
Sources of Agricultural Information

DOUGLAS E. JONES

ABSTRACT

THE CONCEPT OF AGRICULTURE today embraces not only the traditional areas of food and fiber production, but an increasingly broad spectrum of related subjects and concerns which have become important to this evolving field. This article will provide an overview of the types of agricultural information, the formats now being utilized for its storage and distribution, the organizations which play a role in its creation and dissemination, and, finally, where it may be found or how it may be accessed.

INTRODUCTION

The first part of this article identifies principal sources of agricultural information—who produces it, what forms it takes, and where it comes from; the second part provides a brief look at major library collections where agricultural information may be found or otherwise accessed. Representative examples are provided throughout with suggested sources for fuller and more detailed information.

A necessary concern when considering sources of agricultural information is the different types of agricultural information now available. Books and journals, both popular and scholarly, undoubtedly will continue to be the principal means of providing agricultural information. Theses, dissertations, and conference proceedings are included in this category. Another familiar form is the research report or technical bulletin published by experiment stations, government agencies, or other research organizations. Maps, aerial photographs, and related sources are important for the study of soils, water, plant pathol-

ogy, and other disciplines. Patents and other types of intellectual property have traditionally been important for agricultural engineering, and now biotechnology, hybridization, and gene splicing make this an even more important type of information. Laws, standards, and official guidelines play an increasingly important role in agriculture whether in the area of farm labor or pesticide application. The widespread use of computers has produced a growing number of numeric and textual databases in electronic format containing everything from weather forecasts to market reports. Many of the organizations discussed later are involved in the production and distribution of information in several of these forms. A fuller review of this topic is contained in the chapter on "Agricultural Literature" in *Information Sources in Agriculture and Food Science* (Lilley, 1981).

ORGANIZATIONS WHICH PRODUCE AGRICULTURAL INFORMATION

The organizations involved with the funding, production, or distribution of information fall somewhat naturally into a spectrum ranging from those with primarily local concerns to those with broad regional or international concerns. However, the increasingly interdependent nature of research, technology, and commerce means that even a narrowly focused state agency may need to concern itself with international issues.

Local Level

Major sources of information at the local or state level are colleges and universities. These institutions play a unique and indispensable role in the conduct of basic and applied research, much of which is done in response to the local geoclimatic and socioeconomic conditions.

In the United States, the seventy-two land-grant institutions provide a vast array of agricultural information through the agricultural experiment station and extension service programs. These institutions, together with fifty-three other state universities and twenty-four system administration offices, constitute the National Association of State Universities and Land Grant Colleges (NASULGC) which collectively represents the largest body of researchers and resources for agricultural research and development. Typically, each institution has a college or other similar organizational unit for agriculture with a publication or information section responsible for distributing research and extension materials. The information distributed via official college, agricultural experiment station and extension service bulletins, reports, and other publications represents only a small fraction of the total information generated at such institutions. The remainder is distributed via books, journals, conference proceedings, etc. Additional information on NASULGC members is contained in *Serving the World: The People and Ideas of America's State and Land-Grant Universities* (NASULGC, 1987).

Outside the United States, colleges and universities perform similar roles in generating and distributing information. Although arrangements vary considerably, typically one must contact the appropriate department within the college or university to arrange for publications, and it is not uncommon for materials to be available only on an exchange basis. A variety of national and international directories provide listings of departments within colleges and universities; *World of Learning* (1988) is particularly useful, not only for its international coverage but for its listing of publications by each institution.

Also of importance at the local or state level are the many governmental research and regulatory agencies concerned with agriculture from a variety of public perspectives including marketing, statistics, pesticide and environmental controls, water resources, farm labor, land-use planning, and soil conservation. These agencies tend to be more challenging for libraries to identify and their publications more difficult to acquire systematically. For the United States, the *State Government Research Directory* (Gill & Tufts 1987) is an attempt to identify many of these agencies, and although the list is limited to government-funded research, many regulatory agencies also are included because research is a necessary part of their regulatory responsibility. For information on such agencies outside the U.S., sources such as the *Worldwide Government Directory* (1987) provide a useful, if somewhat limited, list of state or province-level agencies. Also, some subject-specific directories such as *Horticultural Research International* (International Society for Horticultural Science 1981) provide good access to local agencies.

In addition to universities and local governmental agencies there are many private agricultural organizations, the membership of which ranges from professionals to practitioners to interested individuals. In the United States these organizations are largely state-based interest groups, sometimes representing local chapters of a national parent group. The *Directory of American Agriculture* (1989), for example, lists over 4,000 such organizations on a state-by-state basis. Generally, the publications of these groups are limited to newsletters and public awareness pamphlets; however, many also publish substantive reports of enduring local or even national interest. Acquisition of these documents tends to be difficult and scattered at best, and, therefore, bibliographic control of these materials very poor.

National Level

The principal sources of information at this level are the national governments, national research organizations, and companies or corporations involved in agricultural research. The United States will be discussed as an example of national government information sources.

The U.S. federal government is one of the largest sources of agricultural information in the world by virtue of the studies done by federal researchers, as well as federally funded research conducted by both

public and private research organizations. For example, in 1988 the AGRICOLA (Agricultural Online Access) database listed over 1,500 U.S. Department of Agriculture (USDA) publications and the National Technical Information Service (NTIS) database of technical reports listed over 760 items sponsored by the USDA. Distribution is largely accomplished through either the Government Printing Office (GPO) or the National Technical Information Service. In addition, many federal agencies regularly distribute information beyond what is made available via the GPO or the NTIS.

Publications originating from regional branches of federal agencies represent a special concern because many are not made available to either GPO or NTIS for further distribution and bibliographic control. Federal depository librarians have long been concerned by these "fugitive" documents (Bower, 1989) which are often referred to in press releases, editorials, journal articles, or other federal documents, but which are essentially "lost" and difficult to obtain or even identify accurately.

There is a disturbing trend, unfortunately, toward less federal information being distributed through the Government Printing Office. For the years 1980-82, a tally of the USDA entries in the *Monthly Catalog of U.S. Government Publications* (MoCat) shows a total of 5,025 publications listed or an average of 1,675 publications per year. During the period 1986-88, the latest years available, the total number of entries is down to 3,734 or an average of 1,245 publications per year, an average decrease of 430 items per year or 26 percent. It is possible, of course, that there were actually 26 percent fewer documents produced by the USDA during that same time period; however, this seems highly unlikely. What seems more likely is that there are more fugitive documents, and/or more information is being stored in electronic format and not "published" in a customary way. Agricultural librarians used to relying on the federal depository library program as a passive way of acquiring government documents may need to be increasingly wary of such an approach.

It is not yet clear how, or even whether, access to the vast amount of information now being generated in electronic format by federal agencies and its contractors will be managed. Kranich (1989) provides an insightful and disturbing assessment of this issue and its potential impact on agricultural information users. The cost reduction philosophy behind the *Management of Federal Information Resources* guidelines (United States. Office of Management and Budget, 1985) is in direct conflict with the equal access to information policy under which most libraries operate. Perhaps most disturbing is the definition generally used by the Office of Management and Budget (OMB) which suggests that machine-readable data files are generally not considered government publications and are therefore not subject to the same accessibility and dissemination guidelines as other government information.

In addition, the OMB circular strongly encourages dissemination through private sources which raises a host of concerns including currency, cost, accessibility, and long-term availability.

The USDA is, of course, most prominent as a source of agricultural information. It is comprised of forty-nine major agencies, the titles of which serve as a veritable catalog of the subjects and concerns of modern agriculture, from soil conservation and commodity credit to human nutrition and world agriculture. In addition, a variety of other federal departments and agencies provide vital information for agricultural interests. Within the Department of Interior, for example, the Bureau of Reclamation, Bureau of Land Management, and, to a lesser extent, the Fish and Wildlife Service and the Park Service conduct a great deal of research related to water resources, grazing, and watershed management, fisheries and forestry. Even within an agency such as the Department of Defense there are units such as the Army Corps of Engineers and the Defense Mapping Agency which produce research reports and maps of interest to agricultural researchers.

Maps and atlases are often overlooked as sources of agricultural information, yet they provide unique and readily comprehensible information on topics such as soils, water, vegetation, desertification, climate, disease, and pest distribution. Soil survey maps such as those prepared by the U.S. Soil Conservation Service are a familiar example. The quality and usefulness of thematic maps and atlases is not as widely appreciated as it should be. For additional information, *Map Librarianship* (Larsgaard, 1987) provides an excellent overview and useful bibliographies. New remote sensing techniques are being applied to a variety of agricultural concerns. The Earth Resources Observation System (EROS) Data Center located in Sioux Falls, South Dakota, for example, provides access to over 11 million images and photographs. The *Remote Sensing Sourcebook* (Carter, 1986) is a comprehensive worldwide guide to these sources of information.

Another unique source of agricultural information is the patent, an increasingly important component in technology transfer. Most of the major advances in agricultural engineering and machinery, agricultural chemicals and pharmaceuticals, and, more recently, biotechnology (including genetic engineering, tissue culture, and enzymes) can be documented in the patent literature. Plant patents for asexually reproduced new plant varieties are also handled by the Patent and Trademark Office (PTO). Copies of patents are available from the PTO, from patent depository libraries located throughout the United States, and through a variety of document delivery services. New sexually reproduced cultivars are protected through the Plant Variety Protection Office which is a part of the Agricultural Marketing Service of the USDA. Evenson (1989) provides an interesting overview of this topic using patents as a basis for studying technology transfer and agricultural competitiveness. Several guides are available which provide detailed

information on sources of patent information in other countries—for example, *Patents Throughout the World* (Greene, 1985) and *Patent Information and Documentation in Western Europe* (Bank et al., 1981).

While the size and complexity of U. S. government agricultural research make it unique, organizational structures and sources of agricultural information of most other national governments address similar concerns in recognizably common patterns. In the United Kingdom, for example, one finds the Ministry of Agriculture, Fisheries and Food (MAFF) and the Agricultural Research Council (ARC) with their various departments, institutes, and stations. Her Majesty's Stationery Office (HMSO) publishes many of the official materials while the individual agencies also publish a large number independently. Readers are referred to the *Worldwide Government Directory with International Organizations* (Gill & Tufts, 1987) or the *Europa Yearbook* (1988) for country by country listings. In addition, many country-specific and region-specific yearbooks and handbooks provide more detailed agency listings.

Regional, International, and Professional Organizations

In the second half of the twentieth century, professional associations and research organizations have become major sources of information through their sponsorship of research; publication of journals, books, and reports; establishment of standards; and organization of conferences. The number and variety of these organizations reveal a vast network of communication and common concerns. For example, the *Agricultural Research Centres* (1988) directory and encyclopedias of associations (Koek K. E., 1989; Burek et al., 1989) list over 15,000 agricultural organizations. The range of subjects and geographical coverage represent the entire spectrum of current agricultural interests, from the Crawfish Research Center at the University of Southwestern Louisiana to the Consultative Group on International Agricultural Research (CGIAR) with its thirteen institutions spread throughout the world. The following list, while highly selective, identifies some of the major associations and research centers in a variety of areas.

An excellent example of a national organization concerned with agriculture across several disciplines is the American Society of Agronomy (ASA) located in Madison, Wisconsin. It currently has over 12,000 members concerned with crop production and soil management and publishes five major journals, two directories, and monographic and special publication series.

At the regional and international level are several important organizations. Perhaps foremost is the Food and Agriculture Organization of the United Nations (FAO), headquartered in Rome with a staff of 7,000 and a budget of \$250 million. Its broad goals of increasing agricultural production, raising nutritional levels, and improving the quality of rural life are appropriately addressed primarily to developing countries

where the need to provide food and clothing is critical as a basis for further development. FAO produces a variety of journals, reports, indexes (including the AGRIS database), handbooks, and training manuals. These include practical materials designed for the farmer in developing countries as well as research materials for scientists and engineers. A special microfiche program is available which automatically provides copies of all publications listed in *FAO Documentation: Current Bibliography* (United Nations, 1972) including the useful, but otherwise difficult to acquire, working documents and field reports.

The Consultative Group on International Agricultural Research (CGIAR) also focuses on research designed to meet the needs of developing countries. Based in Washington, D.C., and supported in part by the World Bank, FAO and the United Nations Development Programme (UNDP), CGIAR supports thirteen specialized international agricultural research organizations such as the Centro Internacional de Agricultura Tropical (CIAT), International Rice Research Institute (IRRI), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the International Livestock Centre for Africa (ILCA).

In addition, many regional organizations have been formed to address common concerns. CAB International in Wallingford, England, is one of the best known and broadly based with representatives of Commonwealth and other nations and territories. Its many specialized bureaus and research centers not only conduct research of worldwide interest, but the library collections serve as the basis for the highly regarded CAB abstract journals. The Asian Productivity Organization (Tokyo), consisting of seventeen Asian and Pacific governments, serves as a think tank and catalyst for research on problems in that region of the world as well as providing training, consulting services, and publications—e.g., newsletters, books, and conference proceedings. A similar organization in the Americas is the Interamerican Institute for Cooperation on Agriculture (IICA). Based in San Jose, Costa Rica, it includes members from the Organization of American States and focuses on research, training, and rural development. A large publication effort includes training manuals, reports, journals, indexes, and bibliographies. A unique award offered by IICA is the Inter-American Agricultural Award for the Participation of Women in Rural Development.

Other types of organizations critical to agricultural research and the provision of information are those which play a large role in funding research but generally do not directly conduct it. *Agricultural Assistance Sources* published by the International Agricultural Development Service (1982) provides an excellent overview of the primary organizations providing international agricultural assistance including scope, interests, addresses, and brief bibliographies. In addition to providing funding, most sponsor conferences and publish reports, monographs, manuals, and newsletters.

The multilingual or regional organizations are among the best known. Foremost among these is the World Bank, based in Washington, D.C., which serves as one of the largest single sources of aid for agricultural research and development in Third World countries. Founded in 1945, the World Bank consists of three institutions: the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), and the International Finance Corporation (IFC). Other important agencies of this type include the Arab Fund for Economic and Social Development (Safat, Kuwait), the African Development Bank (Abidjan, Ivory Coast), the Asian Development Bank (Manila, Phillipines), the Inter-American Development Bank (Washington, D.C.), and the International Fund for Agricultural Development (IFAD) (Rome).

In addition, many private, nonprofit institutions provide significant funding for agricultural research and development. Representative institutions include the Winrock International Institute for Agricultural Development (Morrilton, Arkansas), and the International Development Research Centre (IDRC) (Ottawa, Canada), the Ford Foundation (New York), and the Saudi Fund for Development (Riyadh, Saudi Arabia).

Bilateral assistance organizations constitute the third major funding group and the largest source of funding. The U.S. Agency for International Development (USAID) located in Washington, D.C., ranks at the forefront of such organizations, along with the Canadian International Development Agency (CIDA) in Quebec, Canada, the Swedish International Development Authority (SIDA) in Stockholm, Sweden, as well as many other European and Pacific Rim countries.

Beyond the large agricultural organizations with broad interests are many with a more specialized focus such as professional societies and trade associations. At the national level, one finds examples such as the Soil Science Society of America (SSSA) with over 6,000 members and a budget of \$750,000. It publishes three of the principal journals in the field as well as a special publication series. A related organization is the Soil and Water Conservation Society with 14,000 members and a budget of \$900,000. Its twenty-five standing committees reflect a wide range of interests. Similar to SSSA, it publishes one of the premier research journals in the field as well as a variety of monographs and technical reports. The American Society of Agricultural Engineers (ASAE), another major professional society with some 9,000 members and a \$2.5 million budget, not only publishes journals and monographs, but, like many of its engineering society counterparts, provides a large number of technical reports on microfiche and establishes standards and specifications for equipment and structures. Similarly, the Association of Official Analytical Chemists (AOAC), formerly the Association of Official Agricultural Chemists, publishes *Official Methods of Analysis* (Williams, 1984) which is recognized throughout the world as the authoritative source in this area. AOAC also publishes a variety of journals,

books, conference proceedings, and manuals. Two examples of soil and water engineering organizations at the international level are the International Institute for Land Reclamation and Improvement (ILRI) in the Netherlands, which is particularly concerned with management of land and water resources in developing countries, and the International Commission on Irrigation and Drainage (ICID) in New Delhi, India, which is largely concerned with irrigation, drainage, and flood control and strongly encourages not only engineers, but economists, ecologists, social scientists, and agricultural specialists to address these topics.

The plant sciences have general associations as well as ones for most individual cultivars. The Crop Science Society of America (CSSA), based in Madison, Wisconsin, has sixteen standing committees addressing a broad spectrum of concerns relating to field crops. Its journals and other publications are recognized as standard works in the field. Among the many noteworthy international organizations is the Netherlands-based International Society for Horticultural Science (ISHS) whose membership includes both scientists and institutions from eighty-six countries around the world. Its journals, conference proceedings, and research directory, *Horticultural Research International*, are recognized worldwide for their quality and timeliness.

Several regional organizations are important as specialized sources of information. The Asian Vegetable Research and Development Center (AVRDC), headquartered in Taiwan with representatives from Germany, Japan, China, Phillipines, Korea, Thailand, and the U.S., is dedicated to research in the development of crops in the humid and subhumid tropics. The International Institute of Tropical Agriculture (IITA) located in Ibadan, Nigeria, performs a similar function with a focus on tropical crops such as maize, cowpeas, soybeans, and cassava. Dryland agriculture poses unique problems for an increasingly large number of farmers using marginal land and water resources. One response has been the establishment of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India which focuses on improved plant varieties and methods of soil and water management.

Concerns about seed quality and availability have fostered many organizations and professional societies concerned with seed science and technology as well as the seed trade. In the United States, for example, the American Seed Trade Association (ASTA), located in Washington, D.C., includes fifty-three state groups representing breeders, growers, wholesalers, and retailers of all types of seeds. Established in 1883, ASTA has a long history of research and publication addressing the needs of the seed industry. The International Seed Testing Association (ISTA), with headquarters in Zurich, Switzerland, develops, publishes, and promotes the uniform application of standard procedures for sampling and testing seeds. In addition, ISTA promotes research in all areas of seed science and technology and publishes journals, conference proceedings, handbooks, and a glossary.

Crop protection is another area well represented by active research centers and societies at national, regional, and international levels. A national example is the Entomological Society of America (ESA) based in Lanham, Maryland, which has over 9,000 members and a budget of \$1.5 million; its many committees and sections range in interest from "Systematics" to "Extension and Regulatory Entomology" and its journals, reference standards, and tests represent basic works in this field. A well-known and important agency at the regional level is the European and Mediterranean Plant Protection Organization (EPPO) which, as the name suggests, emphasizes crop and forest protection in Europe. Based in Paris, it publishes two journals and numerous technical reports. Of somewhat broader scope is the International Centre of Insect Physiology and Ecology (ICIPE), based in Nairobi, Kenya. Its aim is to promote advanced insect biology research, provide advanced training to selected fellows, and contribute to increased food production by studying pests of major crops (such as sorghum shootflies and cereal stem-borers) and livestock diseases (such as tsetse flies, ticks, and other disease vectors), especially those plaguing developing countries.

A related area of widespread interest and research is weed science. The Weed Science Society of America (WSSA), located in Champaign, Illinois, is a key organization with members from academe, industry, and regulatory agencies. It publishes two major journals and sponsors an annual convention. The European Weed Research Society (EWRS), headquartered in West Germany, includes members from over forty countries and focuses on communication, education, and training through the publication of journals, conference proceedings, and a directory. The International Weed Science Society (IWSS) in Corvallis, Oregon, fosters communication between the many weed science and related societies. While it is neither as large nor as active as the other two organizations, it nevertheless provides a very important liaison function as well as encouraging research and sponsoring symposiums.

Forestry and range management have assumed an increasingly larger role in agricultural research because of their impact on watershed management and soil conservation. The fuelwood crisis in much of the Third World also has pushed agroforestry forward as a major research area. Two examples of national organizations are the Society of American Foresters (SAF) and the Society for Range Management (SRM). Each publishes a number of key journals and other technical materials important to research in this area. Internationally there are many noteworthy organizations including the International Union of Forestry Research Organizations (IUFRO), representing over 15,000 scientists from 102 countries, and the International Council for Research in Agroforestry (ICRAF), which conducts studies and promotes research on joint land use problems in the tropics.

The area of animal science and livestock production includes an almost bewildering array of professional organizations and societies. In

addition to organizations concerned generally with animal production, health, welfare, and nutrition, it is probably safe to say that almost every type and breed of animal has one or more societies fostering research, publication, and education about it alone, from stately limousin cattle to the lowly opossum. The examples in the later discussion are purely illustrative and cannot begin to represent the range of organizations producing animal science information. However, directories such as *Agricultural Research Centres* (1988) and the encyclopedias of associations (Koek, K. E., 1989; Burek et al., 1989) are excellent starting points for additional information. The American Society of Animal Science (ASAS), located in Champaign, Illinois, is concerned with all aspects of animal production and processing, including livestock products. With over 4,500 members and four regional associations, it represents a major source in the production and dissemination of animal science information. At the international level are research organizations such as the International Livestock Centre for Africa (ILCA) based in Addis Ababa, Ethiopia, which emphasizes research on livestock production systems, especially ruminant livestock, for developing countries. ILCA not only conducts and publishes research, it also has embarked on a program to collect, microfiche, and index regional livestock literature. A more specialized area such as aquaculture, for example, has a variety of national, regional, and international organizations which sponsor and/or conduct research as well as publish the major journals in the field. The American Fisheries Society (AFS), founded in 1870 and now located in Bethesda, Maryland, has over 8,500 members and four regional groups representing all types of aquatic science professionals. Its three journals are among the core publications in the field. In addition, it produces a directory, books, and special publications. The World Aquaculture Society (WAS) in Baton Rouge, Louisiana, includes both plants and animals in its scope. It is international in scope and includes libraries and research institutions as well as individuals among its 2,300 members. Its journal and annual conference proceedings represent an important source of literature for the field.

This brief survey of organizations producing information would be remiss in not mentioning two additional areas critical to agriculture—money and people—that is agricultural economics and rural sociology. The American Agricultural Economics Association (AAEA), located in Ames, Iowa, has long been a major force in research, teaching, and publication. Its 4,500 members represent professionals from government, industry, and academe and its journals are key sources of information. An important example on a regional level is the Organisation for Economic Co-operation and Development (OECD) with headquarters in Paris. While the scope of OECD research and publication goes well beyond agriculture, it is nevertheless a key source of information on the economic aspects of European agriculture, fisheries, and environment as well as world trade and aid for developing countries. Among organi-

zations which provide sociological research and information, one cannot overlook the American Farm Bureau Federation (AFBF), headquartered in Park Ridge, Illinois, with over 3 million members, and the National Grange (NG), in Washington, D.C., with 400,000 members. The research done by both organizations is largely geared to solving local problems and supporting political action, but their concerns reflect the critical needs of farmers today. On a more scholarly level there is the International Rural Sociology Association (IRSA), currently located at Michigan State University in East Lansing, Michigan, with a membership of 1,600 rural sociologists and other social science professionals around the world. As with other such organizations, it fosters communication and research, sponsors conferences, and publishes a directory.

This review of organizations involved with the creation and dissemination of agricultural information provides evidence of two trends which portend important and challenging issues for agricultural libraries. First, there is significant growth in the number of such organizations—because of an increasing number of new or more specialized subject areas and because such organizations are being formed in states and countries where they did not previously exist. One result is that it is simply more difficult to identify, bring under bibliographic control, and provide physical access to the publications of such organizations. Librarians and documentalists must recognize this challenge and set in motion the information-harnessing apparatus necessary to deal with it. That may include educating policy makers and the governing boards of societies; it may include more networking and cooperative collection development among libraries at all levels, perhaps even the establishment of regional clearinghouses with responsibilities for both bibliographic and document control; and it may include some technological “fixes” such as optical scanning of elusive or local interest documents coupled with high-density storage technology. A second, related trend toward the formation of interdisciplinary associations further complicates the problem because it may well be more difficult to recognize such organizations and, once identified, the publications may be harder to classify and represent by subject headings. Subject areas such as environmental protection, global warming, biotechnology, technology transfer, and complex systems draw upon so many different disciplines for definition and methodologies that new terms and concepts are needed to intellectually corral them and make them accessible to others.

Commercial Publishers

Commercial publishers play a major role in the distribution of agricultural information through both journal and book publishing. Few publishers concentrate exclusively or even primarily on agriculture, but most major science publishers such as Elsevier Applied Science

Publishers, Pergamon Press, Butterworths & Co., Academic Press, Interstate Printers and Publishers, Springer-Verlag, Paul Parey, Lewis Publishers, A. A. Balkema Publishers, and CRC Press, to mention but a few, are active in agricultural publication. One interesting development in the last fifteen years has been for some professional associations and societies to turn the printing, distribution, and marketing of their journals, and sometimes books, over to commercial publishers while retaining editorial control at the society. Frequently this is done in recognition of the fact that publishing today requires the full-time efforts of both clerks and highly skilled professionals to deal with a variety of tasks from editing and printing to marketing, mailing, and subscription maintenance. It is not clear if this trend will continue or diminish, especially given the current widespread concern over serial price increases.

Another interesting phenomenon in recent years has been the amazing number of acquisitions and mergers of publishers. One result of that process has been increased centralization of press ownership among a few individuals and corporations, most of which are non-United States. The implications of this are not clear, but there is concern about monopolization and manipulation of the market system which might have significant consequences for the availability of information. University presses provide an important, although relatively small, supply of scholarly works, often based on regional or special subject interests. One concern apparently shared by both large and small presses is the difficulty of finding good scientific authors. Frequently, the most knowledgeable experts are so involved with research or other commitments that they cannot afford the time professionally to write the many books that probably should be written. Faculty seeking promotion and tenure may feel that six articles will carry more weight with peer review committees and administrators than one book. Hence, journals and conference proceedings continue to flourish. There are many positive aspects of commercial publication including the fact that materials can be easily identified and readily obtained. Generally speaking, the editing, typography, and graphics of books and journals today are of high quality, due in part to the high level of technology throughout the publishing process.

COMPUTERS AND SOURCES OF AGRICULTURAL INFORMATION

Computer-readable information sources deserve special mention because they present rather unique concerns and possibilities. There is a considerable body of agriculture-related software now available for tasks such as recordkeeping, management of crops and livestock, irrigation and fertilizer calculations, feed formulation, and vehicle maintenance. Some agencies, such as the state extension services in the United States, provide some software at no charge or for a small fee. Major software directories such as the *Software Catalog: Microcomputers*

(1989) and *Data Sources: Software* (1989) provide up-to-date listings by subject of commercially available programs.

Machine-readable databases are rapidly becoming the standard format for numeric information although some of that information also continues to be published in paper or microform. The range of information and sources is quite broad, including marketing and production data for crops and livestock; animal and human food; nutrition and consumption data; and soil, weather, and environmental data. National and state governments tend to be the chief collectors of this information, but, as mentioned earlier, their role in disseminating or making this information available is not yet clear. Evinger (1988) has surveyed U.S. federal agencies and compiled a list of *Federal Statistical Data Bases* which provides a brief description and availability information. The *Federal Data Base Finder* (Zarozny, 1987) also helps to identify many relevant sources. NTIS serves as a distributor of some federally produced software and databases, although their holdings represent a small portion of what is available. A slightly dated, but nevertheless useful, source is the *Agricultural Databases Directory* (Williams & Robbins, 1985). It includes information on 428 databases, both textual and numeric, from the well known *Computer-Readable Databases* (Williams, 1985) and additional information is provided on databases produced by some sixty extension services. The *Directory of United Nations Databases and Information Systems* (United Nations, 1985) provides descriptions of the many agriculture-related files maintained by the United Nations including their currency, scope, and availability.

A broad range of private, corporate, and governmental organizations provide funding for agricultural research, teaching, and study. Among the many guides and directories which list such funding sources is the *DRG: Directory of Research Grants* (1989), which provides a brief description of over 2,000 programs supported by federal and state governments, private foundations, corporations, and professional associations. In addition, the *Foundation Grants Index* provides information on grants awarded annually by over 400 major private foundations representing more than 20,000 new award listings each year (Kovacs, 1988). Both are available in print and online. In addition, the University of Illinois maintains a continuously updated list of research funding opportunities through the Illinois Research Information Service (IRIS). This list is available only online. With listings for over 4,000 funding opportunities available from both federal and nonfederal sponsors, it represents one of the largest and most comprehensive sources of current funding information.

Of special interest to U.S. researchers and those who help them find information is the USDA's Current Research Information Service (CRIS), a computer-based documentation and reporting system designed to track current publicly supported agricultural and forestry research projects. Each of the more than 30,000 records now available

includes key information about the investigator, performing organization, sponsoring organization, objectives, approaches, progress, and publications. CRIS is available online and recently has been put on a CD-ROM. The *Federal Research in Progress* (FEDRIP) database, compiled and distributed by NTIS, includes records submitted by the USDA as well as other records of potential interest from the Department of Energy, the National Aeronautics and Space Administration, National Institutes of Health, and the U.S. Geological Survey. It is available through DIALOG Information Services.

The principal bibliographic databases—AGRICOLA, CAB, and AGRIS—are discussed in detail in the article by Sarah Thomas, "Bibliographic Control and Agriculture," in this issue of *Library Trends*. However, there are several other bibliographic databases which supplement those three. For example, additional information on agricultural economics and the business aspects of agriculture can be found in the PTS F&S Index and PTS PROMPT, both produced by Predicasts, which focus on business magazines, newspapers, and trade journals to provide coverage on companies, new products or technologies, industry reports, regulations, sociopolitical factors, and related information. A related database, produced by Pioneer Hi-Bred International, is AGRIBUSINESS U.S.A., which covers all aspects of agribusiness including the crop and livestock industries, chemicals, biotechnology, finance, equipment, and marketing. A unique aspect of this database is that it includes bibliographic, limited full-text items, and statistical tables.

Food Science and Technology Abstracts and Foods Adlibra focus on processing—that is, turning the raw agricultural products into the foods that appear on grocery shelves. Subjects include vegetables, meats, drinks (wine as well as milk), and all aspects of processing and storage. Coffee drinkers may be interested to know that there is even a database devoted to that one amazingly popular drink—Coffeeline produced by the International Coffee Organization in London. For those interested in fish there is Aquatic Sciences and Fisheries Abstracts (ASFA) produced jointly by the National Oceanic and Atmospheric Administration and Cambridge Scientific Abstracts. ASFA covers both aquaculture and marine fisheries topics selected from over 5,000 sources of primary information. Selected Water Resources Abstracts, produced by the Department of the Interior, provides access to a broad range of materials dealing with water resources economics and planning, hydrology, irrigation, and water quality. It represents materials identified at over fifty water research centers and institutes in the United States.

Several directory-type databases are now available in the agricultural chemical field which provide detailed information such as one would expect to find in a handbook on the variety of chemicals used in agriculture. Among these are the Agrochemicals Handbook and the European Directory of Agrochemical Products, both from the Royal

Society of Chemistry, as well as the Pesticide Databank, jointly produced by the British Crop Protection Council and CAB International.

AGRICULTURAL LIBRARIES

Francis Crick, Nobel laureate and one of the discoverers of the molecular structure of DNA, has observed that "communication is the essence of science" (Crick, 1979). The first part of this article has examined one part of the communication process—the creation of agricultural information from its many sources and in its many forms. Another critical part of this large-scale communication process is storing and making available what has been created so that the link between one mind and another will be complete. By far the most widespread and successful means of fulfilling that mission to date has been through the creation of libraries where materials are acquired, bibliographically controlled, and systematically housed so that users can retrieve a book or journal directly. In the second half of this century, however, libraries—especially research libraries—are evolving toward a much more complex model in which physical collections will continue to be fundamental to the library, but, in addition, there will be increased systematic or planned reliance on other collections as well as increased utilization of electronic formats such as locally available CD-ROMs or remotely accessed full-text databases. The largest and best agricultural libraries are generally affiliated with the largest and best agricultural research programs. In the United States, for example, the older and larger land-grant institutions have generally excellent agricultural collections, most with special strengths important for regional research interests. The U. S. National Agricultural Library (NAL) houses perhaps the largest and richest collection of agricultural and forestry-related materials in the world and is especially strong in Americana but replete with materials from around the world. In addition, other major libraries house impressive, often unique, collections. For example, the U.S. Department of Interior library contains one of the largest collections on natural resources, reclamation, conservation, fish, and wildlife. Important specialized collections such as those on post-harvest storage technology at the Department of the Interior or the arid lands collection at the University of Arizona represent special strengths. The *Directory of Special Libraries and Information Centers* (1989) provides detailed descriptions of hundreds of special agriculture-related libraries throughout the United States and Canada. In the United Kingdom, the CAB International libraries, located at the various Commonwealth research bureaus and institutes, collectively represent very strong European materials as well as literature from developing countries. Agricultural holdings in the British Library are truly impressive with special strengths in twentieth-century journals and conference proceedings from around the world. The immensity of the British Library collection

plus the outstanding document delivery service provided by the Lending Division have made it one of the best known and most frequently used document delivery services in the world. In the related areas of natural history, ecology, and conservation the library of the British Museum (Natural History) surely ranks as one of the world's best collections.

In addition to strong national library collections, most countries also have specialized libraries associated with major agricultural research organizations. The FAO library in Rome contains an impressive collection which is especially strong in materials from Africa, South America, and Asia. It also includes the holdings of the former International Institute of Agriculture Library. Another example of a specialized research collection is that of the International Rice Research Institute in the Phillipines which attempts to collect rice-related materials comprehensively. IRRI is now considering the feasibility of publishing the institute's many publications on CD-ROM.

CONCLUSIONS

The success of the agricultural enterprise in today's world is as critical to the success of society as it was 5,000 years ago, in fact, perhaps more so today. The effectiveness and efficiency with which a country or a people produce the food and fiber necessary to meet basic human needs is a basic measure of the quality of life. The types and sources of agricultural information reviewed here reveal a variety, complexity, and mass of information. The books, journals, conference proceedings, maps, theses, reports, remote sensing imagery, patents, and other types of information emanating from tens of thousands of sources are a testament to the richness of the field which must somehow be managed. It also suggests a commitment and concern on the part of individuals and governments in every part of the world to improve that effectiveness and efficiency. Our task as librarians is to facilitate the communication process, to ensure that researcher *A* can identify and get access to what researcher *B* has learned, to make sure that those involved in technology transfer at whatever level have the resources to do their job, and to ensure that policy makers and the general public have access to appropriate information.

The questions which present themselves are challenging ones and are certainly not unique to agricultural libraries. Since no single library can collect everything, what should it try to collect? What agreements can be reached between libraries to try to ensure that nonephemeral materials are collected somewhere? How can the identification and bibliographic control of materials be improved? How can technology be used to facilitate the storage and retrieval of information?

Perhaps the best answer is that librarians must be proactive. They must educate themselves and others about the problems and concerns they face. "Others" includes not only users but administrators, policy

makers, legislators, and the public. Librarians need to work actively with the sources of information—e.g., publishers, professional associations, government agencies, etc.—to make them aware of problems and, it is hoped, become a part of the solution. Perhaps the model used by the Engineering Societies Library (ESL), in which the professional engineering associations actively deposit their materials with ESL in exchange for their long-term storage and listing in *Engineering Index*, could be aggressively pursued by NAL and other national libraries. Agricultural librarians should be encouraged to publish in appropriate agricultural journals as well as library journals. Existing organizations, such as the American Library Association, the Special Libraries Association, and the International Association of Agricultural Librarians and Documentalists, can provide effective forums for discussion and action. The newly formed United States Agricultural Information Network (USAIN) has a unique opportunity to play an important role in addressing this and other related issues. As it becomes increasingly difficult for libraries to acquire as much information as they and their users believe they need, libraries must focus more attention on the issues of access to information beyond the local level and to making access more readily available and hassle-free. Perhaps it is time to consider more seriously such seemingly farfetched notions as computerized clearinghouses of electronically scanned documents using the library as a gateway. Indeed, many documents and databases are now essentially “uncollectable” because they are available only on a computer somewhere and known to only a few. As newer computer technologies make older ones obsolete, such information is at risk of being lost forever. It is hoped that new storage technologies such as CD-ROMs, in conjunction with systematic information management policies, will provide the means to address this concern.

REFERENCES

- Agricultural research centres: A world directory of organizations and programmes* (9th ed.). (1988). Essex, United Kingdom: Longman.
- Bank, H.; Fenat-Haessig, M.; & Roland, M. (1981). *Patent information and documentation in Western Europe*, (Commission of the European Communities). Munchen: K. G. Saur.
- Bower, C. E. (1989). Federal fugitives, DNDs and other aberrants: A cosmology. *DttP, Documents to the People* 17(3), in press.
- Burek, D. M.; Koek, K. E.; & Novallo, A. (Eds.). (1989). *Encyclopedia of associations, national organizations of the U.S.* Detroit, MI: Gale Research Inc.
- Carter, D. J. (1986). *The remote sensing sourcebook: A guide to remote sensing products, services, facilities, publications and other materials*. London: Kogan Page Ltd.
- Crick, F. (1979). Quoted in Garvey, W. D., *Communication: The essence of science* (p. ix). Oxford: Pergamon Press Ltd.
- Darney, B. T., & Leighton, H. M. (Eds.). (1989). *Directory of special libraries and information centers*. Detroit, MI: Gale Research Inc.
- Directory of American agriculture* (Vol. II). (1989). Washington, DC: Agricultural Resources & Communications, Inc.
- DRG: Directory of research grants*. (1989). Phoenix, AZ: Oryx Press.
- Europa world yearbook*. (1988). London: Europa Publications Ltd.

- Evenson, R. E. (1989). U.S. agricultural competitiveness: evidence from invention data. In J. J. Molnar & H. Kinnucan (Eds.), *Biotechnology and the new agricultural revolution*. AAAS Selected Symposium: 108. Boulder, CO: Westview Press. 173-208.
- Evinger, W. R. (Comp.). (1988). *Federal statistical data bases: A comprehensive catalog of current machine-readable and online files*. Phoenix, AZ: Oryx Press.
- Fisher, G. (Ed.). (1989). *Data sources: Software*. New York: Ziff-Davis Publishing Company.
- Gill, K., & Tufts, S. E. (Eds.). (1987). *State government research directory: A descriptive guide to basic and applied research and data collection programs and activities sponsored and/or conducted by the government agencies of the 50 states, the District of Columbia, and the U.S. territories. Worldwide government directory with international organizations*. Bethesda, MD.: National Standards Association.
- Greene, A. M. (1985). *Patents throughout the world*, 3rd ed. New York: Trade Activities.
- Horticultural research international: Directory of horticultural research institutes and their activities in 61 countries*. (1981). Wageningen: PUDOC, Centre for Agricultural Publishing and Documentation.
- International Agricultural Development Service. (1982). *Agricultural assistance sources* (4th ed.). Arlington, VA: International Agricultural Development Service.
- Koek, K. E. (Ed.). (1989). *Encyclopedia of associations, international organizations*. Detroit, MI: Gale Research Inc.
- Kovacs, R. (Ed.). (1988). *Foundation grants index: A cumulative listing of foundation grants reported in 1987*. New York: Foundation Center.
- Kranich, N. C. (1989). Information drought: Next crisis for the American farmer? *Library Journal*, 114(June 15), 22-27.
- Larsgaard, M. L. (1987). *Map librarianship: An introduction* (2nd ed.). Littleton, CO: Libraries Unlimited.
- Lilley, G. P. (Ed.). (1981). *Information sources in agriculture and food science*. London: Butterworths.
- National Association of State Universities and Land-Grant Colleges. (1987). *Serving the world: The people and ideas of America's state and land-grant universities*. Washington, DC: NASULGC.
- Software catalog: Microcomputers*. (1989). New York: Elsevier Science Publishing Company.
- United Nations. (1972). *FAO documentation: Current bibliography*. Rome: Food and Agriculture Organization.
- United Nations. (1985). *Directory of United Nations databases and information systems*. New York: U.N.
- United States. Office of Management and Budget. (1985). *Management of federal information resources*. Circular A-130. Washington, DC: Government Printing Office.
- Williams, M. E. (Ed.). (1985). *Computer-readable databases: A directory and data sourcebook*. Chicago: American Library Association.
- Williams, M. E., & Robins, C. G. (Eds. & comps.). (1985). *Agricultural databases directory*. (Bibliographies and Literature of Agriculture, no. 42.) [Beltsville, MD]: The National Agricultural Library, USDA.
- Williams, S. (Ed.). (1984). *Official methods of analysis of the Association of Official Analytical Chemists*. Arlington, VA: AOAC.
- World of learning*. (1988). London: Europa Publications Ltd.
- Zarozny, S. (Ed.). (1987). *Federal database finder: A directory of free and fee-based databases and files available from the federal government* (2nd ed.). Chevy Chase, MD: Information USA Inc.