleges, other institutions, and governmental agencies could pool their resources to adopt technologies for distance learning (Bowen & Thomson, 1994). A*DEC is a nonprofit distance education consortium owned and operated by 50 state universities and land-grant colleges (A*DEC, 1996). A*DEC is grounded in the land-grant philosophy and includes teaching, research, Extension, and international programming.

According to A*DEC's strategic plan, it has changed its name and mission as a "proactive" response to a rapidly changing future in which (a) local, state, and national borders no longer bound education; (b) "just-in-time" learning becomes essential in the knowledge-age society; and (c) education is challenged to compete with the private sector.

The mission of A*DEC is to develop and provide responsive, high-quality, and economical distance education programs and services related to food and

agriculture; nutrition and health; community and economic development; and children, youths, and families. Programs and services will be delivered to K-12 educators, community colleges, social service agencies, non-A*DEC four-year institutions, consumers, and agriculture producers via the Internet, audio conference, videotape, satellite downlink, and printed publications. A*DEC programming includes formal higher education credit courses, informal lifelong learning and outreach opportunities, and other distance-delivery opportunities such as national and international research seminars.

MSUE's Involvement in Electronic Information Dissemination

In 1989, MSUE implemented an agricultural marketing program in cooperation with DTN to expand existing areas of marketing to Extension staff and clientele by providing them with an electronic source of market information. According to Brewer (personal communication, 1997), this was the first project of its kind in the United States to offer electronic marketing information in County Extension offices. The program was piloted in selected Extension offices throughout the state that housed agents specializing in agricultural marketing. MSUE is continuing to use DTN/FarmDayta services to provide up-to-date research-based agricultural information to clients and Extension staff members.

In 1994, MSU developed a satellite communication system, called LearnNet. The downlink network is managed by MSUE and its local Extension offices statewide. Presently, LearnNet operates 86 satellite downlinks in Michigan's 83 counties (Evans, 1996). The satellite system is used to deliver MSUE's own

educational and administrative programming, as well as that of other MSU units and various other nonprofit state agencies that are interested in reaching audiences statewide.

In January 1995, MSUE developed an additional satellite communications program, the Rapid Response Information Program (RRIP), in cooperation with two independent firms, DTN and FarmDayta. DTN and FarmDayta, as stated earlier, merged operations in 1996.

DTN/FarmDayta provides agricultural-based news, weather, marketing, and production information via satellite and radio communications to more than 2,800 farmers, agribusiness firms, and agriscience educators in Michigan. It has more than 120,000 subscribers nationwide.

The RRIP coordinator developed the following objectives to guide the program:

1. Provide farmers and agribusiness firms with timely, high-quality, research-based information.
2. Update MSU information several times a week.
3. Disseminate information to producers quickly and directly.
4. Provide short, self-contained educational programs.
5. Provide updated information on MSUE seminars, activities, and bulletins.

No other information service available to Michigan producers provides as up-to-date, timely, research-based Extension and MAES information as does RRIP.

The RRIP coordinator conducted a baseline study of every Michigan DTN subscriber before the start of the program in February 1995. FarmDayta was reluctant to release subscribers' names; therefore, they were not surveyed at that time. Of the 1,625 DTN questionnaires that were mailed, 729 (45%) were returned after the initial mailing. Data collected from the questionnaires enabled the project coordinator to identify (a) specific information DTN subscribers were interested in receiving and (b) demographic information on subscribers.

Respondents were asked what type of information they were most interested in receiving. Comments included the following: updated weather reports, marketing forecasts for grain and livestock, weed- and pest-control information, agricultural seminar information, and Crop Advisory Team (CAT) information.

MSUE is also using two-way interactive video conferencing via code/decode systems. CODEC is an acronym for code/decode, a device that allows both desktop video-conferencing systems and classroom-presentation systems to relay signals over high-grade telephone lines called T1's. CODEC users can see and speak to each other through computer video interface in near-real time.

Most CODEC systems located at Michigan universities and colleges are part of the MICTA network—a consortium of 103 higher-learning institutions throughout Michigan that use compressed video to deliver interactive classroom instruction from one institution to another (LearnNet, 1997). These systems typically are located in lecture halls and are designed to accommodate large numbers of students. MSUE

uses CODEC systems primarily for meetings among Extension staff and with partners in other agencies.

In spring 1997, MSUE purchased a number of desktop video-conferencing (DVC) units. DVC is "desktop" based. "Participants sit at their desks, in their own offices and call up other participants using their personal computer in a manner much like a telephone" (Hudson, 1996, p. 1). This is made possible through a network of computers together in offices using ethernet or Integrated Services Digital Networks (ISDN) telephone lines that link personal computers at different locations.

The video is created through a small camera, which often is placed on top of the computer monitor of each system. Participants need only to "dial up" the ISDN number to connect, and in seconds they can see and hear other participants. Participants also have the ability to share and transfer data, and to operate authorized software. DVC systems typically are used for person-to-person or small-group communication (LearnNet, 1997).

MSUE houses DVC units in Extension offices and plans to use DVC for educational delivery to clientele and students by Fall 1997. The primary difference between DVCs (located in MSUE conference rooms) and CODEC (classroom-based systems located at other colleges and universities) is ease of scheduling. According to Evans (personal communication, 1997), "DVC will give MSUE its 'own' videoconferencing system that will not involve the external gatekeepers or extensive machinations associated with the use of larger CODEC systems."

The DTN/FarmDayta Delivery System

DTN/FarmDayta has a base of approximately 120,000 subscribers, concentrated in the Midwest. The subscriber base in Michigan consists of approximately 1,700 DTN subscribers and 830 FarmDayta subscribers. DTN/FarmDayta provides agricultural marketing information, 24-hour weather radar and satellite images, national and international news, advertisements, and other agronomic-based information for multiple enterprises.

The equipment necessary to receive this information is leased from DTN or FarmDayta. Subscribers pay a start-up fee of approximately \$300; the additional monthly lease fee ranges from \$40 to \$90, depending on the services desired. MSU information is provided to Michigan subscribers at no extra cost and can be received as part of the basic service.

The equipment used consists of a Ku-band outdoor satellite dish about .75 meters in diameter, a VGA computer monitor, a satellite receiver, and a computer printer (optional). The receiver in newer models from both companies contains a hard disk for data storage and an abbreviated keyboard for control of the screen menus and printing options. As updated information is downloaded from the satellite, the new file overwrites the previous information. The information may be viewed at any time. The unit also has the capability of printing a hard copy. Both monochrome and VGA color units are available, although most new subscribers choose the color systems because of the graphics capabilities, especially weather radar, satellite, and CD-ROM images.

There is a slight difference between page formats of the two systems. DTN color systems allow 27 lines of 80 characters each; monochrome systems allow only 24 lines of 80 characters. FarmDayta systems allow 20 lines of 80 characters. This difference requires the editor to format the same article differently to use the maximum amount of available space per page for both systems.

Information is edited and saved in ASCII (text) format. Each article must contain a code that identifies the page number and the final destination of the article. RRIP articles and alerts are sent strictly to DTN/FarmDayta systems. Each system has its own identification number or "address" so that DTN/FarmDayta can control exactly what information goes to each system.

Information from MSU is uploaded in a communications software program (Procomm) and sent out via phone modem to a DTN/FarmDayta earth station. The earth station transmits the information to the satellite, and the satellite transmits the signal back to Michigan. This entire process can be completed in a matter of seconds.

The RRIP coordinator is responsible for monitoring and purging stale information and giving priority to the most timely information. From April 1 to August 1, 1996, RRIP uploaded 162 articles to subscribers. The coordinator works with campus specialists, County Extension educators, and Experiment Station researchers to gather timely information from numerous MSU departments: Agricultural Economics, Agricultural Engineering, Animal Science, Botany and Plant

Pathology, Crop and Soil Sciences, Entomology, Geography, and Outreach Communications.

The program coordinator met with faculty and Extension specialists in departments before starting RRIP. This gave the coordinator an opportunity to explain the program, provide DTN/FarmDayta subscriber demographics, and identify faculty's and Extension specialists' role in providing timely research data and stories that would be made available to every DTN/FarmDayta subscriber in Michigan.

During the growing season, MSUE Crop Advisory Teams (CATs) comprising county educators, campus specialists, and researchers gather the latest data on growing-degree-day (GDD) accumulations, weed and insect infestations, fertility, integrated pest management (IPM) control measures, and identification and control of current disease problems in field crops and vegetables.

Weekly, during the growing season (April through October), Extension specialists, agents, and researchers hold conference calls to discuss current insect and disease alerts, market forecasts, and weather updates from around the state. This timely and valuable information is then compressed into concise articles and provided to DTN/FarmDayta subscribers the day of the CAT meetings. This CAT information is also made available through print media, the Internet, and fax service to those who pay an annual subscription fee.

The updated information is divided into "pages" of text not exceeding 25 lines by 80 characters for DTN and 20 lines by 80 characters for FarmDayta systems. As previously stated, each page or article is assigned a code that determines its final

destination. All pages (eight) are made available to Michigan DTN/FarmDayta subscribers at no additional cost.

The pages on DTN consist of an index page (page 1) that lists the article titles, followed by the date the article was uploaded to the subscriber. This enables the subscriber to identify new articles quickly. The index page also lists the coordinator's name, address, telephone number, and e-mail address for subscriber questions and concerns. The remaining seven pages consist of text-based information.

FarmDayta article titles also are followed by the uploading dates and are identified as MSU information. During the growing season, articles are uploaded daily by 12:00 noon. This time spot was identified by subscribers in the RRIP pilot study as being one of the highest viewing times of the day. During the off-season, information is updated three times a week, usually Monday, Wednesday, and Friday, and uploaded by 12:00 noon. The coordinator announces date changes on the index page so that subscribers are aware of them as they occur.

Advantages of DTN/FarmDayta-Type Satellite Sources

The advantages of accessing information through satellite sources are many, when considering the ease and quickness of a satellite-linked system in a farmer's home or office. There are now many different sources of agricultural information--newspaper, magazine, newsletter, and radio and television broadcasts. A relatively new entrant into the agricultural information ring is the Internet. Numerous providers of weather and marketing information are available on the Internet to farmers and

agribusinesses that have access to personal computers and telephone modems and/or subscribe to an Internet service (i.e., CompuServe, America Online, Prodigy, and so on).

One of the advantages of a service like DTN/FarmDayta as compared to the Internet is that information is packaged in a format that fits subscribers' needs. Another advantage of satellite transmission is that the signal can be beamed into the most remote rural locations (Kessler, 1996).

According to Knorr (1966), telephone companies offer Internet access for a flat fee. With the addition of a second telephone line, a much-needed accessory for the busy Internet reader, the bill comes to about \$540 a year. That average cost is the approximate annual subscriber fee for the basic DTN/FarmDayta color service.

Another advantage of DTN/FarmDayta is its speed. The Internet can get congested and slow during peak hours. Also, if a farmer does not have a vast, newer computer processor, it will be even slower. Further, some information on the Internet may not even be accessible with an older personal computer with limited memory.

Schumacher (1989) examined factors influencing agriculturalists' use of online databases. A brief summary of his findings is useful in defining the array of variables contributing to the use or nonuse of electronic information resources in the agricultural sector (Shill, 1992). Schumacher surveyed 931 subscribers to Doane's Agricultural Computing Newsletter in June 1987 to identify factors limiting the use of Agline and other agricultural information databases. Major variables limiting the

use of AgLine, a Doane database, were: "Can't get my modem to work," "I need a modem," "Telephone costs are too high," "I need a communications package," and "Overall cost is too high." Only 1% of the population in Schumacher's survey did not own a computer. Therefore, his results provide significant insights into the actual use of online databases by farmers who were self-identified computer users (Shill, 1992).

Another advantage of satellite service is the availability of local information. Farmers and agribusinesses may not find local cooperative and livestock market prices on the Internet, but they are available to DTN/FarmDayta and other similar systems. This availability of market information offers growers and producers the option of tracking commodity prices the same as a broker, trader, or local grain elevator would do. This ability to track prices and lock in future markets can increase profits substantially.

In a recent survey of Colorado subscribers to DTN, users indicated they had "increased net farm income by an average of nearly \$1,500 per year and that they check the service more than three times a week" (Senft, 1995, p. 10). This increase in income could be attributed to the instant access to commodity market information from across the nation. The survey results also showed that users viewed the satellite information before they read a newspaper or magazine (Senft, 1995).

Adopters and Nonadopters of Electronic Information Technology

Who are the adopters of new innovations in agricultural communications? Why do farmers and agricultural firms continue to adopt new technologies? Who are

the nonadopters, and why are they hesitant to experiment with new forms of communication technology? Many researchers in the telecommunications field have examined the adoption and diffusion of new technologies.

Diffusion theory, in general, predicts that those who first adopt an innovation will be more likely than late adopters to have more income resources, be younger, and have more skills in hearing about and using the innovation (Rogers, 1983). According to Rogers, diffusion is the process through which an innovation is communicated via certain channels over time among members of a social system. Rogers also stated that early adopters attend more to the mass media and tend to be males of higher socioeconomic status.

Ettema (1984) assessed the characteristics of adopters and nonadopters of agricultural videotext systems. According to his results, the average age of adopters was 42; the average age of nonadopters was 49 years. Adopters were also better educated than nonadopters. The adopters' farming operations generated, on average, more than \$200,000 revenue annually, significantly greater than the revenue for nonadopters. Also, the willingness to innovate was the largest difference between adopters and nonadopters.

In a 1985 Nebraska survey of subscribers to Agri-Vis, a scrolling teletext system, it was found that most users were in the top 5% in terms of farm size, even though it was inexpensive to subscribe to Agri-Vis (Jorgensen, 1985).

Riesenberg and Gor (1989) studied farmers' preferences for methods of receiving information on farming practices. They performed a Kruskal-Wallis

analysis of respondents' preferences for methods of receiving information on new or innovative farming practices by farm size, age, and education. According to their results, computer-assisted instruction was the number-one preference of all age groups, and it was ranked second in preference by respondents in all categories of education.

Abbott and Yarbrough (1992) found similar results regarding adoption and use of four technologies by Iowa farmers in 1989. Of the respondents, 31% who adopted video and teletext systems had farm sizes of 100,000-plus acres. Twenty-nine percent of the users had a college education, and 55% were younger than 33 years old.

Adoption of video/teletext systems increased rapidly during the period from 1985 to 1989, from less than 5% using any one system in 1984 to nearly one out of five adopting the system by 1989 (Abbott & Yarbrough, 1992). Abbott and Yarbrough thought that this increase was a result of the introduction of a new teletext service, DTN, in 1984.

Abbott performed another study from 1987 to 1988 in which he surveyed more than 700 Iowa farmers. The study was conducted to determine the farmers' interest in and use of three agricultural electronic communication systems. Agri-Vis and DTN were teletext, and Exnet was an interactive computer-based videotext system. Abbott found that farmers with small gross incomes were less interested in perishable information; the younger, higher-income farmers actually used the three systems to retrieve agricultural information. Almost 7% of the adopters had gross

incomes that exceeded \$100,000. The respondents most often mentioned new technology as the "best" source for information about grain and livestock futures.

Abbott (1989), Warner and Clearfield (1982), Suchman (1980), Hamblen (1994), and Fleming (1995) provided data suggesting that the effect of agricultural videotext and teletext systems depends on the farmer's mix of crops or livestock, demographic factors, and the utility the farmer sees for market information. Demographic statistics of DTN/FarmDayta subscribers nationwide provide support to the studies mentioned and to the diffusion-of-innovations theory proposed by Rogers (1983).

According to a 1996 DTN/FarmDayta demographics summary of 111,175 subscribers in the United States and Canada, 63% had some college education and 35% were college graduates. Seventy-one percent had incomes in excess of \$100,000. Fifty-nine percent were between 35 and 54 years of age, and 68% owned or leased a computer. Seventy-one percent of the subscribers grew corn, 65% grew soybeans, and 41% grew wheat. Arguably, these three commodities have very volatile markets. They also are susceptible to climatic changes, pest infestations, and disease. These factors, combined with new technology and changing production practices, strengthen the need for electronic information dissemination that can provide farmers and agricultural firms with the latest knowledge.

Many factors may contribute to the nonadoption or underuse of electronic information sources in agriculture. According to Iddings (1990), those factors include:

1. **Age**—Older farmers are less willing than younger ones to learn new technologies.
2. **Experience**—Farmers tend to be unhappy with nonfunctioning hardware and might revert to traditional methods if new technology proves too complex.
3. **Attitudes toward technology**—Traditional farmers who equate success with long hours and hard work may be less likely to adopt.
4. **Education**—Better educated farmers are more likely to purchase and use new technology than less educated ones.
5. **Farm size**—Larger farmers are in greater need of timely, critical information to make production and marketing decisions than are smaller farmers.

Demographic data from the above-mentioned studies also supported Iddings's findings. Age, education, farm size, and attitude toward new technology and change are major factors in a farmer's adoption of communication technology.

International Use of Satellite Programs in Agriculture

India

India developed one of the first and considered to be one of the largest satellite communication projects of its time. The Indian Satellite Instructional TV Experiment (SITE) was conducted during 1975-1976. According to Mody (1978), for the first time ever, a satellite transmitted programs directly to television sets in remote villages in India. Daily 4-hour programs provided nonformal education in

agriculture and health to villagers and formal education to school children and teachers. The Agriculture Ministry specified lists of topics for agricultural programs.

Special television sets were given to villages not larger than 3,000 in population, with a majority of receivers being placed in village schools (Mody, 1978). After the first month, average evening audience size decreased from 300 to approximately 100 per set. Socioeconomic status was found to be inversely related to television viewing. Small farmers and landless laborers formed the greater part of the audience; larger farmers attended only on days when they expected drama because "they already knew much of the instructional content through their other sources of information" (Mody, 1978, p. 119).

There were noted advantages to this satellite project in assisting the agricultural sector of India. Evaluative data showed that television viewing did increase contact between farmers and village-level Extension agents. There was also a large gain in knowledge about improved varieties of animal breeds (Mody, 1978). The larger farmers did not see a great benefit from this satellite project because they already had access to the same information that was being broadcast. It was also discovered that there was no gain in general agricultural knowledge, partly because farming techniques varied from region to region (Mody, 1978).

Since the inception of the SITE project in 1975, India has launched its own domestic satellite, Insat 1A in 1982 and Insat 1B (Hudson, 1990). By 1986, satellite communications covered more than 70% of the population and included All India Radio (AIR), in addition to television and India's expanding film industry.

Indonesia, Peru, and the West Indies

In 1979, the United States Agency for International Development (USAID) developed and implemented a program to aid the developing world in testing the use of satellite communications (Hudson, 1990). The goal of the program was to assist developing countries in using satellites for developmental purposes. Indonesia, Peru, and the West Indies were targeted for this project.

In Indonesia, 13 new universities were linked via a satellite audio-conferencing system that enabled a professor at one institution to teach students about agriculture and science at several locations. This program was beneficial because it filled a demand for specialized faculty in basic sciences and agriculture. The network also was used for faculty training and administrative meetings.

With support from USAID, the Peru Rural Communications Services Project (RCSP) was developed and administered. The goal of the project was to use satellite communications to provide telephone services and teleconferencing to support development activities in an isolated region of Peru (Hudson, 1990). The teleconferencing activities were developed by the Peruvian Agriculture, Health, and Education ministries. According to Hudson, the project incorporated a variety of training, diffusion, and promotion strategies. A total of 658 audioteleconferences were sponsored by the ministries and Entel during 1984 and 1985, involving almost 12,000 participant hours (Mayo, Heald, Klees, et al., 1987).

The third project supported by USAID was the University of the West Indies Distance Teaching Experiment (UWIDITE; Hudson, 1990). The main applications

of the satellite network supported Extension services that sustained agricultural development and information distribution, in addition to courses for credit and extramural studies. UWIDITE continued beyond its pilot-project phase and is now supported by various agencies.

China

China has had great success with satellite communications in educational programming. China developed a distance education institution (T.V. University) that provides educational programming to thousands of students throughout the country. Through T.V. University, the Chinese government has educated millions of students on various topics (i.e., agriculture, health, and business).

Although China's major emphasis in satellite communications is on military applications, educational programming, and governmental transmission, since 1974 the nation has had success with remote sensing used for agriculture and forestry, in addition to geological prospecting, environmental protection, and urban planning (Hudson, 1990).

Canada

Canadian farmers have access to satellite communications via DTN/FarmDayta, in addition to services provided by the Canadian Ministry of Agriculture. According to DTN/FarmDayta subscriber demographics, approximately 3,862 Canadian farmers subscribe to this satellite communications service. Subscribers are divided by province, there being 1,567 in Ontario, 1,029 in Saskatchewan, 643

in Alberta, 439 in Manitoba, 156 in Quebec, and 28 in British Columbia. Canadian growers can use much of the same information as those in the United States, with the exception of information pertaining to local grain and livestock markets, weather, and commentary on U.S. agricultural policy.

The Ontario Ministry of Agriculture is studying different communication programs to assist Extension personnel in providing information to the urban and rural populace of Ontario. The Ministry of Agriculture currently provides research-based information to the turf and agricultural industry via its WWW site on the Internet. This site is linked to many sites through Canada and the United States and provides a wealth of turf-management information and knowledge on various crop-production practices.

Australia

Australian communications experts recognized in the mid-1970s that satellites would be advantageous in reaching remote towns and homesteads. Approximately 20% of Australia's population live in a few cities and large towns, or are scattered throughout isolated farms, sheep stations, and aboriginal settlements (Hudson, 1990). In the late 1980s, about 300,000 people lived in rural regions outside the coverage areas of the national broadcasting stations and conventional telecommunications providers.

It was not until 1981 that a domestic satellite system was established in Australia. The organization that founded the system was Aussat Proprietary, Ltd., a joint venture between the Australian government and Telecom Australia. In 1985,

Aussat launched its first two satellites, followed by a third in 1987. Since then, a number of other Australian satellites have been launched, including Hughes Communications satellites in 1992 and 1994. Some of Australia's satellite services include (a) program feeds for the commercial television networks, (b) distance education by the Special Broadcasting Service, and (c) long-distance telephony.

In addition to commercial communication, universities have used satellites for teleconferencing and ongoing distance education (Hudson, 1990). The agricultural industry is using satellites to provide marketing and weather information to farmers via their personal computers and the use of GPS for precision agriculture.

Summary

The use of video and teletext for delivery of perishable agricultural information dates back to the early 1980s. Teletext use among public and private providers of agricultural information grew during the 1980s. Teletext enabled the sender to provide perishable information that could be updated several times each day.

As technology improved, teletext system providers like DTN moved from using television and FM radio signals to Ku band satellite technology. Ku band satellite technology provided the ability to reach clientele outside the geographic territory of the FM stations (DTN, 1995).

The early 1990s saw even further improvements in technology. DTN and Farm Dayta adopted a satellite receiver for their systems that enabled subscribers to view color graphics and expanded communication and information services. High-resolution pictures, graphics, audio, and text were now available.

MSUE's involvement with teletext communications systems started in 1989 with the implementation of a pilot project in cooperation with DTN. The project focused on providing up-to-date agricultural marketing information to a selected group of County Extension offices throughout the state via DTN units. The Extension specialists and agents would then make this information available to their clientele. To this day, a number of County Extension offices still are using DTN/FarmDayta units for current marketing, weather, and field crop production information.

In 1995, MSUE developed a new satellite-based communications program, RRIP, in cooperation with DTN and FarmDayta. The main purpose of RRIP is to disseminate high-quality, timely, useful agriculture-based MSUE and MAES information to nearly 3,000 Michigan DTN/FarmDayta subscribers. This information may include weather summaries; IPM updates; livestock, dairy, field crop, and vegetable marketing and production information; and Extension resource updates and activities.

A number of studies in other states have identified similar characteristics of adopters of agricultural videotext and teletext systems, and more recent use of satellite- and Internet-based systems. Rogers (1983), Ettema (1984), Abbott (1987), Reisenberg and Gor (1989), and Abbott and Yarbrough (1992) found that adopters of electronic information dissemination are more likely to be younger, have higher incomes, be better educated, and have larger farming operations than nonadopters.

Suchman (1980), Warner and Clearfield (1982), Abbott (1989), Hamblen (1994), and Fleming (1995) also provided data suggesting that the impact of agricultural videotext and teletext systems depends on the farmer's mix of crops or livestock, demographic factors, and the utility the farmer sees for marketing information.

This study was undertaken to identify characteristics of Michigan DTN/FarmDayta subscribers, their use and application of MSUE information made available to them via their DTN/FarmDayta system, the subscribers' perceptions of the effectiveness of RRIP as a communications tool, and the subscribers' use of Internet sources of agricultural information.

CHAPTER III

METHODOLOGY

Introduction

The methods and procedures used in the study are explained in this chapter. Sections include the purposes of the study, the population and sampling procedures, instrument development, validity and reliability, data-collection procedures, and data-analysis techniques.

Purposes of the Study

The researcher had six main purposes in conducting this study. The first purpose was to gather demographic information on farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services. The second purpose was to determine the use, effectiveness, and importance of satellite communications in the dissemination of agricultural information, specifically MSUE and MAES information, to farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services.

Third, the researcher sought to identify other methods of information retrieval that DTN/FarmDayta subscribers use to access MSUE and MAES information, in addition to their satellite systems. Fourth, the researcher sought to identify the

number of DTN/FarmDayta subscribers who own personal computers and have printers linked to their DTN/FarmDayta systems. The fifth purpose was to identify the number of DTN/FarmDayta subscribers who access the Internet to retrieve agricultural information and their use of that information. The researcher's sixth purpose was to determine the number of DTN/FarmDayta subscribers who would be willing to pay a fee to receive MSU information on their DTN/FarmDayta systems.

Validity

External Validity

The external validity of a study can be severely affected by the interaction in the analysis of variables such as subject selection, instrumentation, and experimental conditions (Campbell & Stanley, 1963). To guard against external-validity problems, the researcher used a random, representative sample of Michigan DTN/FarmDayta subscribers that was chosen by specialists at DTN/FarmDayta.

Face Validity

Face validity of the instrument was established by the researcher and a panel of experts representing the departments of Agricultural and Extension Education, Agricultural Economics, Educational Administration, and Outreach Communications at MSU. Changes were made to reflect their suggested improvements.

Content Validity

The instrument was evaluated for content validity by the researcher and a panel of experts from the departments of Agricultural Education, Outreach

Communication, and Educational Administration, as well as DTN/FarmDayta. Changes were made according to their recommendations.

Reliability

The researcher was unable to draw a small sample of Michigan DTN/FarmDayta subscribers to conduct a pretest of the instrument. Therefore, he was unable to run a reliability test. DTN/FarmDayta would only agree to release one set of addresses for the entire study because of clientele confidentiality. A post-reliability test was performed on the Likert-type question that concerned respondents' perceptions of the importance of MSU informational categories (Item 1 on the survey). The post-reliability analysis had an alpha of .66.

The Population and Sampling Procedures

The population for this study included farmers, agribusiness firms, agriscience educators, and agricultural financial institutions in Michigan that subscribed to either DTN or FarmDayta communication services. At the time of the study, subscribers represented 67 of the 83 counties in Michigan. A random sample of both DTN and FarmDayta subscribers was selected, using a 95% confidence level to determine the number of individuals to sample.

DTN and FarmDayta agreed to release one set of Michigan subscriber addresses (Appendices C and D), and FarmDayta provided the researcher with address labels. DTN did not supply address labels; therefore, the researcher was required to send the instruments, cover letters, and return-addressed stamped

envelopes to a mailing service in Omaha, Nebraska. The mailing service then labeled and mailed the envelopes back to Michigan.

At the time the study was conducted, there were approximately 1,700 DTN subscribers and 900 FarmDayta subscribers in Michigan. Therefore, at a 95% confidence level, the sample included 325 DTN subscribers and 275 FarmDayta subscribers ($N = 600$). The random sample was drawn with the assistance of DTN and FarmDayta specialists (Appendices C and D).

FarmDayta personnel randomly picked FarmDayta subscribers by sorting the file of six-digit customer numbers. The sort fields applied position 6,1 ascending and position 5,1 descending. The first 275 subscriber records were selected from this output, and address labels were then mailed to the RRIP coordinator.

DTN subscribers were randomly selected by first identifying the total number of subscribers. The total number of subscribers was then divided by the number of subscribers desired for the study. Following this procedure, every fifth subscriber was selected, yielding a sample of 325 DTN subscribers. The address labels for those individuals were then sent to the mailing service.

Instrument Development

The researcher developed the survey instrument (Appendix E) used in this descriptive study after studying other instruments designed to measure demographic characteristics, uses and applications of electronic information, and the effectiveness of electronic information dissemination in agriculture. The written questionnaire consisted of the following eight parts:

In Part I, Question 1, respondents ranked the importance of the MSU information categories on DTN/FarmDayta, using a Likert-type scale ranging from 1 (most important) to 5 (least important). For Question 2, respondents rated the overall MSU information on their DTN/FarmDayta units, using a Likert-type scale ranging from 1 (very important) to 10 (least important).

In Part II, respondents were asked to provide specific demographic and personal data.

Respondents' use of MSU information when making input decisions regarding the farm or agribusiness firm was elicited in Part III.

In Part IV, respondents were asked to identify the methods they most commonly used for receiving MSU information, other than DTN/FarmDayta units, and whether they were willing to pay a fee for the MSU information on DTN/FarmDayta.

Part V concerned respondents' increased awareness of services and information available through MSU as a result of DTN/FarmDayta.

In Part VI, respondents were asked to identify how often they thought the MSU information on DTN/FarmDayta should be updated and what MSU could do to improve this program.

Part VII identified the number of subscribers who had a printer linked to their DTN/FarmDayta unit and the number of respondents who owned a personal computer.

Part VIII identified the number of respondents who had access to the Internet, which Internet provider they were using, whether they accessed agricultural information from the Internet and what type of information they accessed, and the applicability of agricultural information accessed from the Internet to their operation, as compared with MSU information.

Before distributing the survey to DTN/FarmDayta subscribers, the researcher was required to send a draft copy of the survey instrument to the DTN and FarmDayta research departments for review. Both DTN and FarmDayta approved the instrument and agreed to participate in the study.

Data-Collection Methods

The instrument was mailed to DTN/FarmDayta subscribers on March 1, 1996. The subscriber received a cover letter, questionnaire, an addressed, postage-paid return envelope, and an MSUE bookmark as a token of appreciation for agreeing to participate in the study. The cover letter (Appendices F and G) briefly described the MSU information program, MSU departments contributing information, goals of the project, and the importance of the subscriber's response to the questionnaire. A quick response was requested.

Three weeks after the first mailing, FarmDayta subscribers who had not responded were mailed a follow-up letter (Appendix H), a replacement questionnaire, and an addressed, postage-paid return envelope. Four weeks after the first mailing, all DTN subscribers were mailed a follow-up letter (Appendix I), a replacement questionnaire, and an addressed, postage-paid return envelope.

Second mailings were color-coded to assist the researcher in data analysis. Two and five weeks following the first mailing, DTN/FarmDayta subscribers were reminded electronically via their DTN/FarmDayta units to return the completed questionnaires.

Of the 600 questionnaires that were mailed, 256 were returned by June 12, 1996. This resulted in a response rate of 43%. Responses of early and late respondents were compared to determine whether significant differences existed between the two groups. The responses of early respondents were not significantly different from those of late respondents, so the findings from this study can be generalized to the population (Miller & Smith, 1983).

Data-Analysis Techniques

Data were analyzed using the Statistical Package for the Social Sciences (SPSS/PC+). Descriptive statistics such as frequencies, means, percentages, and multiple response analysis were used in analyzing the data. Correlations were used to determine whether relationships existed between selected variables. Chi-square analysis was performed on interval data to determine differences between specific variables. Qualitative analysis was performed on responses to open-ended questioninthes. Results of the data analyses are presented in Chapter IV.

CHAPTER IV

FINDINGS

Introduction

Findings based on the analysis of responses to items in the survey instrument are presented in this chapter. The findings are presented in the following sections: description of study respondents, perceived importance of MSU information on DTN/FarmDayta systems in Michigan, respondents' rating of MSU information on DTN/FarmDayta, respondents' use and application of MSU information on DTN/FarmDayta, alternative communication channels used by respondents to retrieve MSU information, respondents' answers to statements about MSU information on DTN/FarmDayta, respondents' use of personal computers and the Internet, and age and educational level of respondents using various technology and communication channels.

Description of Study Respondents

Analysis of the data revealed that of 151 valid cases, 96% (242) of the respondents were male. Four percent (10) were female (see Table 1).

Respondents were asked to identify the individuals who viewed their DTN/FarmDayta systems. Of 225 valid cases, multiple-response analysis identified 47.1% of the responses as husbands, 42.2% as wives, and 40% as sons/daughters (see Table 2).

Table 1: Gender of respondents.

Gender	Frequency	Percent
Male	242	96.0
Female	10	4.0
Total	252	100.0

Table 2: Viewers of DTN/FarmDayta systems.

Viewer	Frequency	% of Responses	% of Cases
Husband	106	24.4	47.1
Wife	95	21.9	42.2
Son/daughter	90	20.7	40.0
Employee	87	20.0	38.7
Customers	41	9.4	18.2
Students	15	3.5	6.7
Total	434	100.0	

Note: Respondents could identify more than one viewer.

Chi-square analysis revealed that 60 respondents were in the 50 to 59 year age group, 52 were in the 40 to 44 year age group, and 44 were ages 35 to 39 (see Table 3).

An examination of the educational background of the respondents showed that 72 had a high school education, and 65 had some college (see Table 4). Fifty respondents had a bachelor's degree, and 43 had completed a 2-year technical degree.

Table 3: Age of respondents.

Age	Cases Observed	Expected	Residual
< 25	1	28	-27.00
25-29	5	28	-22.00
30-34	35	28	7.00
35-39	44	28	16.00
40-44	52	28	24.00
45-49	36	28	8.00
50-59	60	28	32.00
60-64	13	28	-15.00
65+	5	28	-23.00
Total	252		

Chi-square = 140.57 $df = 8$ Significance = .0000

Table 4: Educational background of respondents.

Educational Background	Cases Observed	Expected	Residual
High school	72	48.60	23.40
Some college	65	48.60	16.40
2-yr. technical degree	43	48.60	-5.60
Bachelor's degree	50	48.60	1.40
Master's degree	13	48.60	-35.60
Total	243		

Chi-square = 43.5638 $df = 4$ Significance = .0272

Perceived Importance of MSU Information on
DTN/FarmDayta Systems in Michigan

Respondents were asked to give an overall ranking of importance to nine informational categories provided by MSU on their DTN/FarmDayta systems. They used a 5-point Likert-type scale, on which 1 = most important and 5 = least important (see Table 5). The four areas of greatest importance to respondents were production (crops), marketing, weather, and research, in that order.

Table 5: Respondents' rankings of informational categories.

Category	Mean	SD	Minimum	Maximum	Valid N
Production (crops)	1.57	.89	1.00	5.00	244
Marketing	1.65	.97	1.00	5.00	243
Weather	1.84	1.12	1.00	5.00	243
Research	2.08	.99	1.00	5.00	236
Farm safety	2.86	1.22	1.00	5.00	234
MSU seminars	2.92	1.15	1.00	5.00	232
Production (livestock)	3.00	1.50	1.00	5.00	231
Vet facts	3.56	1.39	1.00	5.00	220
Dairy	4.03	1.23	1.00	5.00	227

Respondents' Rating of MSU Information on DTN/FarmDayta

Respondents were asked to rate the MSU information they received on their DTN/FarmDayta systems. They used a 10-point Likert-type scale, where 1 = very important and 10 = least important. The mean rating was 3.51 (see Table 6).

Table 6: Respondents' overall rating of MSU information on DTN/FarmDayta.

Variable	Mean	<u>SD</u>	Minimum	Maximum	Valid N
Rating	3.51	1.54	1	10	214

Respondents' Use and Application of MSU Information

Respondents were asked whether they used MSU information to make input decisions for their operation (Table 7). Of 176 valid cases, multiple-response analysis identified 85.8% of the respondents using MSU information for crop-input decisions and 72.2% for marketing decisions.

Table 7: Respondents' use of MSU information for input decisions.

Agriculture Input	Frequency	% of Responses	% of Cases
Crops	151	46.2	85.8
Marketing	127	38.8	72.2
Livestock	49	15.0	27.8
Total	327	100.0	

Note: Respondents could identify more than one use of information.

Alternative Communication Channels Used by Respondents to Retrieve MSU Information

Respondents were asked to identify which source(s) of communication they used to retrieve MSU information, in addition to their DTN/FarmDayta systems (see Table 8). Of the 230 valid responses to this question, 82% used Extension bulletins,

57.8% attended seminars and meetings, and 51.7% made contact with an Extension agent.

Table 8: Sources of communication used by respondents.

Source	Frequency	% of Responses	% of Cases
Extension bulletins	189	38.3	82.2
Seminars/meetings	133	26.9	57.8
Contact with Extension agent	119	24.1	51.7
Contact with Extension office	53	10.7	23.0
Total	494	100.0	

Note: Respondents could identify more than one source of communication.

Respondents' Answers to Statements About MSU Information on DTN/FarmDayta

Respondents were asked whether they would be willing to pay a fee to receive MSU information on their DTN/FarmDayta systems (see Table 9). Of 224 valid responses, only 22.7% said they would pay a fee to receive MSU information.

Respondents were given space on the questionnaire to provide written comments concerning why they would or would not consider paying a fee to receive MSU information. A sample of the comments follows. A complete list of all comments is provided in Appendix J.

Table 9: Respondents willing to pay a fee for MSU information on DTN/FarmDayta.

Willing to Pay Fee	Frequency	Percent
Yes	51	22.7
No	173	77.3
Total	224	100.0

Would be willing to pay a fee if:

- "Included all Crop Advisory Team (CAT) Alerts"
- "Provided more specific information"
- "Provided fruit information"

Would not be willing to pay a fee because:

- "Cost enough for basic package"
- "My taxes support the University"
- "DTN already has this information"
- "School budget"
- "Too much duplication"

Respondents were asked whether the MSU segment on DTN/FarmDayta had increased their awareness of the services and information available from MSU (see Table 10). Of 255 valid responses, 35.7% said yes, and 64.3% said no.

Table 10: Awareness of MSU information and services via DTN/FarmDayta.

Aware of Information/Services	Frequency	Percent
Yes	91	35.7
No	164	64.3
Total	255	100.0

Respondents who agreed that the MSU segment on DTN/FarmDayta had indeed increased their awareness of MSU services and information were asked to describe how this segment had affected their operation. A sample of comments is shown below. A complete list of all comments from respondents is provided in Appendix K.

General Comments:

- "Learned about the Wheat 2000 program"
- "Extension bulletins are a very useful source of information"
- "Learned about different herbicide practices"
- "Made me more aware of research and recommendations that may change practices on our farms"
- "Timely information on seminars and bulletins not always available with county MSUE newsletter"
- "Materials available for class use"

Respondents were asked to identify how often MSU should update information on DTN/FarmDayta (see Table 11). Of 196 valid cases, 60.7% identified three times a week, 20.4% said two times a week, and 14.8% said every day.

Table 11: Updating of MSU information on DTN/FarmDayta.

Frequency of Update	Frequency	Percent
3 times a week	119	60.7
2 times a week	40	20.4
Every day	29	14.8
Other ^a	8	4.1
Total	196	100.0

^aOther times to update were one time per week, as often as needed, and when new information was available.

Respondents were asked to comment on how MSU could improve the information provided to them on their DTN/FarmDayta systems. A sample of comments is shown below. A complete list of all comments from respondents is provided in Appendix L.

General Comments:

- "Provide more information on no-till"
- "More marketing information"
- "Keep articles as short as possible and to the point"
- "Additional potato information"
- "More horticulture"
- "Updates on computer software applicable to agriculture"

Respondents' Use of Personal Computers and the Internet

Respondents were asked whether they owned a personal computer other than their DTN/FarmDayta units (see Table 12). Of 240 valid cases, 77.5% said yes and 22.5 said no.

Table 12: Respondents who owned personal computers.

Owned a Computer	Frequency	Percent
Yes	186	77.5
No	54	22.5
Total	240	100.0

Respondents also were asked whether they used a printer with their DTN/FarmDayta units (see Table 13). Of 241 valid cases, only 27.8% said yes; 72.2% said no.

Table 13: Respondents with printers linked to their DTN/FarmDayta systems.

Used a Printer	Frequency	Percent
Yes	67	27.8
No	174	72.2
Total	241	100.0

Respondents were asked to identify which Internet on-line service they subscribed to (see Table 14). Only 13.8% of the respondents subscribed to Internet services.

Table 14: Internet on-line services to which respondents subscribed.

On-line Service	Frequency	Percent
America Online	16	6.3
CompuServe	4	1.6
Prodigy	4	1.6
Other ^a	11	4.3
Total	35	13.8

^aOther on-line services: Pioneer, IBEX, HDT, and Century.

Respondents then were asked whether they accessed agricultural information from the Internet (see Table 15). Of 214 valid cases, only 9.8% said yes; 90.2% said no.

Table 15: Respondents who accessed agricultural information from the Internet.

Accessed Information	Frequency	Percent
Yes	21	9.8
No	193	90.2
Total	214	100.0

Respondents who said they accessed agricultural information from the Internet were asked to describe the type of information they retrieved. A complete list of topics is shown below:

- Farm program
- Insect information
- Software information
- Site-specific and general crop management
- Hay markets
- Alternative agriculture

Respondents who accessed agricultural information from the Internet also were asked whether the Internet information was more applicable to their operations than was MSU information (see Table 16). Of the 18 respondents answering this question, nine (50%) answered affirmatively.

Table 16: Respondents' opinions about whether information on the Internet was more applicable to their operations than was MSU information on DTN/FarmDayta.

Internet Info. More Valuable	Frequency	Percent
Yes	9	50.0
No	9	50.0
Total	18	100.0

Results of Cross-Tabulation Between Respondents' Age and Educational Level and Their Ownership and Use of Computer Technology and Various Communication Channels

Cross-tabulations were performed between respondents' age and educational level and their ownership of personal computers, use of printers with

DTN/FarmDayta systems, and access to the Internet. The results are provided in Tables 17 and 18, respectively.

Cross-tabulations also were performed between respondents' age and educational level and their use of various communication channels to receive agricultural information. The channels listed were MSUE bulletins, seminars, contact with an Extension agent, and contact with an Extension office. The results are shown in Tables 19 and 20, respectively.

A summary of the findings, conclusions drawn from the findings, implications, recommendations for further research, and reflections are presented in Chapter V.

Table 17: Cross-tabulation of respondents' age with their ownership of personal computers and printers and access to the Internet.

Age Group	N	Respondents With Personal Computers		Respondents With Printers		Access to the Internet	
		Freq.	%	Freq.	%	Freq.	%
Under 25	1	1	100.0	1	100.0	1	100.0
25-29	6	4	66.6	2	33.3	0	0.0
30-34	35	29	82.8	11	31.4	5	14.7
35-39	44	34	77.2	5	11.3	6	13.6
40-44	52	42	80.7	22	42.3	2	3.8
45-49	36	29	80.5	8	22.2	3	8.3
50-59	60	40	66.6	11	18.3	3	5.0
60-64	13	6	46.1	4	30.7	1	7.6
65+	5	1	20.0	3	60.0	0	0.0

Table 18: Cross-tabulation of respondents' educational level with their ownership of personal computers and printers and access to the Internet.

Educational Level	<u>N</u>	Respondents With Personal Computers		Respondents With Printers		Access to the Internet	
		Freq.	%	Freq.	%	Freq.	%
High school	72	58	80.5	12	16.6	5	6.9
Some college	65	51	78.5	17	26.1	4	6.1
2-yr. tech. degree	43	34	79.0	14	32.5	2	4.6
Bachelor's degree	50	41	82.0	17	34.0	6	12.0
Master's degree	13	13	100.0	7	53.8	4	30.7

Table 19: Cross-tabulation of respondents' age with their use of various communication channels.

Age Group	N	MSUE Bulletins		Seminars		Contact With Extension Agent		Contact With Extension Office	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Under 25	1	1	100.0	1	100.0	1	100.0	1	100.0
25-29	6	4	66.6	3	50.0	3	50.0	1	16.6
30-34	35	27	77.1	19	54.2	18	51.4	5	14.2
35-39	44	32	72.7	223	52.2	24	54.5	10	22.7
40-44	52	36	69.2	19	36.5	21	40.3	7	13.4
45-49	36	26	72.2	19	52.7	14	38.8	10	27.7
50-59	60	51	85.0	36	60.0	32	53.3	15	25.0
60-64	13	9	69.2	9	69.2	5	38.4	4	30.7
65+	5	3	60.0	3	60.0	3	60.0	1	20.0

Table 20: Cross-tabulation of respondents' educational level with their use of various communication channels.

Educational Level	N	MSUE Bulletins		Seminars		Contact with Extension Agent		Contact With Extension Office	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
High school	72	70	97.2	45	62.5	33	45.8	14	19.4
Some college	65	47	72.3	34	52.3	36	55.3	14	21.5
2-yr. degree	43	35	81.3	26	60.4	24	55.8	15	34.8
Bachelor's degree	50	30	60.0	22	44.0	24	48.0	13	26.0
Master's degree	13	10	76.9	9	69.2	7	53.8	2	15.3

CHAPTER V

CONCLUSIONS AND IMPLICATIONS, RECOMMENDATIONS FOR FURTHER RESEARCH, AND REFLECTIONS

Introduction

The researcher had six main purposes in conducting this study. The first purpose was to gather demographic information on farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services. The second purpose was to determine the use, effectiveness, and importance of satellite communications in the dissemination of agricultural information, specifically MSUE and MAES information, to farmers and agribusiness firms in Michigan that subscribe to DTN/FarmDayta satellite services.

Third, the researcher sought to identify other methods of information retrieval that DTN/FarmDayta subscribers use to access MSUE and MAES information, in addition to their satellite systems. Fourth, the researcher sought to identify the number of DTN/FarmDayta subscribers who own personal computers and have printers linked to their DTN/FarmDayta systems. The fifth purpose was to identify the number of DTN/FarmDayta subscribers who access the Internet to retrieve agricultural information and their use of that information. The researcher's sixth

purpose was to determine the number of DTN/FarmDayta subscribers who would be willing to pay a fee to receive MSU information on their DTN/FarmDayta systems.

Conclusions and Implications

Michigan DTN/FarmDayta subscribers' use and perceptions of the effectiveness of the RRIP at Michigan State University were analyzed in this research. Several major findings emerged from the study. They are discussed in the following pages.

Characteristics of Respondents

Gender. Of the 252 respondents who identified their gender, 242 (96%) were male. Only 10 (4%) were female. These numbers represent the primary subscribers of the DTN/FarmDayta system. Fleming (1995) found similar results in his study of DTN subscribers in Nebraska. Ninety-five percent of the Nebraska respondents were male and 5% were female.

Viewers. The different viewer categories for this study were as follows: husband, wife, son/daughter, employee, customers, and students. Comparing the percentage of total cases for the husband and wife categories, there was only a 5% difference in the number of husbands who viewed the DTN/FarmDayta system. These data suggest that although males were the primary subscribers, females or wives viewed the system nearly as much as their husbands did. The same can be said for sons/daughters and employees.

Educational background. The educational backgrounds of Michigan DTN/FarmDayta subscribers ranged from a high school degree to completion of a master's degree. According to chi-square analysis, the expected number of cases for each educational background category was 48.6. The educational category with the lowest residual (difference between expected and observed) was a bachelor's degree.

More than 68% of the observed cases had educational levels ranging from a high school education to completion of a 2-year technical degree. Only 26% had earned a bachelor's or a master's degree. These data are similar to those from previous studies in which characteristics of adopters of electronic communications technology, specifically video and teletext, satellite systems (DTN/FarmDayta), and the Internet, were analyzed. Ettema (1983), Riesenberg and Gor (1989), Hamblen (1994), Fleming (1995), and DTN/FarmDayta (1996) all provided data showing that the educational level of adopters of new technology was either a high school diploma, some college, or completion of a 2-year technical degree.

Age. Age of respondents ranged from under 25 to over 65 years. The top three age categories were as follows: 23.8% of the observed cases were between 50 and 59, 23.8% were between 40 and 44, and 20.6% were between 35 and 39. Results of the chi-square analysis were very significant; the expected number of cases for each age category was found to be 28. Two categories had low residual numbers: 30 to 34 years (residual 7.00) and 45 to 49 years (residual 8.00).

Similar results have been found in multiple state studies of adopters of technology. Ettema (1983) found that the mean age for an adopter of videotext was 41.9 years. Riesenbergs and Gor (1989) identified approximately 42% of their respondents as being between the ages of 20 and 51. Hamblen (1994) and Fleming (1995) found that 43% and 32.2% of their respondents, respectively, were between the ages of 36 and 45.

As previously mentioned, males constituted the largest group of primary subscribers of DTN/FarmDayta systems, but wives used the system nearly as much as their husbands did. There may be a number of reasons for wives using the DTN/FarmDayta system nearly as much as their husbands did. One reason might be that wives were responsible for the bookkeeping and financial aspects of the farming operation and were using DTN/FarmDayta to track current markets and to predict future marketing trends.

Perceived Importance of MSU Information

Of a total 256 respondents, 244 had a combined mean ranking of 1.5 for crop production information on a 5-point scale (1 = most important, 5 = least important). Two hundred forty-three respondents ranked marketing second, with an overall mean score of 1.65; weather was ranked third, with a score of 1.84. Research information ranked fourth in importance, with an overall mean score of 2.88 from 236 respondents. Information on farm safety and MSU seminars was ranked average in importance, with means of 2.86 and 2.92, respectively. Livestock information,

including production, veterinarian facts, and dairy material, had mean rankings of 3.00, 3.56, and 4.03, respectively.

From these data, the RRIP coordinator was able to identify the informational categories that subscribers ranked as most important. These data then were used to identify specific departments and Extension specialists at MSU that could provide the RRIP coordinator with timely, useful information. The largest percentage of articles that RRIP provides to Michigan DTN/FarmDayta subscribers consists of crop production and research, marketing, weather data and predictions, and MSUE seminar schedules and activities.

The majority of DTN/FarmDayta subscribers in Michigan (more than 80%) are cash grain producers who grow mainly corn, soybeans, and wheat. The same is true for DTN/FarmDayta subscribers nationwide. Results of a 1996 DTN/FarmDayta subscriber demographics study indicated that corn, soybeans, and wheat are the top three commodities produced by subscribers.

As stated earlier, Ferris (1996) identified DTN/FarmDayta subscribers as producing a substantial percentage of the total cash grains in Michigan. This group needs many types of information to ensure success and growth. This study and others (Fleming, 1995; Hamblen, 1994) have supported the fact that larger, higher income farmers see the importance of and are willing to adopt new technologies to gain information. Therefore, MSUE is challenged to provide its clientele with the latest information on the agricultural commodities that are most important to them.

Respondents' Rating of MSU Information on DTN/FarmDayta

RRIP has been an effective tool in disseminating agricultural information to DTN/FarmDayta subscribers in Michigan. Of the 256 respondents, 214 gave MSU information an overall mean rating of 3.51 on a 10-point scale (1 = very important, 10 = least important). This rating was based on an overall critique of MSU information that is available on DTN/FarmDayta.

These data only suggest that respondents believed MSUE information was above average. They were not asked to compare MSUE information with that from other sources (i.e., private industry or the United States Department of Agriculture), nor were they asked to reflect on or explain their ratings.

To ensure the on-going success of a program like this one, the information provider must survey its clientele regularly to determine their needs and interests. Providing farmers and agribusiness firms in Michigan with useful, timely information is one of the underlying purposes of MSUE.

Respondents' Use and Application of MSU Information

The data indicated that respondents used the MSU information for input decisions in their operations. More than half of the respondents (58.8%) said they used MSU information for input decisions pertaining to crops. Nearly 50% said they used MSU information for marketing, 18.8% for livestock, and 5.9% for other areas of agricultural input, such as pesticide application, dairy production, spray scheduling, and weather reports.

With the sizes of operations that are characteristic of DTN/FarmDayta subscribers (more than 70% of DTN/FarmDayta subscribers nationwide have incomes in excess of \$100,000), input data could mean sizable gains in production and profits if the data are timely and useful. In today's cash grain and livestock markets, these commodities are very sensitive to changes in weather, consumer demand, and international production. Therefore, producers and marketers need to stay abreast of the latest market information.

Agricultural technology is constantly changing. Pesticides and other agricultural chemicals are regularly being updated, restricted, or replaced by new chemicals. Farmers and agribusiness firms must stay abreast of this information so that they are prepared to make the correct input decisions. Therefore, Extension must play a role in communicating pertinent information to its clientele. To do this, Extension personnel must understand how their clientele communicate, retrieve, and use information.

Sources of Communication Respondents Used to Retrieve MSU Information

Respondents used traditional sources of communication to retrieve MSU information. The study results showed that 188 (82%) of the respondents preferred Extension bulletins. Nearly 60% of the respondents attended seminars and meetings, and 51% contacted County Extension agents to retrieve information. Only one-fourth of the respondents contacted the Extension office. Respondents also identified other communication sources such as the MSU Crop and Soil Science

Newsletter, Crop Advisory Team (CAT) Alerts, MSU computer programs, and magazines.

These data strongly support the remaining need for print media in an era in which electronic information dissemination is rapidly growing. Extension bulletins, although not the best way to provide rapidly changing information, do contain research-based information that can be very beneficial to the agricultural producer. The reader can also archive and retrieve print media at a later date. This is an option that some DTN/FarmDayta subscribers do not have. The older systems do not have the memory capabilities to store data. Therefore, a subscriber must link a computer printer to the system so that the information can be printed.

Respondents' Reactions to Statements Concerning MSU Information on DTN/FarmDayta

Willingness to pay a fee. Although the respondents ranked the MSU information on DTN/FarmDayta above average, only 51 (19.6%) of them said they would be willing to pay a fee for the MSU segment on DTN/FarmDayta. Respondents were willing to pay a fee under one or more of the following circumstances: "Fee was minimal," "included all CAT alerts," and "it provided more specific information and provided fruit information."

Respondents who opposed paying a fee stated, "I pay enough for the basic DTN/FarmDayta system," "my taxes support the University," "DTN/FarmDayta already has the information," "school budget," "there is too much duplication," and "not enough use to justify, and I can get MSU material elsewhere for no cost."

Should MSU charge DTN/FarmDayta subscribers a fee for Extension information in the future? Should MSUE put all Field Crop CAT Alert information on DTN/FarmDayta systems? Will subscribers be interested in paying additional money above and beyond their annual DTN/FarmDayta subscribership fee? These questions must be considered as technology changes, MSU Extension clientele's demands for information retrieval change, and reduced Extension budgets make shifts in program support likely.

Awareness of MSUE information and services. Are DTN/FarmDayta subscribers more aware of MSU information and services because of RRIP? Ninety-one (35.7%) of the respondents said the MSU segment on DTN/FarmDayta had made them more aware of MSU information. Some of the respondents commented about how the information in the MSU segment had affected their operation: "learned about different herbicide practices" and "made me more aware of research and provided timely information on seminars and bulletins not always available with county MSUE newsletter."

Updating of information. Thus far, the importance, usefulness, and application of MSU information provided to Michigan DTN/FarmDayta subscribers have been discussed. The respondents' desired frequency of updates is addressed next. Of 196 valid responses, 119 (60.7%) thought three times a week was adequate, 40 (20.4%) selected twice a week, and 29 (14.8%) thought the information should be updated every day. Four percent of the respondents thought that

information should be updated as often as needed or when new information became available.

Fleming (1995) found similar results among DTN/FarmDayta subscribers in Nebraska. Fifty-five percent of the respondents read the Nebraska local news segment once or twice each week, and 25% read it three to five times a week.

These data are important from two perspectives. First, communicators must provide fresh, timely information on electronic systems like DTN/FarmDayta to ensure loyal viewership. Stale information may force readers to look to other sources of timely information. An advantage of DTN/FarmDayta is the sender's ability to update information 24 hours a day, 7 days a week. This can also be accomplished with television and radio, but not as quickly and efficiently. The RRIP coordinator has the capability of sending information to DTN/FarmDayta subscribers across the state or nation within minutes of receiving the information from Extension specialists and MAES researchers.

Second, RRIP must not send too much information to its subscribers. A minimum of 35% to 40% of the Michigan DTN/FarmDayta subscribers rent early versions of the DTN/FarmDayta system, which do not have the memory capability to store data. When a new article is sent to the earlier versions, it replaces the existing article. Therefore, as an on-going practice, the sender must weigh the importance of information and determine how long the information should stay on the system to ensure that the audience has had ample time to review it. This is a challenge because communicators must continually identify their clientele's needs

and also identify the importance and timeliness of valuable information. To make electronic information dissemination successful and effective, this challenge must be met on a daily and sometimes an hourly basis.

Improve information provided. As mentioned earlier, communicators must frequently evaluate communications programs to ensure they are meeting the needs and interests of their clientele. In this study, the respondents were asked to comment on how RRIP could improve the information provided to them via the MSU segment on DTN/FarmDayta. Critical comments were as follows: "more no-till information," "more marketing information," "additional potato information," and "keeping articles as short as possible and to the point and need more up-to-date information." Positive comments were: "seems to be all right," and "I think you are doing a fine job and would like to see it continue." The comment "keeping articles as short as possible and to the point" is very important for communicators (senders) to consider when providing articles and alerts on DTN/FarmDayta. National DTN/FarmDayta statistics indicate that the typical DTN/FarmDayta subscriber spends approximately .9 hours each day on the system. Arguably, this figure could be lower during the busy growing season. Fleming (1995) indicated that more than 97% of the Nebraska DTN subscribers who responded to his study spent from 1 to 15 minutes reading the local news segment.

The RRIP coordinator attempts to provide subscribers with short and concise articles that are less than 25 lines long. A story of 25 lines or less constitutes a page (screen) on DTN/FarmDayta systems. Concise articles provide readers with

specific, detailed information and give the communicator (sender) more space for additional articles on the system. The maximum use of available space is critical during the growing season, when weather, disease, and insect alerts are sent out weekly and sometimes daily.

Respondents' Use of Computers and the Internet

The researcher had two purposes for collecting data on Michigan DTN/FarmDayta subscribers' use of computers and the Internet. First, he was interested in comparing the number of respondents who owned personal computers with the national DTN/FarmDayta average. According to 1996 DTN/FarmDayta subscriber demographics, approximately 68% owned or leased a personal computer. More than 77% of the respondents in this study owned a personal computer, nearly 10% above the national average. Are Michigan DTN/FarmDayta subscribers more technologically advanced or more willing to adopt newer technologies as compared to the national average? One may argue that they are, but further research should be conducted to answer that question.

The second purpose was to identify the number of subscribers who accessed the Internet, to discover which commercial on-line service they used, and to learn how many retrieved agricultural information from the Internet. Finding out how MSU information that is available on DTN/FarmDayta compared with that gained via the Internet also was of interest.

Of 256 respondents, only 35 said they subscribed to one of the following Internet services: America Online, CompuServe, Prodigy, Pioneer, IBEX, HDT, or

Century. Only 21 (9.8%) of 214 respondents accessed agricultural information from the Internet. The type of information respondents retrieved from the Internet included insect information, hay markets, site-specific farming, general crop management, alternative agriculture, and software information.

Respondents who stated that they accessed agricultural information on the Internet were asked whether the Internet information was more applicable to their operations than was the MSU information on DTN/FarmDayta. Of 18 responses, nine said yes and nine said no.

It can be argued that DTN/FarmDayta subscribers are adopters of technology. The average farm size and annual income of DTN/FarmDayta subscribers place them in the category of adopters, according to income criteria published by Rogers (1983). If the respondents of this study were adopters of technology, why was their access to and use of the Internet so low? Was this because of the cost of Internet services? Have they seen no need to spend more time accessing agricultural information? Do they have outdated personal computers that are slow or not capable of running the latest Internet software? Had they tried the Internet but become frustrated when the system was slow and busy?

The low number of Internet users in this study supports the fact that satellite services such as DTN/FarmDayta will continue to be a viable and efficient means of communication for years ahead even as the Internet expands and grows. Adopters are not using the Internet to its full potential. One reason may be the fact that it is quick and easy to access DTN/FarmDayta. The system is not slowed by high use

as is the Internet, and subscribers can browse through a variety of informational sections with the push of a button. Another advantage is the technical support DTN/FarmDayta provides to all its customers. Subscribers can call a toll-free number that is open beyond normal business hours. Also, if the system malfunctions mechanically, DTN/FarmDayta will replace or repair it at no cost to the subscriber.

The only disadvantage to satellite service of this type is severe weather. Heavy clouds and/or rainfall can break the signal from the satellite to the receiver, thus slowing the data transfer. High winds also can cause distorted reception and may cause a shift in the receiver dish; thus, the signal is lost until the dish is repositioned. Despite these minor problems, this satellite service is still an efficient and effective communication tool for the agricultural industry.

Relationship of Respondents' Age and Educational Level to Their Use of Computer Technology

The relationship of respondents' age and educational level to their ownership of personal computers, use of computer printers with their DTN/FarmDayta systems, and Internet access is discussed in this section. Twenty-nine (82.8%) of the respondents in the 30 to 34 age group owned a personal computer, as did 42 (80.7%) of those in the 40 to 44 age group and 34 (75.5%) of the respondents in the 35 to 39 age group.

A small percentage of respondents from each age group accessed the Internet for agricultural information. Five (14.7%) of the respondents in the 30 to 34

age group accessed the Internet, as did 6 (13.6%) of those ages 35 to 39 and 3 (5.0%) of those in the 50 to 59 age group.

Only 42.3% of the respondents in the 40 to 44 age group had printers linked to their DTN/FarmDayta systems. Another 31.4% of those ages 30 to 34 and 22.2% of the 45 to 49 age group had printers linked to their DTN/FarmDayta systems.

Educational level of the respondents was positively correlated with their personal computer ownership. The more education a respondent had, the more likely he or she was to own a personal computer.

Of the respondents with a high school education, 58 (65.1%) owned personal computers. Furthermore, 51 (77.2%) of the respondents with some college owned computers, 34 (79.0%) of those with a 2-year technical degree had their own computers, and 41 (83.6%) with a bachelor's degree and 13 (92.8%) with a master's degree owned personal computers.

Abbott and Yarbrough (1992) found similar results with regard to Iowa farmers' adoption of microcomputers. Their results indicated that 58% of the respondents who adopted computers were between the ages of 35 and 54.

Educational level of the respondents also was positively correlated with printer usage. Twelve (13.4%) of the respondents with a high school education used printers with their DTN/FarmDayta systems. Seventeen (26.1%) of the respondents with some college used printers, as did 14 (32.5%) of those with a 2-year technical degree, 17 (34.0%) of the respondents with a bachelor's degree, and 7 (53.8%) of those with a master's degree.

There was also an increase in respondents' use of the Internet as their educational level advanced from high school to master's degree, with the exception of those respondents with a 2-year technical degree. Only 5.6% of the respondents with a high school education accessed the Internet, in comparison to 28.5% of those with a master's degree.

The data indicated that the lowest percentage of respondents who accessed the Internet were in the 2-year technical degree category. Respondents in this category are considered adopters to technology. Therefore, why was there less use of the Internet among this group? Perhaps these graduates had taken a large number of hands-on types of courses but had been given little opportunity to work or communicate with computers and the Internet. Another possibility is that there may have been a large number of 2-year technical degree graduates who were between the ages of 50 and 64. People in these age groups are not considered true adopters of technology.

In this study, the ages and educational levels of the adopters of computers, printers, and the Internet were consistent with those in national studies. This finding suggests that these farmers were adopters of multiple forms of technology.

Relationship of Respondents' Age and Educational Level to Their Use of MSU Information Sources

The relationship between respondents' age and educational level and their use of various MSU information sources is discussed in this section. The results showed that bulletins were the preferred information source for all groups except

those 65 and above, who had equal preference for Extension bulletins, seminars, and contact with Extension agents. The least preferred method of information retrieval for all age groups was contact with the Extension office. The data also indicated that the older the respondent, the more apt he or she was to attend seminars and to contact the Extension office.

As previously stated, nearly 80% of the respondents in age categories 30 to 34 and 45 to 49 owned personal computers. Respondents in the same age groups also evidenced a decline in the use of Extension agents and contacts with the Extension office.

These results would suggest that DTN/FarmDayta subscribers preferred to retrieve information via print media and seminars rather than one-on-one contact with an Extension agent or the Extension office. This may be because respondents preferred to have research-based information that they could access from their home files.

Respondents' educational level also was correlated with the different information sources they used to retrieve MSU information. Respondents with a high school education to a master's degree preferred bulletins over the other MSU information sources. Contact with the Extension office was least preferred.

Recommendations for Future Research

A number of questions for future research were raised in this study. They are as follows:

1. How has RRIP changed the way Extension clientele retrieve agricultural information?
2. Has this type of communication changed the learning behaviors of DTN/FarmDayta subscribers? If so, how and to what extent?
3. Which learning styles best accommodate the use of electronic information dissemination?
4. Should RRIP and other distance learning types of programs replace the traditional Extension agent's role in Michigan?
5. Is RRIP more cost effective for MSUE in comparison to traditional methods of communication?

Reflections

This study was performed to determine the use and effectiveness of satellite communications in the dissemination of agricultural information, as perceived by DTN/FarmDayta subscribers in Michigan. The researcher also identified DTN/FarmDayta subscribers' use and application of alternative sources of communication, such as Extension bulletins, contact with an Extension agent, and the Internet.

Although the research was rewarding and the data assisted the RRIP coordinator in making positive changes in the program, the study was not without its challenges. First, at the time the study was conducted, both DTN and FarmDayta were adamant about not releasing subscribers' names and addresses. After many conversations with FarmDayta representatives, they decided to send the researcher

a set of randomly picked Michigan FarmDayta subscriber labels. DTN would only agree to send the surveys from their home office to a mailing service that would place an address label on each survey envelope. Therefore, the researcher had to bulk mail all DTN surveys to the mailing service before they could be sent out to the Michigan subscribers. This procedure also delayed the mailing of the second survey to DTN subscribers.

Second, DTN and FarmDayta were also reluctant to send out a second survey. The researcher believed this was necessary to increase the response rate. Eventually, both DTN and FarmDayta agreed to assist the researcher in mailing a second survey. This delay prevented the researcher from sending out the second mailing within 3 weeks of the first one.

Last, MSUE encouraged the researcher to conduct this study after the first year of RRIP. Thus, because the researcher carried out the research early in his doctoral program, he did not have an opportunity to review thoroughly every study that had been published pertaining to the use and effectiveness of electronic information dissemination in agriculture.

If he had had more time, the researcher would have changed the survey instrument to include more demographic information and more Likert-type questions. This would have provided data that could have been used in performing true correlation analyses, t-tests, and/or analyses of variance (ANOVAs). T-tests and ANOVAs provide data that support relationships between dependent and independent variables. Although the data from this research supported and fulfilled

the purposes of the study and assisted the RRIP coordinator in identifying the use and effectiveness of RRIP, further research could have been performed that would have benefited RRIP and MSUE.

APPENDIXES

APPENDIX A

LETTER OF APPROVAL FROM THE UNIVERSITY COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECTS

MICHIGAN STATE UNIVERSITY

February 23, 1996

TO: Dennis W. Duncan
311 Agriculture Hall

RE: IRB#: 96-079
TITLE: EVALUATE THE EFFECTIVENESS OF THE DISSEMINATION
OF RESEARCH IN EXTENSION AGRICULTURE AND NATURAL
RESOURCES VIA SATELLITE COMMUNICATIONS
REVISION REQUESTED: N/A
CATEGORY: 1-C
APPROVAL DATE: 02/23/96

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete. I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS approved this project and any revisions listed above.

RENEWAL: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Investigators planning to continue a project beyond one year must use the green renewal form (enclosed with the original approval letter or when a project is renewed) to seek updated certification. There is a maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for complete review.

REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB # and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.

**PROBLEMS/
CHANGES:**

Should either of the following arise during the course of the work, investigators must notify UCRIHS promptly: (1) problems (unexpected side effects, complaints, etc.) involving human subjects or (2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of any future help, please do not hesitate to contact us at (517)355-2180 or FAX (517)432-1171.

Sincerely,

David E. Wright
David E. Wright, Ph.D.
UCRIHS Chair

DEW:bed

cc: Frederick Whims



OFFICE OF
**RESEARCH
AND
GRADUATE
STUDIES**

University Committee on
Research Involving
Human Subjects
(UCRIHS)

Michigan State University
232 Administration Building
East Lansing, Michigan
48824-1046

517/355-2180
FAX: 517/432-1171

The Michigan State University
IDEA is Institutional Diversity.
Excellence in Action

MSU is an affirmative-action,
equal-opportunity institution.

APPENDIX B

**RENEWAL LETTER OF APPROVAL FROM THE UNIVERSITY
COMMITTEE ON RESEARCH INVOLVING HUMAN SUBJECTS**

MICHIGAN STATE UNIVERSITY

January 29, 1997

TO: Frederick Whims
410 Agriculture Hall

RE: IRB#: 96-079
TITLE: EVALUATE THE EFFECTIVENESS OF THE DISSEMINATION
OF RESEARCH IN EXTENSION AGRICULTURE AND NATURAL
RESOURCES VIA SATELLITE COMMUNICATIONS
REVISION REQUESTED: N/A
CATEGORY: 1-C
APPROVAL DATE: 01/29/97

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete. I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the UCRIHS approved this project and any revisions listed above.

RENEWAL: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Investigators planning to continue a project beyond one year must use the green renewal form (enclosed with the original approval letter or when a project is renewed) to seek updated certification. There is a maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for complete review.

REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB # and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.



OFFICE OF
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University Committee on
Research Involving
Human Subjects
(UCRIHS)

Michigan State University
246 Administration Building
East Lansing, Michigan
48824-1046

517/355-2180
FAX 517/432-1171

**PROBLEMS/
CHANGES:**

Should either of the following arise during the course of the work, investigators must notify UCRIHS promptly: (1) problems (unexpected side effects, complaints, etc.) involving human subjects or (2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of any future help, please do not hesitate to contact us at (517)355-2180 or FAX (517)432-1171.

Sincerely,

David E. Wright
David E. Wright, Ph.D.
UCRIHS Chair

DEW:bcd

cc: Dennis W. Duncan

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Excellence in Action

MSU is an affirmative-action
equal-opportunity institution

APPENDIX C

LETTER OF PERMISSION FROM BROADCAST PARTNERS

**BROADCAST PARTNERS**

January 31, 1996

Dennis Duncan
311 Agriculture Hall
Michigan State University
East Lansing, MI 48824-1039

Dear Mr. Dennis Duncan:

This letter is to confirm our agreement that Michigan State University has permission to use a sample selection from the Broadcast Partners Database. The random selection is limited to active units in the state of Michigan. These mailing labels are proprietary and for the one time use by MSUE. This list can not be duplicated or distributed in an form as stated in the Confidentiality Agreement. Upon completion, the results of the survey will be shared with Broadcast Partners.

The total active agriculture universe to select from was 830 records. The random sample was processed by sorting the file on customer number. The customer number is a six digit number. The sort fields applied: 6,1 ascending and position 5,1 descending. The first 277 records were selected from this output.

Please call me if you have any questions.

Sincerely,

Julie Byrnes
Database Coordinator

APPENDIX D

LETTER OF PERMISSION FROM DATA TRANSMISSION NETWORK



Monday, August 05, 1996

Michigan State University
311 Agriculture Hall
Attn: Dennis Duncan
East Lansing, MI 48824-1039

Dear Dennis:

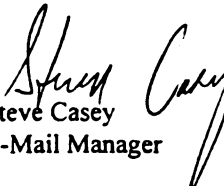
This letter serves as authority for Michigan State University (MSU) to submit a mailing of a questionnaire to DTN subscribers.

The questionnaire must be prepared and sent to DTN or its authorized agent in a sealed, legal size envelope. DTN or its authorized agent will then apply subscriber mailing labels and postage and mail out as first class mail. MSU will be billed for labels and postage.

DTN is in no way responsible for content or results of said questionnaire. MSU will not hold DTN liable in anyway for the results or opinions of questionnaire recipients.

The questionnaire is solely the responsibility of MSU and its designated agents. DTN will simply supply the mailing labels for the questionnaire based on MSU's request of a random selection.

Regards,


Steve Casey
E-Mail Manager

APPENDIX E

SURVEY INSTRUMENT

DTN QUESTIONNAIRE

1. We try to have a mix of MSUE information on the segment each week. Please rank the following topics by importance.

	Most Important			Least Important	
	1	2	3	4	5
Farm Safety Info	1	2	3	4	5
Weather Info	1	2	3	4	5
Production Info (Crops)	1	2	3	4	5
Production Info (Livestock)	1	2	3	4	5
Marketing Info	1	2	3	4	5
Research Info	1	2	3	4	5
Dairy Info	1	2	3	4	5
MSUE Seminar Info	1	2	3	4	5
Vet Facts	1	2	3	4	5
Other: _____	1	2	3	4	5

2. Overall, how would you rate the information you've seen provided by MSUE on the Local Information Segment?

Very Good Very Poor
 1 2 3 4 5 6 7 8 9 10

3. Approximate age of primary subscriber:

___a) Less than 25 years ___d) 35-39 ___g) 50-59
 ___b) 25-29 ___e) 40-44 ___h) 60-64
 ___c) 30-34 ___f) 45-49 ___i) 65 +

4. Gender of primary subscriber: ___male ___female

5. Please check which of the following that best describes your educational background:

___a) high school ___d) bachelors degree ___g) other(_____)
 ___b) some college ___e) masters degree
 ___c) 2 yr. technical degree ___f) Ph. D degree

6. Please check the following individual(s) who view your DTN unit:

___a) wife ___d) students
 ___b) husband ___e) customer
 ___c) employee ___f) son/daughter
 ___g) other(_____)

7. Do you use MSUE information to make input decisions? If so, please check which area(s)

___crops ___marketing ___livestock ___other(_____)
 ___other(_____)

8. Please check the method(s) you most commonly use to receive MSUE information other than your DTN system.

___Extension bulletins ___contact with Extension agents
 ___seminars/meetings ___call the Extension office
 ___other (_____)
 ___other (_____)

(OVER)

9. Would you be willing to pay a fee for the MSUE segment on DTN? ☐ Yes ☐ No

Why or why not? _____

10. Has this MSUE communications program made you more aware of the services and information available through MSUE? ☐ Yes ☐ No

If you answered yes, please describe briefly how the MSUE information impacted your operation

11. Your MSUE pages are updated three times a week. Please check which you feel is most appropriate:

☐ 3x a week ☐ 2x a week ☐ every day ☐ other(_____)

12. How can we improve the information? What would you like to see more of? Less of? What are we forgetting?

13. Do you use a printer with your DTN?

☐ a) Yes ☐ b) No

14. Do you own a personal computer other than your DTN unit? ☐ Yes ☐ No

15. If you subscribe to on-line services, please check which service:

☐ a) Compu-Serve ☐ c) America-On-Line
☐ b) Prodigy ☐ d) other(_____)

16. Do you access agricultural information on the Internet? ☐ Yes ☐ No

If you answered yes, please describe briefly what type of information.

17. If you answered YES to question 16, do you find the agricultural information available on the Internet to be more applicable to your operation than what MSUE is providing on DTN?

☐ a) Yes ☐ b) No

THANK YOU

APPENDIX F

FIRST COVER LETTER FOR FARMDAYTA SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

February 26, 1996

Dear FarmDayta subscriber:

Michigan State University Extension (MSUE) is currently providing three pages of information in the NEWS section of your FarmDayta unit. Faculty and staff members in the departments of Agricultural Economics, Agricultural Engineering, Animal Science, Crop and Soil Sciences, Entomology, Geography, Outreach Communications and Veterinary Medicine are regular contributors of information.

Our goal is to continue providing you with high quality, timely, useful information. Please help us to achieve this goal by completing and returning the brief questionnaire that is enclosed as soon as possible. A prepaid envelope is enclosed for your convenience. We have also enclosed an Extension bookmark as a small token of our appreciation for your trouble.



**OUTREACH
COMMUNICATIONS**

Cooperative
Extension Service
310 Agriculture Hall
East Lansing, Michigan
48824-1035
517/432-1555
FAX 517/355-1804

Thank you.

Sincerely,

Dennis Duncan
Project Coordinator

Enclosures

Michigan State University Extension
programs and materials are open to all
without regard to race, color, national
origin, sex, disability, age or religion.
Michigan State University, U.S.
Department of Agriculture and
counties cooperating.
MSU is an affirmative action
equal opportunity institution.

APPENDIX G

FIRST COVER LETTER FOR DATA TRANSMISSION

NETWORK SUBSCRIBERS

APPENDIX G

FIRST COVER LETTER FOR DATA TRANSMISSION

NETWORK SUBSCRIBERS

**MICHIGAN STATE
UNIVERSITY
EXTENSION**

February 26, 1996

Dear DTN subscriber:

Michigan State University Extension (MSUE) is currently providing eight pages of information that DTN subscribers are most interested in seeing, according to the respondents to the MSUE/DTN survey conducted February 1995. Faculty and staff members in the departments of Agricultural Economics, Agricultural Engineering, Animal Science, Crop and Soil Sciences, Entomology, Geography, Outreach Communications and Veterinary Medicine are regular contributors of information.

Our goal is to continue providing you with high quality, timely, useful information. Please help us to achieve this goal by completing and returning the brief questionnaire that is enclosed as soon as possible. A prepaid envelope is enclosed for your convenience. We have also enclosed an Extension bookmark as a small token of our appreciation for your trouble.



**OUTREACH
COMMUNICATIONS**

**Cooperative
Extension Service**

310 Agriculture Hall
East Lansing, Michigan
48824-1039

517/432-1555
FAX 517/355-1804

Thank you.

Sincerely,

Dennis Duncan
Project Coordinator

Enclosures

APPENDIX H

SECOND COVER LETTER FOR FARMDAYTA SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

March 26, 1996

Dear FarmDayta subscriber,

Three weeks ago you were mailed a survey instrument from Michigan State University Extension (MSUE) regarding MSUE information that is provided to you via your FarmDayta unit. If you have already completed and returned the survey please accept my sincere thanks. If not please do so as soon as possible.

The return of your completed survey is important in order for MSUE to identify what information may be provided to you, the producer, that is timely and useful for your operation.

I have enclosed another survey instrument for your convenience. Please return the survey as soon as possible to the following address:

Dennis Duncan
Outreach Communications
311 Agriculture Hall, MSU
East Lansing, MI. 48824-1039



**OUTREACH
COMMUNICATIONS**

**Cooperative
Extension Service**

310 Agriculture Hall
East Lansing, Michigan
48824-1039

517/432-1555
FAX: 517/ 355-1804

Thank you.

Sincerely,

Maxine S. Ferris

Maxine S. Ferris, Director
Outreach Communications

Dennis Duncan

Dennis Duncan
Program Coordinator

Enclosure

APPENDIX I

SECOND COVER LETTER FOR DATA TRANSMISSION

NETWORK SUBSCRIBERS



Monday, August 05, 1996

Michigan State University
311 Agriculture Hall
Attn: Dennis Duncan
East Lansing, MI 48824-1039

Dear Dennis:

This letter serves as authority for Michigan State University (MSU) to submit a mailing of a questionnaire to DTN subscribers.

The questionnaire must be prepared and sent to DTN or its authorized agent in a sealed, legal size envelope. DTN or its authorized agent will then apply subscriber mailing labels and postage and mail out as first class mail. MSU will be billed for labels and postage.

DTN is in no way responsible for content or results of said questionnaire. MSU will not hold DTN liable in anyway for the results or opinions of questionnaire recipients.

The questionnaire is solely the responsibility of MSU and its designated agents. DTN will simply supply the mailing labels for the questionnaire based on MSU's request of a random selection.

Regards,


Steve Casey
E-Mail Manager

APPENDIX E

SURVEY INSTRUMENT

DTN QUESTIONNAIRE

1. We try to have a mix of MSUE information on the segment each week. Please rank the following topics by importance.

	Most Important			Least Important	
	1	2	3	4	5
Farm Safety Info	1	2	3	4	5
Weather Info	1	2	3	4	5
Production Info (Crops)	1	2	3	4	5
Production Info (Livestock)	1	2	3	4	5
Marketing Info	1	2	3	4	5
Research Info	1	2	3	4	5
Dairy Info	1	2	3	4	5
MSUE Seminar Info	1	2	3	4	5
Vet Facts	1	2	3	4	5
Other: _____	1	2	3	4	5

2. Overall, how would you rate the information you've seen provided by MSUE on the Local Information Segment?

Very Good Very Poor
 1 2 3 4 5 6 7 8 9 10

3. Approximate age of primary subscriber:

- ☐ a) Less than 25 years ☐ d) 35-39 ☐ g) 50-59
☐ b) 25-29 ☐ e) 40-44 ☐ h) 60-64
☐ c) 30-34 ☐ f) 45-49 ☐ i) 65 +

4. Gender of primary subscriber: ☐ male ☐ female

5. Please check which of the following that best describes your educational background:

- ☐ a) high school ☐ d) bachelors degree ☐ g) other(_____)
- ☐ b) some college ☐ e) masters degree
- ☐ c) 2 yr. technical degree ☐ f) Ph. D degree

6. Please check the following individual(s) who view your DTN unit:

- ☐ a) wife ☐ d) students
☐ b) husband ☐ e) customer
☐ c) employee ☐ f) son/daughter
☐ g) other(_____)

7. Do you use MSUE information to make input decisions? If so, please check which area(s)

- ☐ crops ☐ marketing ☐ livestock ☐ other(_____)
- ☐ other(_____)

8. Please check the method(s) you most commonly use to receive MSUE information other than your DTN system.

- ☐ Extension bulletins ☐ contact with Extension agents
☐ seminars/meetings ☐ call the Extension office
☐ other (_____)
- ☐ other (_____)

(OVER)

9. Would you be willing to pay a fee for the MSUE segment on DTN? ☐ Yes ☐ No

Why or why not? _____

10. Has this MSUE communications program made you more aware of the services and information available through MSUE? ☐ Yes ☐ No

If you answered yes, please describe briefly how the MSUE information impacted your operation

11. Your MSUE pages are updated three times a week. Please check which you feel is most appropriate:

☐ 3x a week ☐ 2x a week ☐ every day ☐ other(_____)

12. How can we improve the information? What would you like to see more of? Less of? What are we forgetting?

13. Do you use a printer with your DTN?

☐ a) Yes ☐ b) No

14. Do you own a personal computer other than your DTN unit? ☐ Yes ☐ No

15. If you subscribe to on-line services, please check which service:

☐ a) Compu-Serve ☐ c) America-On-Line
☐ b) Prodigy ☐ d) other(_____)

16. Do you access agricultural information on the Internet? ☐ Yes ☐ No

If you answered yes, please describe briefly what type of information.

17. If you answered YES to question 16, do you find the agricultural information available on the Internet to be more applicable to your operation than what MSUE is providing on DTN?

☐ a) Yes ☐ b) No

THANK YOU

APPENDIX F

FIRST COVER LETTER FOR FARMDAYTA SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

February 26, 1996

Dear FarmDayta subscriber:

Michigan State University Extension (MSUE) is currently providing three pages of information in the NEWS section of your FarmDayta unit. Faculty and staff members in the departments of Agricultural Economics, Agricultural Engineering, Animal Science, Crop and Soil Sciences, Entomology, Geography, Outreach Communications and Veterinary Medicine are regular contributors of information.

Our goal is to continue providing you with high quality, timely, useful information. Please help us to achieve this goal by completing and returning the brief questionnaire that is enclosed as soon as possible. A prepaid envelope is enclosed for your convenience. We have also enclosed an Extension bookmark as a small token of our appreciation for your trouble.



**OUTREACH
COMMUNICATIONS**

Cooperative
Extension Service
310 Agriculture Hall
East Lansing, Michigan
48824-1039

517/432-1555
FAX 517/355-1804

Thank you.

Sincerely,

Dennis Duncan
Project Coordinator

Enclosures

Michigan State University Extension
programs and materials are open to all
without regard to race, color, national
origin, sex, disability, age or religion.
Michigan State University, U.S.
Department of Agriculture and
countries cooperating.
MSU is an affirmative-action
equal-opportunity institution.

APPENDIX G

FIRST COVER LETTER FOR DATA TRANSMISSION NETWORK SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

February 26, 1996

Dear DTN subscriber:

Michigan State University Extension (MSUE) is currently providing eight pages of information that DTN subscribers are most interested in seeing, according to the respondents to the MSUE/DTN survey conducted February 1995. Faculty and staff members in the departments of Agricultural Economics, Agricultural Engineering, Animal Science, Crop and Soil Sciences, Entomology, Geography, Outreach Communications and Veterinary Medicine are regular contributors of information.

Our goal is to continue providing you with high quality, timely, useful information. Please help us to achieve this goal by completing and returning the brief questionnaire that is enclosed as soon as possible. A prepaid envelope is enclosed for your convenience. We have also enclosed an Extension bookmark as a small token of our appreciation for your trouble.



**OUTREACH
COMMUNICATIONS**

Cooperative
Extension Service
310 Agriculture Hall
East Lansing, Michigan
48824-1039
517/432-1555
FAX 517/355-1804

Thank you.

Sincerely,

Dennis Duncan
Project Coordinator

Enclosures

APPENDIX H

SECOND COVER LETTER FOR FARMDAYTA SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

March 26, 1996

Dear FarmDayta subscriber,

Three weeks ago you were mailed a survey instrument from Michigan State University Extension (MSUE) regarding MSUE information that is provided to you via your FarmDayta unit. If you have already completed and returned the survey please accept my sincere thanks. If not please do so as soon as possible.

The return of your completed survey is important in order for MSUE to identify what information may be provided to you, the producer, that is timely and useful for your operation.

I have enclosed another survey instrument for your convenience. Please return the survey as soon as possible to the following address:

Dennis Duncan
Outreach Communications
311 Agriculture Hall, MSU
East Lansing, MI. 48824-1039



**OUTREACH
COMMUNICATIONS**

Cooperative
Extension Service

310 Agriculture Hall
East Lansing, Michigan
48824-1039

517/432-1555
FAX: 517/ 355-1864

Thank you.

Sincerely,

Maxine S. Ferris

Maxine S. Ferris, Director
Outreach Communications

Dennis Duncan

Dennis Duncan
Program Coordinator

Enclosure

APPENDIX I

SECOND COVER LETTER FOR DATA TRANSMISSION

NETWORK SUBSCRIBERS

MICHIGAN STATE
UNIVERSITY
EXTENSION

April 9, 1996

Dear DTN subscriber,

Three weeks ago you were mailed a survey instrument from Michigan State University Extension (MSUE) regarding MSUE information that is provided to you via your DTN unit. If you have already completed and returned the survey please accept our sincere thanks. If not please do so as soon as possible.

The return of your completed survey instrument is important in order for MSUE to identify what information may be provided to you, the producer, that is timely and useful for your operation.

We have enclosed another survey instrument for your convenience. Please return the survey as soon as possible to the following address:

Dennis Duncan
Outreach Communications
311 Agriculture Hall, MSU
East Lansing, MI. 48824-1039



**OUTREACH
COMMUNICATIONS**

Cooperative
Extension Service

310 Agriculture Hall
East Lansing, Michigan
48824-1039

517/432-1555
FAX 517/355-1804

Thank you.

Sincerely,

Maxine S. Ferris

Maxine S. Ferris, Director
Outreach Communications

Dennis Duncan

Dennis Duncan
Program Coordinator

Enclosure

APPENDIX J

RESPONDENT COMMENTS

Would you be willing to pay a fee for MSU information on DTN/FarmDayta?

“If it were minimal”

“Taxes for tax supported tuition should cover”

“MSU is a land-grant college and is partly funded by taxes which I pay”

“If it is information good enough to be worth paying for”

“We pay enough”

“I would not want to pay for pages that advertise meetings that we have to pay to attend”

“If it is more timely than other methods. If it would include what we get in the CAT Alert. I do not want to pay twice”

“Would like all the CAT alerts. However, would need to be alerted to date released”

“Include CAT Alert information, faster than mail”

“Not enough use to justify”

“Small fee”

“Depends on amount”

“Possible-information would need to be specific”

“Extension is a government entity already supported by the taxpayers”

“I could get free information from county agent”

“Most of what is available is also in magazines and newspapers”

“Should be part of subscription fee”

“We pay for the meetings so we should pay for this?”

“Shouldn’t have to-saves you money in mailing”

“As a FarmDayta subscriber, we have access to a lot of weather, marketing and news items currently”

“Your information is a nice addition to the system, but pay for it?”

“Willing to pay for the information I use”

“Too much information”

“I watch the S&P and am interested in national trends not state or local”

“Only a small number of articles each week-many do not apply to my operation-to many other sources of information-I’m already paying through my taxes for research”

“If it was exclusive information. So much of the MSU material is provided so many places I can get elsewhere for no cost”

“Costs enough”

“Most information on DTN is duplicate of CAT which I’m a subscriber. Like hand copy of CAT”

“Pay enough in taxes”

“DTN already has this information”

“Farmers need up to date unbiased information that MSU is able to offer”

“Other services offered for the same information”

“Not using it that much. MSUE should educate me for free”

“Too much duplication”

“It would depend on the quality of information”

“\$500 should cover this and other information”

“If it contains blueberry information”

“Small fee”

“Would have to be updated more often and contain more than tech. Advise with the ability to follow up with email, phone, etc.”

APPENDIX K

RESPONDENT COMMENTS

Has this MSU segment on DTN/FarmDayta increased your awareness of MSU information and services?

“Learned about wheat 2000 program, different herbicide practices”

“Extension bulletins are very helpful source of information”

“By making me aware of research or recommendations that may change practices on our farms”

“Marketing, weather and research are very important to us”

“Added information accessible at my time”

“Information network”

“By reading more than one opinion on marketing and crops I am able to make a better decision”

“It does not and has not”

“Would help if you identified which pages on the main menu are MSUE”

“More readily available for management decisions”

“Lists bulletins available, weed updates and changes”

“With the flood of new laws, equipment and chemicals on the market, MSUE is doing a great job keeping up with the pace”

“Timely information on seminars and bulletins not always available with county MSUE newsletter”

“Work in areas I wasn’t aware of”

“Keep on top of new ideas”

“Another source of information to make decisions by. We don’t jump into anything because of one advisor, we pool information then decide best for our operation”

“Help inform my customer”

“Materials available for class use”

“Crop updates”

“Herbicide updates”

“Farm safety programs”

“Made me more aware of extension bulletins, research results, weed control information and MSU’s marketing advice”

APPENDIX L

RESPONDENT COMMENTS

How may MSU improve the information provided on DTN/FarmDayta?

“Seems to be all right. Could be sure to include political information pertaining to agriculture”

“More on herbicides, field trials for seed corn, soybeans, wheat, as well as alternatives for feeding livestock”

“Timely information that will make us aware of management decisions that we need to take because of this weeks weather or crop decisions”

“I could use more marketing information and weather information plus just plain agriculture news for and about Michigan agriculture”

“We need real information-specifics. Actual figures pertaining to marketing and production practices”

“Would phone numbers for available assistance be possible for a person of a given expertise?”

“CAT Alert information could best be disseminated through FarmDayta. I would pay for this type of information”

“I think you are doing a fine job and would like to see it continue”

“Soil and fertility information and no-till information”

“Its getting to be more information than we have time to read. Keep it as short as possible and directly to the point”

“Have separate columns or areas for MSU news, MFRN news, and Michigan Farm Bureau news-not all together as Michigan News”

“Need more up-to-date information”

“Probably not enough agricultural engineering information. Just include pertinent MSUE information that will help us to do a better job of farming”

“More agronomic information”

“Updates on new computer software/hardware applicable to agriculture for anyone looking to upgrade or starting fresh”

“Marketing and research”

“Forecasts of price projections”

“Video interfaced. Access to library/resources through room 10”

“Additional potato information”

“Growing degree days, insect alert for fruit/vegetables”

“Less agronomic, more horticulture”

“Summer pest outbreak, mosquito born disease information”

“More information on crops like corn, soybeans, wheat, navy beans and vegetable crops”

“Feeder pig prices, cattle prices are hard to find”

“Sprayer information”

“More general agronomic issues and less product orientation”

“Interest in production estimates in Michigan, nation and world wide”

“Soy seeding rates”

“Calendar of events”

“Examples of the statistical information”

“IPM updates”

“Important bills in congress pertaining to agriculture”

“More information and prices for forage crops”

“Dry beans”

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