
Agricultural Reference Services

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ABSTRACT

REFERENCE SERVICE PROVIDES the mechanism by which the user of agricultural information can interface with the larger body of knowledge to secure what is desired. Depending on the type of library or information center, that service may range from the provision of the desired information to the training and educating of the user to identify and locate what he/she needs. Technological advancements have greatly improved the accessibility of the broad range of information relevant for the field of agriculture and have many implications for the achievement of successful reference.

INTRODUCTION

One approach in dealing with the multifaceted topic of agricultural reference service is to organize the discussion by types of agricultural libraries. The four main types of agricultural libraries are: governmental and/or national libraries; academic libraries; private sector libraries; and information centers (including international centers). This approach will help fulfill the purpose of this article which is to survey the variety of libraries and information centers in which agricultural reference service is given, to show how reference varies in each, and to indicate what trends in reference service are occurring. Because agricultural libraries vary greatly according to the organizations they support as well as the countries in which they are located, this survey will highlight only the major issues and trends encountered by agricultural reference librarians. Some of the issues and trends to be addressed are

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those affecting user education, bibliographic searching, communications, collections, and staffing. Before the reference trends in these types of libraries are discussed, a brief consideration of reference service and the reference librarian is appropriate.

THE REFERENCE LIBRARIAN

As will be discussed in more detail later in this article, reference librarians provide a great variety of services for their patrons. Depending upon the size and mission of the library, these services may include: providing factual information; retrieving bibliographic citations; interpretation (advice and counseling as an information expert); teaching (also known as bibliographic instruction or user education); selective dissemination of information (SDI); liaison with user groups; and many other related tasks, depending on the needs and the resources of the organization.

What are the qualities of a good agricultural reference services librarian? There are at least three main attributes: subject knowledge of agriculture; an understanding of agricultural information and librarianship (and its new technologies); and possession of the interpersonal skills to deal successfully with clients. Extensive subject expertise is most important in a situation where the librarian prepares subject reports for users—for example, in a special corporate library or documentation center. Subject knowledge is also important for understanding and interpreting the information needs of agricultural clients.

The second attribute, an understanding of agricultural information and technology, is vital. One of the aspects of agricultural reference service that makes it a challenge is the incredible diversity of the field's literature. It is one of the more interdisciplinary fields cutting across virtually all of the sciences, both applied and pure, plus technology and the social sciences (Frank, 1987, p. 294). And as Garfield and Weinstock (1977) imply, the term *agriculture* describes the mission rather than any approach taken by agricultural scientists (p. 278). In dealing with agricultural literature, therefore, one must also be familiar with the larger body of scientific literature.

The new and rapidly changing technologies used to manage, identify, and access the literature are dramatically altering the way in which reference librarians do their work. Today's successful agricultural reference librarian, therefore, should have a grasp of the many technological trends discussed in this issue, and then be able to apply them to his or her particular situation. This is not an easy task since virtually every agricultural library situation will have its unique features including a spectrum of client needs and demands.

The third attribute needed by the reference librarian, interpersonal skills, is one that is often underrated (Hinckley, 1982, p. 85). To perform reference service well, an agricultural librarian should be a good listener and a skilled, yet gentle, inquisitor in order to perform the "reference

interview"—a brief but important interview or consultation used to determine exactly what the patron needs.

NATIONAL LIBRARIES

There is no international norm by which different countries develop and organize their "national" or major regional libraries. Collection development and document delivery, for example, rather than reference service, seem to be the major areas of emphasis in many national and regional libraries outside of the United States.

In the United States there are three national libraries: the Library of Congress (LC), the National Library of Medicine (NLM), and the National Agricultural Library (NAL). LC is the largest library in the world with the legislated mandate to serve Congress. As the U.S. copyright deposit library, it receives two copies of all American imprints; materials for the collection may be selected from these. As the largest national library, it plays a leadership role in many areas of American and world librarianship. The NLM's collection and services address the needs primarily of the medical community while the NAL is mostly concerned with the agricultural community. The NAL contains the premier agricultural collection in the United States and is one of the largest agricultural libraries in the world (Wortman, 1984). Although many users of this library are the employees of the United States Department of Agriculture (USDA), the NAL provides a number of important reference services for other user groups.

The NAL's development of its computerized database AGRICOLA (AGRICultural On Line Access) has significantly affected agricultural reference all over the world. AGRICOLA is actually a family of databases consisting primarily of bibliographic citations to monographs, government reports, and journal articles selected from approximately 5,000 serial titles. The database includes records for items cataloged or indexed since 1970. It is available through several commercial sources including Dialog Information Services and Bibliographic Retrieval Services (BRS), and, since 1988, this major agricultural database has also been available on CD-ROM.

The public services staff at the NAL also produces the "Quick Bibliography Series"—printed results of various AGRICOLA searches having a broader interest group than just one individual or research group. "ALF" (Agricultural Library Forum), the microcomputer-based electronic bulletin board system, was introduced in late 1988. It "provides electronic access to information about NAL products and services and serves as a focal point for networking activities for those who dispense and use agricultural information" (Pisa, 1988, p. 1). In addition to traditional networking activities, the system can be used to exchange software programs and text or data files between callers.

In recent years the NAL has established several specialized information centers as another approach to fulfilling the reference needs of the

users. The NAL established these centers to "provide enhanced services to its current clientele as well as to develop new service relationships with the public and private sectors" (Frank, 1988, p. 1). The information centers serve educators, consumers, and the private sector in addition to the traditional primary user of the NAL, the agricultural researcher.

NAL has the largest agricultural collection in the United States; consequently, document delivery is a major activity. The NAL, a "library of last resort," supplies copies of agricultural publications not available from any other source (Wortman, 1984). Monographs may be loaned, with restrictions, both in the United States and abroad, and an extensive photoduplication service is offered.

In 1987 a user fee policy for reference assistance was established to apply to users outside of the USDA ("NAL Establishes," 1987). A threshold level of information support services, beyond which a fee is charged, was established—i.e., one hour of staff time or \$25 in computer usage costs. Some categories of users (e.g., USDA staff, congressional and White House staff, other federal staff, and recipients designated by legislation) are provided with a full range of reference services without charge.

Agriculture Canada is the agency of the Canadian government concerned with the agricultural needs of that country (M. C. Cutler, personal communication, August 1, 1989). There is a central Agriculture Canada library in Ottawa which maintains the largest and most general agricultural collection. Approximately thirty branch libraries are located throughout Canada. The central library provides leadership in a number of ways which affects the reference services supplied to the users who are primarily Agriculture Canada staff members. They maintain an online union catalog for Agriculture Canada to which the branches provide cataloging and access via Datapac, a telecommunications network. The Canadian Department of Agriculture translations service is coordinated through the central library and is available to all department employees. Online commercial bibliographic, full-text, and numeric databases are searched, and several CD-ROM files are available in this library. The central library is in the process of developing charge-back programs for direct costs such as commercial online searching and cost sharing for the routing of current journals.

The branch libraries are funded locally, except for the staff, and the collections reflect more the areas of interest of the local department personnel. The major part of the budget is allocated for journal subscriptions. Networking is necessary for the execution of reference because the reference collections are quite small compared to the central library. User education is conducted, primarily on an individual basis, to assist the user in using the collection independently. Bibliographic database searching is done, but CD-ROMs are limited at the branch libraries. An internal electronic system is used to communicate with

users, but telefacsimile machines are not used extensively. Nondepartmental staff are free to use the collection but mostly on an in-house basis.

A final example of a large national agricultural library is one in the Soviet Union. In the Ukraine, the Central Scientific Agricultural Library in Kiev at the Southern Branch of the Moscow-based All-Union V.I. Lenin Academy of Agricultural Sciences is one of the oldest specialized libraries in the Soviet Union. It serves as the scientific and technical center for the Ukrainian agricultural libraries network (Tselinsky, 1982). The network consists of research institutes, experiment stations, and educational institutions providing agricultural information throughout the region. The information and bibliographic activities are diverse and include the publication of current and topical bibliographies, compilation of new book lists, preparation of information publications, arrangement of book exhibitions, and the organization of "specialist's days" and "information days" programs to help satisfy the information requests of scientists and practical agriculturists and for publicizing scientific achievements and agricultural progress.

ACADEMIC LIBRARIES

The organization and type of reference services in academic libraries vary greatly from one institution to the next depending upon the mission of the institution as well as budgets and academic department politics. In the United States, the state land-grant universities are normally the institutions with the mission to conduct agricultural research and extension. Either a branch or departmental library dedicated to one or more aspects of agriculture will exist, or the library support responsibilities will be assumed by a science library or a centralized library.

Two examples of branch agricultural libraries are those at the University of Kentucky and the University of Wisconsin, each with its own staff and collections. At such branch libraries the services might include reference, interlibrary loan, acquisitions, cataloging, and the circulation of materials. The collections are often broad enough to serve a spectrum of agricultural faculty and students—from the needs of research faculty to the class assignments of undergraduates. The subjects covered in the collection may need to encompass such diverse research as forestry, entomology, soil science, or agricultural economics. If the budget is limited, or if there are other departmental libraries, the agriculture branch may include only a core collection.

An alternative to the branch library model, the centralized concept of library organization, has developed in a number of U.S. academic libraries. There is some evidence that this model may be gaining in favor as universities attempt to economize due to reductions in academic budgets, the soaring costs of library materials, and the attempt to make the maximum use of library staff (Olsen, 1979). One disadvantage of the centralized model is that it does not offer the convenience of access of a

branch library located in or near the agricultural departments. The centralized library concept, however, does offer greater economy by not having to duplicate materials and by not having to staff a branch, or branches, with additional personnel. Another advantage of the centralized model is the convenience of having all of the collection in one facility. This eliminates the need for the user with increasing interdisciplinary interests to go to several places to locate the desired information.

A number of universities, including Texas A & M, Iowa State, and Oregon State have consolidated library services, providing their agricultural reference services from a central reference desk that also handles the reference needs of many other subject areas. It is common, and desirable, in a centralized scheme of libraries, to have a reference librarian dedicated to providing expert assistance in the area of agricultural reference. In many libraries the agricultural librarian is also in charge of collection development activities.

The technological changes occurring in academic reference services today are dramatic and are revolutionizing the way in which librarians serve their clientele (Fisher et al., 1987; Saffady, 1989). In the 1970s the advent of online bibliographic searching allowed the reference librarian to search through hundreds of thousands of bibliographic citations in such computerized databases as AGRICOLA, AGRIS, and CAB Abstracts (Frank, 1987, pp. 301-07). Online services have traditionally required the mediating assistance of a librarian or information specialist due to the complexities and varieties of searching protocols utilized by the wide number of databases. Since the introduction in the early 1980s of more user-friendly online searching software packages and lower evening rates, many patrons have been able to perform their own searches (Kesselman & Watstein, 1988). These packages also allow reference librarians with little online training to perform simple, quick, and low cost searches at the reference desk. Such ready reference searches are usually limited to only a few references, normally done to verify questionable or incomplete citations or to find the patron a few references on a specific subject (Brownmiller et al., 1985). The power of online database searching is not only speed, but the flexibility to perform keyword searching and the ability to link a number of terms. This may result in some retrieval of irrelevant citations but also allows the searcher to retrieve citations that would be very difficult to locate using a traditional hardcopy index.

The latest generation of technology that has the world of reference services in a stir is the CD-ROM (Compact Disc-Read Only Memory), with discs that have a storage capacity of as many as 275,000 printed pages. Many academic reference divisions have discovered the immense popularity of CD-ROM stations with their clientele (Starr & Butcher, 1988). While sitting at a personal computer connected to a compact disc player, users in a few minutes, can teach themselves the rudiments of performing a search through hundreds of thousands of bibliographic

records in a database such as AGRICOLA. Not only are the results of such a search immediate, in most libraries they are cost free to the user. Another advantage for many clients is the fact that they are in charge of their own searches (Taylor, 1989, p. 454). This sense of empowerment is exciting for many users who once dreaded the task of searching through dozens of volumes of printed indexes that were often not designed with the inexperienced user in mind.

The advent of CD-ROMs in the library is changing the nature of reference work in ways other than end user searching. If patrons discover that their library does not have the materials referenced in the CD-ROM, then the interlibrary loan office may be requested to obtain them from another library. The increasing demand for interlibrary loans in many libraries seems to be directly linked to the use of CD-ROM bibliographic database stations (Taylor, 1989).

Another bibliographic tool has emerged at the reference desk of many university libraries in the past few years. Online access at the reference desk to major bibliographic utilities, such as OCLC (Online Computer Library Center, Inc.) and WLN (Western Library Network), makes it possible to verify bibliographic citations in one or two minutes rather than the many minutes (or hours) sometimes required by a manual search. Besides speed, these kinds of utilities also allow more flexibility in searching. One can search by author, author-title, title, ISBN, and other fields. But, like the introduction of CD-ROM stations into the library, the use of these bibliographic utilities has increased the load on interlibrary loan offices. More patrons are taking advantage of these utilities, and the result is that those larger libraries which are members of the utilities are experiencing many more requests for loans. Some of these libraries in the United States find that they are lending more materials than they borrow (i.e., are net lenders). Many are raising their lending fees or are asking to be removed from the holdings records in the utilities in order to reduce the volume of requests. These choices will make it more difficult for resource sharing, particularly for those researchers who are trying to locate specialized materials that are held only in a handful of the larger libraries.

In most academic libraries an important component of reference service is teaching patrons how to use the library and its resources. This process is called bibliographic instruction (BI) or user education. BI has two main functions: first, to allow patrons to find information on their own; and second, to reduce the number of simple repetitive questions at the reference desk (Freides, 1983, pp. 459-61). Traditional methods of doing BI are giving formal classes on the use of the library as well as conducting library tours.

A "user friendly" reference area is created by many libraries to help decrease the number of repetitive questions. Some of the ways this is done are: arranging and labeling the reference area and materials as logically as possible; providing good signs and floor maps in prominent

locations; making handouts to explain the use of indexes, catalogs, and other library tools; using expert systems; and using audiovisual media (such as slide/tapes, videotapes, self-guiding cassette tapes). Although these kinds of materials are generally aimed at the undergraduate student, faculty and graduate students might be provided with more technical handouts or in-depth seminars on specific topics (e.g., AGRIS online; the use of Boolean logic in computer searches; the grey literature of agriculture) by the agricultural reference professional.

Another duty of the agricultural reference librarian might be providing current awareness service, also called the selective dissemination of information. In consultation with faculty or other researchers, the librarian develops search "profiles" to retrieve new relevant citations as they are published. Using these profiles, the librarian searches the agreed upon databases on a regular basis (e.g., monthly or quarterly) and then sends the results to the faculty member. The profile can be adjusted as needed, can be input by the librarian each time the search is run, or can be stored electronically—an efficient and consistent method. Some libraries offer a document delivery service whereby the faculty member may request delivery of copies of the desired articles or books. Due to lack of staff and the time and expense required for this type of service, many university libraries charge either full or partial costs. Recent innovations in electronic delivery of information also have affected document delivery in the academic library. The acceptance and expanding availability of electronic mail and telefacsimile services have caused new demands as well as new possibilities for the communication of information.

PRIVATE SECTOR LIBRARIES

Private sector libraries serve a much smaller user community than either national, regional, or academic libraries. Usually the user group is limited by employer, but some private sector libraries will provide limited reference service to people outside of the company. The scope of the reference services provided is also considerably different.

One example of a company in the United States with an agricultural information center is Cargill, Incorporated, a multinational agricultural corporation. Cargill's Information Center is located at the corporate headquarters in Minneapolis, Minnesota, and serves only the employees of the Cargill company, with managers being the primary users (J. Peterson, personal communication, July 17, 1989). Various user education activities are undertaken to market the information services available. They include general classes, participation in the orientation programs for new personnel, and presentations to the different departments and divisions. However, no instruction on how to use the collection is offered. Requests are accepted covering any topic as needed by company personnel. The answer is researched by the staff, whether it be a bibliographic citation or list of citations, a market figure

on a particular crop, or a detailed report including extensive data, citations, government regulations, and other information. The center's collection is consulted, automated bibliographic and/or textual databases and wire services are used, and, if necessary, fee-based information services are utilized. The information is then analyzed and the entire compilation is provided to the requester. Telefacsimile and the Cargill Communication System, a worldwide company electronic mail system, are used extensively to communicate with the users of the Information Center's services. A charge-back program, including both direct and indirect charges, is used to cover the entire budget of the center.

The American Farm Bureau is a trade organization in Chicago with an affiliation with every U.S. state farm bureau (S. J. Schultz, personal communication, August 1, 1989). The library contains a very small collection so the staff rely heavily on networking and other libraries, particularly a nearby public library and Illinois state universities, to meet the needs of the users. The clientele consists of primarily farm bureau staff from the central office or from the different state offices. There are few walk-in users and an in-house electronic mail system and telefacsimile are used extensively. Commercial online bibliographic and full-text databases, including reference sources, are used as needed. There are currently no CD-ROM files available in the library, but there are plans to acquire census information in that format sometime in the near future. Information requests from nonemployees are accepted, but normally no more than thirty minutes will be spent locating the information, and fee services, such as online searching, will not be used for these requests. Referrals to other sources of information are provided. The library is funded centrally and does not charge for its services.

The reference services of two different libraries within Pioneer Hi-Bred International, a corporation in Des Moines, Iowa, vary considerably. The corporate library, serving primarily management personnel, provides mostly ready reference (G. T. Rolofson, personal communication, August 1, 1989). Commercial online databases, as well as full-text, bibliographic, and data files, are utilized by the staff to answer reference inquiries. Agribusiness USA, a commercially available database, was developed at Pioneer, and is still maintained by information services staff, and is used extensively by the corporate library personnel. An in-house online catalog is available throughout the organization. Both bibliographic and data files are available in the library in CD-ROM format. Communication with employees outside of the immediate facility is achieved with an in-house electronic mail system or telefacsimile. The corporate library is funded by a combination of a charge-back program and a centrally-funded budget.

In contrast to the corporate library, many of the staff in research are regular visitors to the plant breeding library (H. Hoeven, personal communication, August 1, 1989). Orientation and training are conducted on an individual basis to assist resident researchers in becoming

independent users. Manuals containing explanations on how to use different library materials and the online catalog, as well as information on various services, are maintained within the library. Overviews of library services are presented to different groups within the corporation. No CD-ROMs are currently available, but online bibliographic databases are accessed. Occasionally the reference collection at a nearby university library is utilized. Pioneer has a part-time employee at the state land-grant university who has access to the reference collection there and, in response to electronic mail requests, provides document delivery to the corporation researchers. Commercial vendors are sometimes used for document delivery, particularly for patents. Telefacsimile is not used extensively. The plant breeding library also serves clientele at forty to fifty locations throughout the United States although many might also use a nearby academic library. Most of the library's budget is funded centrally, and there is limited use of fees for services provided. This library will accept reference inquiries from nonemployees, but most relate to Pioneer company activities.

AGRICULTURAL INFORMATION CENTERS

Agricultural information centers tend to focus on a specialized and, frequently, extremely narrow area of interest. A wide range of information services is offered to the users who may be affiliated with the organization or, in some cases, might be from a world community. Many of the world's agricultural information and documentation centers will be listed in the forthcoming IAALD (International Association of Agricultural Librarians and Documentalists) sponsored publication, *Agricultural Information Resource Centers: A World Directory*. Some of the information services available at a selected few centers are noted below as examples of the kinds of services that might be expected of a specialized information or documentation center.

The Central Tobacco Research Institute (CTRI) Library for Tobacco Information Services in Rajahmundry, India, maintains a subject file of indexed articles on tobacco and other related subjects for ready reference (Rao & Suryanarayana, 1988). The library provides an inquiry service for answering technical questions. Many data are acquired and maintained to assist in this service including, for example, the latest world tobacco statistics, information on Indian tobacco cultivars, and statistics on the production of tobacco in Indian states and elsewhere. Reference guides are developed on specific topics such as the chemical constituents of tobacco, fertilizers, soils, and the pests and diseases of tobacco. Bibliographic searches are performed regularly as requested by the scientists, and bibliographies are prepared. Library staff members also compile collections of articles with abstracts on current research problems in key areas. Reprints received in the library are accessible through an online file and a monthly accessions list is available. Papers, bulletins, directories, and other materials are pub-

lished by the library professionals. Training in the utilization of library resources and in writing technical and scientific articles is conducted in the library for new scientists at the institute and outside research workers.

At the Visayas State College of Agriculture in Baybay, Leyte, the Philippine National Root Crops Information Service (PRIS) analyzes the literature covering a closely defined group of crops of particular local interest (Broadbent, 1987). PRIS acts as a link for information flow among agricultural decision-makers and planners, the scientific community, farmers, and extension personnel. This information service is able, assisted by its link with other specialized information services at the major international agricultural research centers such as the Centro Internacional de Agricultura Tropical (CIAT) and the International Institute of Tropical Agriculture (IITA), to analyze the pertinent literature, provide state-of-the-art reviews and technical reports of significant developments, and put the farmer in contact with the scientist through a system of information analysis. Scientific inquiries which the staff are unable to answer immediately are directed to the most appropriate institution or individual, locally or abroad, through an inventory of root crop scientists.

The Centre Technique de Cooperation Agricole et Rurale (CTA), headquartered in Wageningen, The Netherlands, was established in 1983 and is financed by the European Development Fund. It facilitates and ensures the exchange of existing scientific and technical information particularly between the European Community and sixty-three African, Caribbean, and Pacific states. Many activities are supported (e.g., conferences, seminars, studies, publications, and translations), but one very specialized activity is a question and answer service (Niang, 1987). The users include students, researchers, international organizations, teachers, farmers, agricultural extension staff, and others. Questions received by the service cover a broad range of subjects.

The library at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Patancheru, Andhra Pradesh, India, publishes the *Library Services Bulletin*, a monthly which features news of library developments, services provided, and a list of the publications added during the previous month ("Library," 1987). A quarterly publication listing selected forthcoming conferences on agriculture and related sciences is produced to alert the ICRISAT scientists of important meetings. A selective dissemination of information service, based on current journals received at ICRISAT and a few selected abstracting journals, is offered to scientists at ICRISAT and at relevant national, regional, and international centers in the semi-arid tropics. Abstracts of relevant papers are routed within a month of their receipt to the library. Photocopies of articles requested as a result of the SDI are provided. It was reported in 1987 that automation of the SDI service was planned and would be expanded to include subsets of the CAB and AGRIS databases in all five of the crops mandated to ICRISAT. These, together

with local input, would comprise the SATCRIS (Semi-Arid Tropical Crops Information Service) database. User interest profiles would be matched monthly against the updated database. Comprehensive literature searches, including online database searching via DIALOG, are done on demand.

The Agricultural Research Information Center of the Indian Council of Agricultural Research (ICAR) in New Delhi has collected, compiled, and stored research project files for ongoing and completed projects in agriculture, animal husbandry, and fisheries for dissemination in mimeographed form (Reddy, 1987). Information on the research activities of about 5,000 agricultural scientists is maintained by the center and lists of research personnel are published periodically. Computerized SDI printouts, based on AGRIS magnetic tapes, have been offered since 1987. Another ICAR library, the Indian Agricultural Statistics Research Institute in New Delhi, maintains a complete file of field experiments and publishes research summaries.

The Information System for Agriculture, the Fachinformationssystem Ernährung, Land-und Forstwirtschaft (FIS-ELF), is a national network in the Federal Republic of Germany (Haendler & Laux, 1986). The Zentralstelle fuer Agrardokumentation und-information (ZADI) in Bonn acts as the coordinating center. Twenty-one documentation centers, each responsible for a special field of agriculture or related area, belong to the network. The documentation centers record and index the literature relevant to their special fields. The centers offer different kinds of information services to users, but conducting bibliographic searches in both German and foreign databases in response to special user questions has been one of the most used services. The SDI service is available on a monthly or quarterly basis. The centers offer individual services based on their own databases. They might provide printed materials to inform users about current special topics or special bibliographies. A very specialized service of one of the centers, the Center for Animal Production, is the publication of feed composition tables for different kinds of animals. Some of the documentation centers are connected with a special library which collects the items indexed. In most other cases the document delivery needs can be served by other German libraries.

The International Maize and Wheat Improvement Center (CIMMYT), an internationally funded nonprofit agricultural research and training organization located in Mexico City, established the Scientific Information Unit (SIU) in late 1984 as an integral part of CIMMYT's information services (Hesse de Polanco, 1985). Specific activities of the three major components of the SIU include delivery of bibliographic services to individuals and institutions in developing countries, a document delivery service, development of local management information databases covering CIMMYT-generated and other relevant grey literature, and the production of state-of-the-art reviews prepared by invited

senior visiting scientists and selected CIMMYT staff. *Wheat, Barley and Triticale Abstracts* (produced by CABI), *Wheat, Barley and Triticale Bibliography* (produced by CIMMYT in collaboration with AGRIS), and *Maize Abstracts* (co-published with CABI), are provided free to libraries and collaborators in developing countries. They are available in developed countries by paid subscription. Online searches are performed in the major world bibliographic databases in response to specific requests.

The current awareness services of Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia, were developed for applied agricultural researchers in the developing countries of the tropics (Harris, 1985). Other heavy users of this service include persons and institutions that are directly involved in technology transfer, crop production, and agricultural training activities. Various user groups of CIAT were surveyed to determine ways to meet their information needs. The pages of contents service is the most heavily used of the services offered. All of the users participating are notified of every journal article available in CIAT's library regardless of the language, origin of publication, or length. The Cassava Information Center, the Bean (*Phaseolus vulgaris*) Information Center, and the Tropical Pastures Information Center (all CIAT information centers) have narrow subject scopes and differing methodologies for covering these subject areas, but their current awareness services are similar to the CIAT library's program. Each of the information centers abstracts items received and publishes three compilations of these abstracts each year. Each also offers document delivery services. Requests for literature searches of the information centers' databases are accepted, and specialized bibliographies are available to users. Nonbibliographic reference questions are accepted at the information centers and, if these cannot be answered by the librarians or information specialists, they are referred to a collaborating scientist or to another source of information. The centers' personnel may also be involved in the analysis and synthesis of information for users. They might, in addition, develop reference tools for the researchers, including such items as multilingual thesauri, fact sheets, and articles for newsletters or technical bulletins.

The U.S. National Agricultural Library, as mentioned earlier, has several information centers. The model for these centers is the Food and Nutrition Information Center (FNIC) founded in 1971 (Frank, 1988). In addition to the specialized collection, there is also an active exhibits program. Staff members, including registered dietitians and nutritionists, are often asked to speak and exhibit at various national meetings covering a broad range of topics. The FNIC is a national demonstration center for food and nutrition microcomputer software. Information resources for consumers, educators, professionals, and others are listed on various "pathfinders," specialized bibliographies, or information sheets. NAL has information that centers in the following areas: agricultural

Trade and Marketing, Alternative Farming Systems, Animal Welfare, aquaculture, biotechnology, critical agricultural materials, family, fiber and textile, food irradiation, horticulture, rural, and youth development.

NEW TECHNOLOGY AND REFERENCE IMPLICATIONS

Besides the several new types of electronic reference tools now used routinely in many libraries, there are a number of recent technical innovations being tested. While some of these are being used as reference tools today, others may not be in common use for several years.

A recent addition to the array of electronic tools enhancing reference services is the expert system. An expert system is a sophisticated software program which allows a library patron to be guided through a set of decision-making steps to arrive at answers. The present use of these systems allows the user to interact with a consistent and readily-available tool to answer repetitive questions about such things as public access catalog use, end user database searching, and reference and referral in the library (Travis, 1989, p. 41). Two of the first sophisticated library expert systems were agricultural. The NAL introduced its Answerman system in 1986. Designed for use on a microcomputer, it points users to a variety of agriculture-related reference books and corresponding page numbers (Waters, 1986). A sample component of Answerman is the AquaRef system, an expert advisory system on aquaculture with the capability of being linked to other external programs including bibliographic databases and CD-ROMs (Hanfman, 1989).

Another innovation in optical disc technology is the videodisc—a larger (12 inch) disc than the 5 1/2 inch CD-ROMs with the ability to store and display thousands of images. The videodisc is being used in a number of agriculture-related pilot projects at the National Agricultural Library to demonstrate the medium's textual and graphic storage possibilities (André, 1989, pp. 330-32). The videodisc format has shown great potential for future publication and storage of information since it combines the advantages of compact storage, full-text retrieval, and good image resolution. A number of U.S. land-grant university libraries have cooperated with the NAL in the production of such titles as *Soil Taxonomy*, the *National Corn Handbook*, and the *Fact Book of Agriculture* in this format (p. 330). Another project is the National Agricultural Text Digitizing Project which is testing the feasibility of capturing text and images in digital format for publication on CD-ROM discs. The project began with the production and distribution to forty-four participating land-grant libraries in 1989 of a test disc on aquaculture. The project will continue with a second disc consisting of publications on international agriculture that will be selected by the Consultative Group on International Agricultural Research (CGIAR). This second disc is being supported by the World Bank and the United Nations (p. 331).

These experiments with optical disc technology may revolutionize

agricultural reference work. The concept of scanning documents to store their text and images on a disc, then being able to search the text for keywords has dramatic implications for libraries. What directions this new technology will take and how rapidly is not easy to predict. There are a few problems to resolve before the revolution takes affect in most agricultural libraries. At the moment, videodisc technology is expensive and there is some uncertainty about the permanence of the data on the discs. These barriers will probably be removed in the next few years as new technology advances and as commercial interests enter the field to compete for a new market.

Farmers and extension agents are now tapping into a number of electronic information utilities via videotex and teletex. Videotex is an interactive information system in which data are transmitted over telephone lines between a distant computer and a home television screen or computer screen. Teletex allows the home viewer to receive only the information, while videotex allows the viewer to interact with the remote computer in order to select, manipulate, or input information. Frank (1987, pp. 312-14) provides a good discussion of a number of North American agricultural utilities of these types. AGNET (AGricultural NETwork) was a major videotex service developed by the University of Nebraska College of Agriculture in 1975 to offer management models, current agricultural information, and national and international electronic communication. By 1985 it was self-supporting and was accessed by users in forty-seven states and nine countries (Rice, 1985). During the late 1980s this pioneering service began to falter due to a drop in subscriptions (from 1,000 to 600); rising maintenance costs; the introduction of sophisticated programs for microcomputers; and competition from other services ("A Reflection," 1988). Although AGNET ceased operations in December 1988, at least twenty other North American electronic agricultural information services continue to thrive ("Electronic," 1989).

AgriData Network based in Milwaukee, Wisconsin, is a commercial videotex service which offers national and international news, financial information, weather services, commodity information, and other services. The producer, AgriData Resources, Incorporated, has expanded its services into the international marketplace by forming the AgriData Worldwide system through agreements between AgriData Network/Uninet and international carriers who link to public data networks in the user's country ("AgriData," 1985, p. 13). Another service is ProNet (Packer Produce Network) available in the United States and Canada from Vance Publishing Corporation. ProNet contains price and availability information for fresh fruit and vegetable commodities as well as market analyses, general industry news, and weather (Linden, 1985, p. 10). A new entrant into the business of electronic information delivery is Pioneer Information Network (PIN), an online product of Pioneer Hi-Bred International, Incorporated. The producers of PIN

intend to keep its service easy to use, responsive, and hope to capture subscribers who formerly used AGNET ("It's Too Soon," 1988). A major information service offered by the USDA is its EDI (Electronic Dissemination of Information) Network, providing reports, weather information, and national as well as international trading data ("USDA activities," 1989). The EDI Network is operated by Martin Marietta Data Systems under contract with the USDA.

This arrangement of the U.S. government to provide agricultural information through private vendors has many librarians concerned that a category of "information poor" farmer may not be able to afford the subscription rates of the "privatized" services (Kranich, 1989). Farmers or other users who cannot afford such services may find assistance from their local public library. Although most public libraries are understaffed and have limited resources, there are cooperative networks that can allow them to tap into the resources and reference expertise of larger libraries. Formal reference networks and cooperative reference programs have been explored and are being used successfully to some extent. The Library of Congress, for example, has established a program of cooperative reference with state and public libraries in order to refer questions to the appropriate library (Hahn, 1981). Other state and regional cooperative services, such as the Slavic Reference Service at the University of Illinois and cooperative online searching in Kansas, are being developed to better utilize the limited resources of libraries (Rettig, 1981; Martin, 1986). MINITEX is an interactive network of academic, state agency, and public libraries in Minnesota, North Dakota, and South Dakota intended to provide reference service to some 200 local libraries with limited reference resources (Dustin, 1988). The NAL's concept of a national agricultural network is still in its inception but someday may be a vehicle to provide cooperative reference services within the United States (Thomas, 1989). All these efforts, however, are limited at this point in time and need to be enhanced.

CONCLUSION

The new technology sweeping the world of information science has had a dramatic impact on the working lives of most agricultural reference librarians. This new technology has helped solve many problems but has also created a number of new challenges. Computers, particularly microcomputers, and better and more plentiful telecommunication systems and equipment, have supported a much greater bibliographic control of the agricultural literature. Increased access to both bibliographic information and to documents themselves, and more rapid delivery of information and documentation have resulted.

For the library clientele, particularly in the academic community, the new technology has enabled users to become truly end users, allowing them in many cases to bypass completely the agricultural librarian to access the automated databases. CD-ROM stations and user-friendly

database searching packages permit users to search the literature without the services of an intermediary. In combination with the perception of many users that the librarian and library are barriers between them and their information needs, this capability sometimes misleads users into relying on incomplete information. Librarians need to work with their users to ensure that the use of end user systems does not lead to the acceptance of a myth that those systems are the answer to all information needs. Most of these systems, including CD-ROM, expert systems, videotex, and end user online services, should be seen as just one step in accessing the complex literature of agriculture.

Private sector libraries and information and documentation centers frequently have a strong service orientation. The increased availability of technological advancements allows the staff in these organizations to improve the quality and quantity of the services provided. Although many of the collections of these facilities are not included in any of the cooperative utilities, automation does permit improved in-house bibliographic control. CD-ROMs permit online searching of a broadly based body of literature but are not dependent on the availability of telecommunication systems or the financial resources to access them.

The challenge to increase the sharing of agricultural information, whether through cooperative acquisition programs, last location for specific journal titles in regional agreements, cooperative reference, automated information databases, or other programs, is particularly important in these times of decreasing budgets. Ways must be found to open avenues of cooperation and accessibility in order that agricultural information is shared with those who need it.

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