Agricultural Databases for Decision Support

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SUMMARY. Several factors have emerged recently, have grown in importance, and are now converging rapidly to create a window of opportunity for all of us. These factors constitute six separate but related and important categories: 1) decreasing staff in the U.S. cooperative extension system, 2) increasing complexity of agricultural production technologies, 3) increasing concerns of society, 4) opening of markets globally, 5) increased need for accountability, and 6) rapid progress in computerized information and communication technologies. These factors encourage greater sharing of expertise and resources across states, institutions and departments; more cooperation with the private sector; improved openness and communication on issues of interest to society; greater awareness of our role in the world; and a willingness to consider new approaches. A program approach and model competitively funded program for the future are described.

This paper discusses the philosophy and opportunity for the cooperative extension system, the land-grant university system of research, teaching and extension, and the USDA-Cooperative State Research, Education, and Extension Service (CSREES). Two other papers in this series (Eastwood, 1996; Eastwood and Smith, 1996) are accessible on the World Wide Web (Web). This paper demonstrates maturing of the ideas, the process, and mainstreaming of the program. The issues and ideas presented are the responsibility of the author and do not imply concurrence of the USDA.

This discussion is about Agricultural Databases for Decision Support (ADDs), a program initiated by USDA-CSREES (<http://www.reeusda.gov/adds>). The purpose of ADDs is to address the needs of people for information, knowledge, educational programming, and research. ADDs involves nationwide cooperation across disciplines; research, teaching, and extension; institutions, organizations, and states; and between the public and private sectors. The broad and inclusive approach of ADDs results from a decade of input from developers and users of the databases as well as much trial and error. ADDs and HortBase share many ideas and values in an effort to bring about cooperation to address the knowledge needs of people.

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Window of opportunity

A window of opportunity is open to us as educators, students, researchers, consultants, growers, marketers, service providers, regulators, or administrators. This window of opportunity has been created by a set of factors outside our control, which have emerged recently and are growing in importance. These factors concurrently are causing greater sharing of expertise and resources across states, institutions, and departments; more cooperation with the private sector; improved openness and communication on issues of interest to the community; greater awareness of our role in the world; and a willingness to consider new approaches. These factors are converging rapidly to frame this window of opportunity.

The factors constitute six separate but related and important categories. Each will be discussed only to the extent needed for relating to the ADDS program.

DECREASING STAFF IN THE U.S. CO-OPERATIVE EXTENSION SYSTEM. Strong competition for support at the federal, state and local levels of the cooperative extension system has created gaps in the discipline and program staff support in many institutions and in many subject areas, including horticulture. No longer can we expect each land-grant institution and state cooperative extension service to have strong staff support and development of state educational programs and materials in support of horticulture. Decreasing staff and program support have encouraged multistate and national cooperation in extension programming. This also has created an opportunity and necessity for cooperation with other public entities and with the private sector.

While the terms multistate and regional are popular with Congress and with those groups advising congress on the reauthorization of the research title of the farm bill, a national cooperative approach makes much more sense. National cooperation should be more effective and more efficient in the use of funding support and human resources. National cooperation in this sense means simply to allow all who have an interest and a need to cooperate. It does not imply that all states have a need for a specific topic or program, but if they do, they

may be part of the national cooperative effort. National cooperation also does not imply federal control. National cooperation involves working together to serve better the needs of the people at the local level throughout the nation.

National cooperation implies and requires national coordination and leadership. This coordination and leadership need not reside within USDA, but rather should be empowered by USDA and the private sector. Empowerment is necessary to establish general agreement among the states, institutions, and organizations that this national coordination and leadership is necessary and will occur. Cooperative extension system staff are in an ideal position to provide national coordination and leadership in many areas. Extension staff generally are considered to be knowledgeable, unbiased, understanding of the needs of both industry and society, have backup support from the university, and are accustomed to communicating and organizing efforts.

Empowerment to facilitate national coordination and leadership may be accomplished through the lead state (or states) concept. Empowering a state or institution to lead, and their acceptance of that leadership role, provides the internal authority and backup of the institution for the individual staff members who lead. Establishment of lead states or institutions may be accomplished through a competitive grants program if funding is available, or through a competitive proposal program if there is no central source of funding support. Several states could share in this lead state status as long as responsibilities are detailed in the proposal. States or institutions would develop a proposal for a national cooperative effort in discussion with all appropriate and interested entities from the public and private sectors. Projects would proceed as agreement by the parties and the ensuing empowerment is achieved.

The factor of decreasing staff in the nation's cooperative extension system has created a window of opportunity for national cooperation. National cooperation has the potential to rein-vigorate the entire land grant university system.

INCREASING COMPLEXITY OF AGRICULTURAL TECHNOLOGIES. Agricultural production, marketing and process-

ing technologies and management systems have become more complex over the years. These technologies and management systems require broad expertise and rapid availability of knowledge. Decisions once made with confidence by the manager, using his or her own expertise, now often require input from other sources. The need for information, educational programs, and decision support tools is greater now than at any other time in history. Hence, the factor of increasing complexity of agricultural technologies and management systems has created a window of opportunity for providing the needed knowledge resources for agriculture.

INCREASING CONCERNS OF SOCIETY. Increasingly, decisions made in the privacy of a farm operation have implications beyond the farm gate. Producers face increasing scrutiny from federal and state regulatory agencies as well as from the public. Areas of public concern include the environment—air, water and land resources as well as noise and visual pollution; food safety and quality; worker and public safety; animal care and well being; land-use policies; bioethics and other policy areas. The broadening concerns an agricultural producer must face dictates that assistance must be readily available. This assistance often may be provided by a comprehensive, concise and accurate knowledge and decision support resource. Increasing concerns of society have created a window of opportunity and a necessity for providing appropriate knowledge resources for agriculture.

OPENING OF MARKETS GLOBALLY. Agricultural producers always have had to manage production costs amid fluctuating prices. Producers long have been in competition with other producers in their market area, whether or not they thought they were competing. With increased marketing of U.S. agricultural products globally and the increased potential for products from other countries entering the U.S. market, producers have increased opportunities, but also greater competition. Agricultural producers ultimately will need to be competitive globally to maintain their market. Those who thrive in this increased competition will be those who obtain the necessary knowledge, make best use of decision support tools, and integrate useful research results into progressive and

profitable enterprises. These global markets also create a window of opportunity and necessity for providing appropriate knowledge resources for agriculture.

INCREASED NEED FOR ACCOUNTABILITY. Financial support for programs is becoming increasingly difficult to obtain with industry organizations and government agencies at all levels trying to hold their budgets in check. Administrators are seeking to make better use of limited resources. Program managers must be more accountable than ever for the resources they manage. The increased need for accountability opens a window of opportunity for cooperation to reduce duplication of effort, make better use of resources, and work directly with the public and private sector user community in design, evaluation and updating of knowledge resources. A program becomes truly accountable when appropriate customer or user input is obtained before, during, and after each iteration of every project in that program.

RAPID PROGRESS IN COMPUTERIZED INFORMATION AND COMMUNICATION TECHNOLOGIES. A major success story in our lifetime is the relatively recent explosion of computer, information, and communications technologies. The crown jewel among these is the Web. The information superhighway has received much publicity, and many consider it synonymous to the Web. Other recent technology developments, though often less glamorous, offer much to the user community in the broad area of information, educational programming, and support for decision making. Among these are the compact disc, including CD-ROM and DVD (digital versatile disc or digital video disc). Another area of technology development that often qualifies as awesome is the area of search and retrieval engines. These software programs become the heart and soul of a massive collection of computerized material and allow the user to find specific information, answers to questions, and decision support tools. Without sophisticated and easy to use search and retrieval, a massive collection can become an endless maze.

The state of the art in large multimedia knowledge base delivery is the Web-connected CD-ROM that brings the benefits of both of these technologies to the user. Other names for these web enabled and hybrid CD-ROM. It is likely that in 1 to 2 years, the state of the art will be Web-connected DVD.

This rapid progress in computerized information and communication technologies has opened a window of opportunity for all of us. Will we use this opportunity to cooperate nationally and reach out to our customers, to the people, with useful products to deliver information, knowledge, educational programming, and support for decision making?

The word database, when applied to a collection of information causes some confusion for those who think in terms only of a numeric database. One definition of the Web places database in the proper context: the Web is a large database operating on computers connected to the Internet throughout the world.

The ADDS program

ADDS is a national program designed to encourage nationwide cooperation. This cooperation should extend across states, institutions, departments, government agencies at all levels, and private sector organizations and groups. It should involve research, teaching and extension and should include all appropriate issues and disciplines. ADDS projects should address the information, education, and decision support needs of the people.

ADDS databases are national collections of related educational materials, lists and software tools accessible electronically. They are designed to assist farmers, ranchers, growers, and others involved in agricultural production by providing information, education and support for decision making. These collections have been peer-reviewed and selected by top extension specialists, researchers and other experts from the public and private sectors.

ADDS databases are valuable resources for producers, educators, consultants, service providers, the media, and others. They are intended to assist in making decisions that are profitable to the farmer; help in the production of high quality and safe food, high quality fiber, fuel, or products for recreation or living satisfaction; make best use of the resources available; protect the environment; and be compatible with and support the rural community and its infrastructure.

The ADDS hallmark applies to those projects that follow the philosophy and meet the criteria agreed to by the greater community of developers and users. ADDS uses the sophisticated search and retrieval mechanism

and multimedia capabilities of commercially available software. This software is applied to a cooperatively developed national resource of peer reviewed materials that have been selected by experts for their usefulness.

The ADDS philosophy is available on the Web, and is referenced in this paper. Some aspects of the criteria for ADDS projects will be discussed as they are steadily evolving. A more complete treatise on criteria also is referenced.

ADDS project criteria

An ADDS project...

- Addresses the needs of agricultural producers, those who work with producers in an information, education, or decision-support role, and other individuals and groups that constitute rural America.
- Contains peer-reviewed material from a wide variety of public and private sources which has been selected by acknowledged experts in the field.
- Is national in scope, although inclusive of regional, state or local differences.
- Is comprehensive in reach to bring many of the users' needs into one easily accessed resource.
- Adopts a sophisticated, effective, economical and easy to use off-the-shelf search and retrieval engine.
- Is perpetual and iterative in nature in that version 1 will be supplanted by an improved, more comprehensive, useful and complete version 2, with interim products supplied on the Web.
- Is subjected to continuous review and priority setting for the next version by both users and developers.
- Is likely to sprout specialized versions (3.1, 3.2, etc.) for specific user audiences, such as classroom teaching, crop consultants, greenhouse nurseries...
- Involves the public and private sectors where the mutual advantage of developers and users may be served.
- Addresses areas important to both agricultural producers and society in general, including sustainable practices and systems, efficient and responsible use of resources, environmental protection, production of high-quality and safe food, feed, and other products, proper care and welfare of animals, safety of workers and children on the farm and rural roadways
- Shares information and materials

with other ADDS projects as appropriate for efficiency, quality enhancement, and to extend the reach of each project.

- Adopts enough of the look and feel of other ADDS projects, including the search and retrieval engine where possible, to benefit the trainer and the user of multiple databases.
- Makes appropriate use of multimedia technologies to improve the learning opportunity.
- Is published and distributed on appropriate media including Web-connected CD-ROM and the Web itself.
- Is developed and constantly updated by a multidisciplinary team of editors, with lead editorship on a several year rotation basis where this would benefit the project.
- Is planned by a national committee of individuals from both the public and private sectors who are respected for their knowledge, understanding and experience with that area of agriculture, with committee membership on a several year rotation basis.
- Is distributed throughout and by the land-grant university system, the cooperative extension system, rural libraries, high school vocational agriculture departments, and community colleges.

Orientation of ADDS databases

ADDS databases may be oriented in any direction that makes sense to the developer and the user. Those developed for on-farm use likely will be commodity, species, or perhaps clientele oriented. A pest management consultant would need the appropriate issue-oriented database, while the needs of the Occupational Safety and Health Administration might be met by the appropriate discipline-oriented database.

COMMODITY AND SPECIES-ORIENTED DATABASE. Addresses the broad knowledge needs of a specific kind of agriculture such as cranberry production, melons, winegrapes, etc.

CLIENTELE-ORIENTED DATABASE. Addresses the broad knowledge needs of a specific group of individuals such as small farm owners, greenhouse nursery growers, rural youth, etc.

ISSUE-ORIENTED DATABASE. Addresses in a comprehensive way the

state of the knowledge in an important issue area such as preharvest food safety, pest management, etc.

DISCIPLINE-ORIENTED DATABASE. Addresses in a comprehensive way the state of the knowledge in an important discipline area such as farm safety, business management, etc.

Components of ADDS databases

ADDS databases may include any combination of material needed by the intended users of the database. The electronic publishing media used by the databases have few limitations as to type or size of the material. Following are a few typical components of current or planned ADDS products.

EXPERTISE AND CONTACTS DIRECTORY. Information on people. Includes name and address information, phone, fax and e-mail, discipline and program product information regarding commodity, species, clientele, etc.

FULL TEXT MATERIALS. Selected informational and educational material. Includes fact sheets, pamphlets, proceedings, articles, training materials, and other textual material. These materials may contain charts, tables, photos, color, and links to other locations on the CD-ROM or the Web.

RESEARCH RESULTS. Reports of research results, often from university field days and other events, but also including those from other research agencies and stations.

SOFTWARE DIRECTORY. A directory of available decision support and other software, including that from the university community as well as the private sector, with information as to contact, cost, requirements, and support.

EXECUTABLE SOFTWARE. Executable software which may be a spread sheet, a full-fledged program or a demonstration version of commercial software available for purchase.

VIDEO DIRECTORY. A directory of available videos with the length, cost, contact and other information.

Benefits of the ADDS program

The benefits to agriculture, the environment, society, the land grant university system and the cooperative extension system from ADDS projects are major. Some of the more obvious

benefits are as follows:

- Better use of the top expertise from each state.
- Better quality of material available in each state.
- More rapid access to information and materials for the user.
- Duplication of effort is reduced between and within states.
- Research and information needs may be identified by gaps in databases.
- Specialists time freed from some routine, repetitive information delivery.
- Reduced telephone, mail, and printing costs.
- Reduced storage costs and waste of publications through print-on-demand delivery of fact sheets and other information.
- Efficient and effective delivery of selected decision-support software.
- Users are put in touch with the expertise of the land grant university system through the expertise/contacts database.
- Users are put in touch with software developers and marketers through the software directory.
- The county agents' role in providing information, education, decision making assistance and training in use of the database products to agricultural producers is revitalized.
- Opportunity for specialists from many different disciplines to participate cooperatively in a national project with minimum travel and other expense involved.
- Extension specialists and others function as a national family through electronic networking and the cooperative development of comprehensive national databases.
- Extension's leadership role in providing information, education and decision support for its clientele is strengthened.
- The land grant university and cooperative extension system's leadership role in providing information, education and decision support for its clientele is strengthened.

A model competitive ADDS program for the future

ADDS should be established as a competitively based program under the oversight of the user community. The program would be developed as a series of perpetual national coopera-

tive projects to address the knowledge needs in each area of agriculture. Public-private partnerships and leveraged funding would be encouraged, as would alliances of states, institutions and organizations. These states, institutions and alliances thereof would be empowered to provide national coordination and leadership to carry out these projects in cooperation with the private sector.

Each project would be under the advisory supervision of a separate national public-private committee though the actual work may be managed by one or a few lead states. Each project would develop one or more national resources (databases) that bring the state of the knowledge to the user community in a mode to support competent decision making.

The program could develop rapidly by building upon the base of experience and examples developed in the current ADDS projects. Projects would be encouraged that address knowledge needs identified by potential users. Projects would move forward as the appropriate partnerships, alliances and project leadership evolves. Each project would be expected to glean the useful knowledge and materials, including decision support software and multimedia training modules, from ongoing and already completed projects funded by the Fund for Rural America, teaching and research grants, extension projects and other sources. A strong effort would be put forth in each project to identify knowledge

gaps where further research or development is needed.

Each database would follow a common developmental process and use a common presentation to assure its usefulness, simplify training, and facilitate sharing among the projects. The program would develop and provide training modules for both the creators and users. The program would establish training for the land grant system, government agency staff and others in project development procedures and use of the products.

These products would be distributed widely by the cooperative extension system and the National Agricultural Library, throughout the land grant system, to community colleges, rural libraries, high school vocational agriculture departments, and a broad user community as appropriate. ADDS projects and the feedback they generate would strengthen research, teaching, extension, and reference programs and enable private sector professionals who work with agriculture. They would use all appropriate technologies and be available for value-added distribution via fax-back services, print and other media. Evaluation and future development of each project would consider seriously the input and advice of agricultural producers and other end users.

The program would provide easy access to knowledge developed through the research, teaching and extension efforts of the land grant university system and other public and

private entities. It also would ensure easy access to the information, programs and regulations from USDA agencies and other federal and state departments and agencies.

Public funds would be used to facilitate cooperation and ensure the public needs are addressed while private funding could provide the value-added applications for specific user groups. An overriding premise of the program would be national cooperation among all projects to deliver a one-stop-shop for knowledge to the broad agricultural community of the nation.

Information resources cited

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