Technology Transfer

AgTiIPS: A Customized Voice-mail System for Delivering Lawn, Garden, and Horticulture Information to the Public

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Summary. A computerized information delivery system (AgTiIPS) was developed to deliver lawn, garden, and horticultural information to the public. AgTiIPS was based on voice-mail technology, which allows the public to access about 100 messages through a tone-producing telephone. AgTiIPS has been functioning in a Wyoming community of 47,000 since July 1990, and has delivered more than 700 messages in 1.5 years. Economic analyses for setting up voice-mail systems were conducted and the role of voice-mail in delivering lawn, garden, and horticultural information was discussed.

Land-grant universities have long been recognized for their excellence in agricultural teaching, research, and dissemination of information to the public. Methods for disseminating information are variable. Traditionally they have focused on providing personal and individual attention to the public. This method is time-consuming and requires travel, which has become expensive.

Recent shortfalls in operating budgets have reduced travel funds and personnel support at a time when growing urban/suburban populations are demanding more assistance from Cooperative Extension offices. This has forced us to consider alternate delivery methods. This paper de-

scribes the design and development of one such alternate delivery method-AgTiIPS. AgTiIPS stands for Agricultural Telephone-interactive Information Processing System. A review of the literature revealed just two publications concerning the use of voice-mail to deliver information to the public (Hill et al., 1991; Smith and Beck, 1991).

AgTiIPS was developed as an alternative and supplementary method for delivering a variety of information to the public. In Wyoming, demographic trends have indicated that much of the population is located at or very near several population centers. Consequently, a greater demand is being placed on county Cooperative Extension offices for lawn, garden, and horticultural information. A survey of available Univ. of Wyoming Cooperative Extension publications (bulletins, research journals, and miscellaneous and special publications) reflect this demand in that a significant percentage (31%) addressed horticultural topics (Legg and Vincelli, 1989). Therefore, AgTiIPS was devoted to delivering lawn, garden, and other horticultural information to the public.

About voice-mail. Voice mail has been identified as the next big revolution in office communications (Stone, 1989). Voice mail systems operate by designating a computer to serve as an answering machine that responds to telephone-produced tones. AgTiIPS is a customized voice-mail system.

Historically, voice-mail was the logical outgrowth of two technologies: Touch-Tone telephones and digitized voice recordings through a computer (Stone, 1989). Of these technologies, digitized voice recordings have been available much longer, but the initial quality was poor (Stone, 1989). Recent advances in voice-digitizing technology, coupled with the tone-producing telephone, provided the basis for voice-mail systems.

Voice-mail was first made available on large main-frame computers, but this technology now has been transferred to smaller desk-top computers. Several voice-mail systems are currently available for IBM-PC and IBM-compatible computers, varying widely in price, quality, and capabilities.

Voice-mail systems sometimes are accompanied by programming languages that allow them to perform information delivery functions. Using these languages, creative and sometimes complex programs can be coupled with digitized message recordings or voice-synthesized verbalizations to form information delivery systems. Voice synthesis is an attractive alternative to voice-digitized recordings because it functions by reading and then verbalizing words that are typed into ASCII files. This alleviates the need for time-consuming recording sessions.

AgTiIPS configuration. AgTiIPS consists of various hardware components, software, and more than 100 messages. The hardware consists of a turbo-charged (8 MHz) IBM PC-XT-compatible computer (Intel 8088 microprocessor) configured with 640 k of random access memory, and a 200-MB fixed disk (\$1500; a voice-digitizing board (Watson, \$300), a high-capacity mass-storage device (400-MB WORM drive, Micro Design International, \$1700), a telephone line surge protector (\$20), and a tone-producing telephone. The voice-digitizing board was equipped with a voice-synthesizing chip. An uninterruptible power supply (American Power Supply model 450, \$200) was added to minimize AgTiIPS down time from momentary power

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lapses (brown-outs) or major power lapses (black-outs) of less than 20 min in duration.

The software consists of the programming language VIS (Voice Information System) and the VIS code that allows AgTiIPS to function. The VIS structure resembles a Rolodex™ card-file system. A total office card files exist, one each for incoming messages, outgoing messages, phone book, calendar, and dictation. AgTiIPS makes use of the outgoing message card file for delivering information to the public and the incoming message card file for capturing and recording the responses and selections of each caller. Messages were recorded in low-compression (high-quality). VIS runs under DOS.

AgTiIPS has a total of 112 messages; 14 of which are menus, three are information-oriented, and one functions as the end-of-message subroutine. The remainder are specific for lawn, garden, and horticultural topics.

One message was entered into an ASCII file and then tested by Univ. of Wyoming employees to determine acceptability of the quality of speech that was produced by the computer reading that file and then verbalizing it through the voice-synthesizing chip. Results indicated that it was not acceptable. Messages were, therefore, recorded through the telephone, digitized, and stored on the fixed disk. This provided acceptable speech quality. Messages also were stored on the WORM drive to create a permanent backup. About 160 MB were required to store these messages.

Developing AgTiIPS messages. The effort required to capture information from subject matter experts and place it on AgTiIPS was a time-consuming task. Records indicate that 2.5 days were required per finished message to assimilate the extracted information, create an intelligible script, and read and edit that script into AgTiIPS. Thus, the 94 AgTiIPS messages required 235 working days for completion.

Using AgTiIPS. At the beginning of each call, AgTiIPS answers and then plays the initial message that welcomes the caller and tests for a tone-producing telephone. If the caller does not have such a telephone, AgTiIPS will then play a short message informing them to contact the Natrona County Cooperative Extension Service Master Gardener's program to obtain the desired information. At least 66% of Natrona County residents should have touch-tone telephones, as this represents the percentage of farms and ranches that do have such telephones in Wyoming's remotely located Big Horn Basin (Legg and Vincelli, 1989). If the caller does have a tone-producing telephone, AgTiIPS plays a message that instructs them on interrupting AgTiIPS menu listings to make a selection and responding to an AgTiIPS prompt within 5 sec, or the system will hang up. If a caller is uncertain about which message to select, the listing can be repeated.

When that message is completed, AgTiIPS plays the main horticulture menu to the caller. This consists of 10 subject menus. Subject menus each have a listing of one or more messages involving house plants, outdoor flowers, trees and shrubs, turf, vegetables, horticultural crop diseases, insects, irrigation and watering, soils, or pruning and sunscald. The caller then may select a subject menu that, with one exception, provides a list of specific messages. The exception is houseplants, which is further divided into two submenus—one for general houseplant care and one for specific houseplants. The caller then selects a message to be heard.

When the caller has heard an AgTiIPS message through to its completion, the program reverts to the end of message subroutine, which provides an opportunity to hear that message again, to go to the previous menu, or to end the current AgTiIPS session.

Time requirement for callers to work their way through the informational messages and menu choices is, at most, 3 min and 45 sec. The longest message that AgTiIPS offers is 3 min and 48 sec. Therefore, if callers know which AgTiIPS message they want to hear, replay no menus, hear just one message, and follow a message selection sequence through to its completion, they will spend a maximum of 8 min and 17 sec on the telephone. This usually will be shorter, however, since most callers will interrupt the menu listings to dial their selection as soon as it is heard over the telephone. Time spent on the telephone can be reduced further if the caller plans the message selection sequence prior to dialing AgTiIPS.

AgTiIPS learning aids and message hard copies. AgTiIPS was designed to be used without a set of written instructions. This means that users can call the AgTiIPS telephone number, listen to the various menu choices, select messages from which to gain information, replay the just-heard message, and/or jump back and forth between menus so they may listen to other messages. However, some callers may be uncomfortable browsing through the menus without the use of a learning aid or set of instructions. Therefore, a pamphlet was developed that explains how to use AgTiIPS and it provides a complete listing of all AgTiIPS menus and message selections, so that callers can plan their message selection sequence.

If a particular AgTiIPS message is too long or detailed to be assimilated over the telephone, users can acquire a printed copy. These copies are available at the Natrona County Cooperative Extension Office for a modest fee.

User response to AgTiIPS. AgTiIPS was located in Casper, Wyo. (population 47,000) and began operating on 16 July 1990. Through 1 Jan. 1992, AgTiIPS had logged 575 calls (383 per year). Of these, most (50.5%) were single-message calls, although 33.9% were multiple-message calls. Total messages delivered during this period was 708 (472 per year). Menus most frequently accessed included those for outdoor flowers (18.8%), specific houseplants (17.2%), trees and shrubs (14.8%), vegetables (14.0%), and turf (13.5%). This may be contrasted with that of CEVIS (another voice-mail system), which delivered much of its information on outdoor plants, controlling ants, food preservatives, growing tomatoes, watering lawns, tomato fruit diseases, renovating old lawns, and weekly tips (Smith and Beck, 1991). AgTiIPS messages were delivered to the public throughout the year, the majority in August (50.8%). The next-most active time period was September through November (27.3%), with the remainder (20.9%) being distributed from December through July. Calls were received throughout the week, with the fewest on Sunday (7.1%) and 12.9% on Saturday. Percentage of weekend calls for CEVIS was about the same (20%) (Smith and Beck, 1991). Calls were made at all hours of the day and most hours of the night, with most being from 8:00 a.m. to 5:00 p.m. (77%). In contrast, more than half of the calls to CEVIS were after normal working hours (Smith and Beck 1991).

Keeping the public informed. The introduction and initial use of AgTiIPS depended on informing the public of

its availability through newspaper articles, radio announcements, and television promotions (sponsored or gratis programs). We discovered that these efforts needed to be sustained to maintain the public's awareness of AgTiIPS. Similar difficulties were encountered by Hill et al. (1991). In addition, a copy of the AgTiIPS brochure was included with each mailing from the Natrona County Cooperative Extension Office to the citizens of Casper or residents of Natrona County. We found that this complemented the media-related promotions by providing a more permanent source for the AgTiIPS telephone number, AgTiIPS instructions, and AgTiIPS message listings.

Discussion

Delivering lawn, garden, and horticultural information to the public over the telephone involves a number of different methods. To determine which are being used, and which are used most frequently, we surveyed the horticulture, plant science, or landscape architecture departments of each 1865 land-grant university in the United States. Results indicated that most states used extension specialists, county agents, hired staff and/or master gardeners to respond to telephone calls from the general public (92%). The next-most frequently used methods were voice-mail systems (20%) and tape-recorded messages (14%). Additional delivery methods included the use of answering services, dedicated play-back machines (other than voice-mail), computer-based information retrieval (a call-you-back method), and electronic mail and bulletin boards (also call-you-back methods) (15%). Since the majority of states rely on extension specialists, county agents, hired staff, and/or volunteer master gardeners, we chose to compare the costs of these labor-intensive methods with that of a voice-mail system.

As stated, cost of the voice-mail system hardware was \$3720. Cost of extracting the specific information and then writing and recording 94 messages totaled \$35,580. Total initial cost for our system was, therefore, \$39,300. However, this figure would have been less had the scripts been prepared, incurring recording costs only (\$5022) or if they were already on tapes (\$4220), because some voice-mail systems can upload tape-recorded messages directly. If we assume that each message delivered by a specialist, county agent, or other paid staff lasted 5 min, we can calculate the number of years that would be required to recoup the cost of installing the voice-mail system in Natrona County, Wyo., for each of three initial start-up costs. As shown in Table 1, a great number of years would be required to recoup the initial start-up cost of \$39,300 (regardless of salary level) given that just 472 messages were delivered per year. For the other start-up costs, the number of years required for recouping the initial investment were much lower (Table 1). These results suggest that, if possible, quality scripts on various topics should be procured from extension bulletins or from surrounding states if the voice-mail system is to serve communities with populations of about 50,000 people.

Economic analyses of the Master Gardeners Program for Natrona County were conducted by first determining the number of extension specialists used (5) and the number of days required of each for training session (1). This equaled 7 specialist days due to travel requirements. Specialist days were then expressed as total dollars at different hourly and salaried wages (i.e., 7 specialist days/260 working days per year x average annual salary). These dollars then were added to annual travel costs (\$536 for the first year), inflated at 2% per year, and summed over years to determine the number of years required for the voice-mail system to be

Table 1. Required number of years to break even at three volumes of messages being delivered per year when paid staff, at various hourly and salaried wages, answer routine lawn, garden, and horticultural questions vs. having a voice-mail system at the same. Three start-up costs were used for the voice-mail system: 1) cost of hardware plus the cost of extracting the information from specialists, placing that information into intelligible scripts, and recording those scripts on the voice-mail system (\$39,300); 2) cost of hardware plus recording already prepared scripts (\$5022); and 3) cost of hardware plus uploading tape-recorded message (\$4220).¹

Hourly wage ² (\$)	Annual salary (\$)	472 messages per year			1000 messages per year			10,000 messages per year		
					Start-up costs					
		\$39,300	\$5022	\$4220	\$39,300	\$5022	\$4220	\$39,300	\$5022	\$4220
No. of years to break even										
5	10,400	82	21	19	54	11	10	9	2	2
6	12,480	75	18	16	48	10	8	8	2	1
7	14,560	69	16	14	44	9	7	7	1	1
8	16,640	64	14	12	40	8	7	6	1	1
9	18,720	60	13	11	37	7	6	6	1	1
10	20,800	56	12	10	34	6	5	5	1	1
11	22,880	53	11	9	32	6	5	5	1	1
12	24,960	50	10	9	30	5	5	4	1	1
13	27,040	48	10	8	28	5	4	4	1	1
14	29,120	45	9	8	27	5	4	4	1	1
15	31,200	43	8	7	25	4	4	4	1	1
16	33,280	41	8	7	24	4	4	3	1	1
17	35,360	40	8	7	23	4	3	3	1	1
18	37,440	38	7	6	22	4	3	3	1	1
19	39,520	37	7	6	21	4	3	3	1	1
20	41,600	35	7	6	20	3	3	3	1	1

¹An extra phone line may be needed at this volume (add \$300 for extra voice-mail board).

²Assuming a 2% wage or salaried increase per year.

operational to recoup each of three initial start-up costs (Table 2). For the \$39,300 start-up cost, a great number of years would be needed to recoup the costs of training 25 master gardeners in Natrona County, regardless of the hourly or salaried wages. For the \$5022 and \$4220 start-up costs, however, the number of years required to recoup the initial investment were much less (Table 2). These results again emphasize the need to reduce the costs of extracting, organizing, and writing the scripts that are to be read into the voice-mail system.

Four final points need to be made. First, the Natrona County extension office houses Wyoming's only horticulture specialist and also has a strong Master Gardeners Program. Given this, AgTiIPS may have been competing with the horticulture specialist and the Master Gardeners Program for calls. Second, AgTiIPS was designed to deliver often-requested information to the public through voice-recorded messages. AgTiIPS does not have the capability to handle requests for other information, take a message, research a requested topic, and deliver the requested information as would a specialist, county agent, or master gardener. Therefore, voice-mail systems configured such as AgTiIPS should not be viewed as complete replacements for specialists or extension staff but, rather, as methods for augmenting the delivery of repetitive information and/or for the relief of extension personnel when delivering repetitive information to the public. We point out, however, that voice-mail systems can be designed to record questions from the public and then be accessed by specialists, county agents, or master gardeners. Answers then may be placed on the voice-mail system for the caller to retrieve at a later time, or may be delivered directly to the caller at their home by the

specialist, county agent, or master gardener. Such a system was developed by Hill et al. (1991) for delivering nutrition and cancer information to the public over the telephone.

Third, a voice-mail system such as AgTiIPS does not require a great deal of expertise or education to set up. An individual is needed who has rudimentary programming expertise to write the computer program that will ultimately run the system. As for hardware and software set-up and maintenance, we found the voice-mail board and software easy to configure and install, requiring about 30 min. Recording the messages was also easy to do, as this required finding the correct outgoing message card and then pressing the correct function keys that allowed us to begin and end recording sessions, splice, and manipulate segments of speech. System maintenance thus far has required the offloading of the AgTiIPS message log (up to 15 min daily). Annual maintenance costs, including the telephone charge, were \$800. No attempt has been made to change these messages from one year to the next as they were identified as oft-asked questions.

Finally, it is important to consider some people's reluctance to talk to recording machines and other such systems over the telephone. This consideration led us to design a system through which the public would not be forced to talk to AgTiIPS but, rather, would listen to recorded instructions and messages as they are played over the telephone. Even so, our records indicate that 15.6% of the callers terminated their sessions with AgTiIPS prior to accessing a message. This termination rate suggests that some citizens of Casper and Natrona County felt uncomfortable interacting with voice-mail. Origin of this discomfort may be due to a number of causes, ranging from fear of voice-mail technology to frustration from browsing through the AgTiIPS menus and not finding the message they want. We suspect that the level of user comfort with voice-mail varies with their ability and willingness to adapt to new technologies in exchange for needed information, and the degree to which that information is needed. We believe this paper offers specialists and agents in other settings the criteria needed to determine if voice-mail is appropriate in their situation.

Table 2. Economic analyses for having extension specialists train people in a Master Gardeners Program to answer routine lawn, garden, and horticultural questions vs. having a voice-mail system dispense that information. Three start-up costs for the voice-mail system were used: 1) cost of hardware plus the cost of extracting the information from specialists, placing that information into intelligible scripts, and recording those scripts on the voice-mail system, (\$39,300); 2) cost of hardware plus recording already prepared scripts (\$5022); and 3) cost of hardware plus uploading tape-recorded messages (\$4220).

Hourly wage ^a (\$)	Annual salary (\$)	Start-up costs		
		\$39,300	\$5022	\$4220
<i>Years to break even</i>				
5	10,400	35	6	5
6	12,480	33	6	5
7	14,560	31	6	5
8	16,640	30	5	5
9	18,720	29	5	4
10	20,800	28	5	4
11	22,880	27	5	4
12	24,960	26	5	4
13	27,040	25	4	4
14	29,120	24	4	4
15	31,200	23	4	4
16	33,280	23	4	3
17	35,360	22	4	3
18	37,440	21	4	3
19	39,520	21	4	3
20	41,600	20	3	3

^aAssuming a 2% wage increase per year.

Literature Cited

- Hill, L.W., M.J. Harveywebster, J. Usinger-Lesquereux, and S.T. St Jeor. 1991. The use of voice mail in a nutrition and cancer information telephone service. *J. Amer. Dietetic Assn.* 91: 347-348.
- Legg, D.E. and P.C. Vincelli. 1989. Sugar beet production and pest management practices in the Big Horn Basin of Wyoming. *J. Sugar Beet Res.* 26:17-32.
- Smith, R.C. and P. Beck. 1991. CEVIS-Call Extension Voice Information System: a client information dissemination approach. *HortScience* 26:926.
- Stone, M.D. 1989. Replacing the receptionist: PC-based voice mail systems. *PC Magazine* 8:186-234.