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SpudNet, an electronic information system for Australian potato growers

Barry Philp
Primary Industries and Resources SA

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SpudNet, an electronic information system for Australian potato growers

This report details outcomes of an overseas study of electronic information systems being used in the United States potato industry, with a view to their use in the Australian potato industry. It is an initial step in the development and introduction of an electronic information platform to service the Australian potato industry.

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September 1998

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An overseas study of electronic information services for the Australian potato industry

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CONTENTS

INDUSTRY SUMMARY

Electronic information services are in their infancy as a tool in the agricultural extension process. Electronic services in the US are currently being used as an additional channel to deliver newsletters, printed information or critical warnings cheaply and quickly. They have not replaced traditional workshops, field days, seminars, mail and fax systems. There is currently no substitute for "kicking dirt" and getting growers to touch, feel and observe new technology "in the flesh".

Many farmers currently do not have the equipment or expertise to use electronic information services. However the coming convergence of Internet, TV and phone services will greatly simplify access, reduce the skills needed and dramatically increase the use of electronic services. The Data Transfer Network (DTN) is a forerunner of this technology. DTN is a simple to use information system delivered in the same way as satellite pay TV, and is being used by many farmers.

Most web sites observed were acting as large, worldwide electronic libraries. They have the advantage of helping users sort through and access vast amounts of information quickly and cheaply. SpudNet must not be a passive information source that sits and waits for customers to access it. SpudNet should have the capacity to actively drive information out to growers and have a human perspective that users can relate to (enable growers to ask questions and seek answers from specialists).

The power of new tools which can tailor information to specific crop and management situations is only just beginning to be realised, mainly through weather data based disease and irrigation forecasting services. Further development of these tools is being slowed in the US by significant levels of funding which are directed into the extension network. Companies supplying these new tools and services are beginning to emerge in some regions, and these services could well provide business opportunities for service providers in Australia.

The establishment of many web sites has been driven by computer technology rather than the needs of users. Very few web site operators were investigating the customers which used their services and how useful they found the service. A critical stage in establishing an electronic information service will be market researching of potential users, identifying the types of information products they need, and designing them to meet their requirements.

Initially, the main customers of SpudNet services would be industry service providers together with the most technically advanced potato growers. This must be quickly expanded however to include the majority of growers. Industry will also need to decide whether it uses SpudNet as a mechanism to supply packages of information tailored to the needs of other people along the value chain, such as wholesalers, retailers and consumers.

For SpudNet to be successful, it must have:

- a vision for how it is to serve the Australian potato industry;
- develop products and services based on customer needs;
- focus on products and services that can inform a customer and predict what is likely to happen to a crop in the near future;
- harness people skills in technical/agronomy, computing, information management, graphic design and marketing arenas;
- introduce a range of information products in a staged and strategic manner;
- be structured to ensure that people generating information delivered by SpudNet have ownership and responsibility for it;
- be business focused and put in place appropriate charging mechanisms so it can become self funding.

SpudNet has the potential to be a major channel through which the potato industry gathers information and processes data in the future. There is a huge array of valuable information available around the world, and SpudNet will be an important "road map" for the potato industry to find this information.

Business opportunities exist through provision of services from an electronic information site. Disease forecasting and irrigation scheduling are the most advanced of these services in the US potato industry. Provision of these types of services may be taken up in Australia by consultants or commercial supply companies.

RECOMMENDATIONS

Recommendation 1
The Australian potato industry ***proceed with development of*** an electronic information platform – ***a simple web site***. It offers a major benefit of providing low cost easy access to a large volume of information.

Recommendation 2
This electronic information site ***be established with a business structure*** and have its management team represent industry stakeholders and customers. The service should be managed using good business principles and look to becoming profitable in the long term.

Recommendation 3
Skills in areas of technical information (agronomy etc), computing, graphic design, information management, marketing ***be used in the design*** of the Australian potato industry's electronic information site.

Recommendation 4
National teams of people with skills ***in specific technical areas*** be created to design, assemble and maintain the major information areas on the site. These teams must be aligned with the Australian potato industry's national technology transfer strategy.

Recommendation 5
Information ***products*** on the web site be designed and improved ***in close consultation with customers.***

Recommendation 6
The web site wherever possible ***drive information and services out*** to sectors of the potato industry and not be a simple sedentary electronic library. It should adopt the strategy of being the Australian potato industry's portal to the information world.

Recommendation 7
The Australian potato industry electronic information service ***have a strong promotion policy*** that not only informs potential users about the service, but also offers training to customers in the use of electronic services.

Recommendation 8
As the use of electronic information services becomes more widespread in the community, the Australian potato industry give close consideration to new user groups of their web site, particularly the ***opportunity for product promotion with potato consumers*** and retailers.

Recommendation 9
Development of specific crop agronomy services using ***weather stations only proceed after the electronic platform is well established*** and business planning identifies there is opportunity for these services to be profitable.

BACKGROUND

In recent years there have been several research proposals submitted to the Horticultural Research and Development Corporation for the establishment of an electronic information platform for the Australian potato industry. The Australian Potato Industry Council R&D Committee subsequently supported this overseas study to investigate the feasibility of developing electronic information services.

Originally this study was to cover the US, UK and Holland. However desk top research indicated that the most sophisticated electronic information systems were being used in the US, and the overseas study was concentrated there.

Why Use Electronic Information Services

The Australian Potato Industry has had a strong R&D program for many years that has generated considerable volumes of valuable information. To derive a dividend from this investment in R&D, and to assist the potato industry to improve its international competitiveness, there is a need to achieve higher levels of adoption of new technology.

Electronic information services offer a new more accessible way of storing and delivering technical information to growers, processors, agribusiness, and all stakeholders in the potato production and marketing chain. Electronic services more importantly offer opportunity to format information into decision making tools that can be used on a day to day basis for crop and business management.

Objectives of Study

The main purpose of this overseas travel was to investigate improved information delivery systems and services that will accelerate the adoption of new technology in horticultural industries, with a major focus on the potato industry. This included identifying:

- and investigating improved, lower cost, easier to use information delivery systems for growers, agribusiness and industry service providers.
- opportunities for new interactive decision making tools that make it easier for growers to use more sophisticated technology on a day to day basis.
- and evaluate new services that enable adoption of improved crop production or farm management technology.

The main emphasis of this study was on the underlying applications and techniques for information delivery, and business opportunities associated with these rather than electronic wizardry.

VISITS AND OBSERVATIONS

Universities dominate the supply of electronic information to the farming community in the US. To gain a broader perspective of how these services were viewed, the study targeted a range of people with different roles in the US potato industry. In addition to meeting key university staff, visits and interviews were also held with county extension agents, consultants, potato growers, processing companies, and service organisations.

Following are key observations made.

UNIVERSITIES

Michigan State University – East Lansing

MSU's web site commenced more than 15 years ago with data bases of information on home horticulture, home maintenance and food preservation (inquiry topics that nobody wanted to handle). This has now been expanded to include virtually all major crops in Michigan and delivers:

- publications traditionally produced by extension staff
- bookmarks or links to other web sites
- links to databases of references held in libraries
- links to experiment stations and trial data
- lists county offices, staff and contact details

MSU's site delivers information using 3 groupings of staff.

- "Area of Expertise" teams to prepare highly specialised information on some crops (eg asparagus, soybeans, dairy). These crops are identified through cooperation with neighbouring states.
- "Crop Advisory" teams are responsible for preparing weekly newsletters on seasonal crop issues (includes use of meteorologist to assist with prediction of anticipated pest or disease problems).
- A broad range of general publications, coming events, and directories of specialists is managed using web site staff and agriculture extension trainees.

University of Wisconsin – Madison

Has a comprehensive array of information, including update of trial data on line so that growers, chemical companies and others with an interest in the data can obtain it as soon as it becomes available.

Wisdom potato management software originally developed by Dr Walt Stevenson and currently marketed by Gemplers in CD Rom form is being overhauled, with an upgraded version to be released shortly. This new version will incorporate:

- an expanded range of pest/disease photos and descriptions (over 1,000)
- manage crops on a field basis
- have built in warnings on risky rotation or chemical use practices
- incorporate GPS mapping of disease, pest and weed outbreaks
- link to satellite monitoring of canopy temperature and RH for disease outbreak predictions
- compare graphs from previous seasons
- have chemical use record keeping to comply with legislative requirements

University of Florida – Gainesville

FAIRS – Florida Agricultural Information Retrieval System was started by UFG in 1981, was subsequently published as 24 CD Rom's, and then formed the information base of their web site. Publications are loaded on a database, and files to suit printing or screen reading functions are created "on the fly".

Management of the site uses a number of electronic tools to inform authors of the need for reviews, approving new publications, and maintaining dockets of information generated during development of a publication (eg photo and text files).

FAWN - Florida Automated Weather Network commenced operation 1 year ago with 16 weather stations across the state (also 400 stations from flood and water management agency). Weather data is downloaded to the web site every 15 minutes, and growers can access data from the station closest to them. Used principally for freeze warnings, FAWN is also being used for irrigation scheduling.

UFG also has a comprehensive system of office, staff, program information available off their web site. Now beginning to develop decision support software for specific crops (soybean and citrus). This has a GIS component to link crop records to property location.

Oregon State University – Malheur and Corvallis

Dr Clint Shock (Malheur Experiment Station) provides a late blight forecasting service to potato growers across Oregon. It is based on 17 weather stations (operating 4 years with 2-3 stations per potato production district) and uses a slightly modified Wisdom P day system. Information on late blight is posted on web sites, emailed to a list of chemical suppliers and applicators, provided on phone recorded messages, and publicised by county extension staff and media. A student manually extracts and distributes data, although this could be automated.

Daily irrigation crop water use data (for major crops in Treasure Valley district) is loaded on the Malheur web site. It uses Penman estimates from weather station data. This data could be presented in a more farmer friendly form.

Dr Al Mosley operates a comprehensive web site for the potato industry at Corvallis with numerous links across the country. This includes an excellent collection of potato variety information. Dr Mosley has also set up Extension Net – a national emailing system between potato extension and service personnel across the country. This enables people to pose questions and receive responses from anybody on the network. A similar network is being established for potato growers, but does not have significant traffic yet.

OSU also has an impressive web site for seed certification (200,000 ac of grass and potato seed crops). This has been custom built to manage certification records, allow seed growers to interrogate the certification stages, and issue certification tags.

Prof James Green at Corvallis is developing the Hortbase Information System in conjunction with the American Society for Horticultural Science. It comprises a series of information centres for greenhouse and nursery, fruit, vegetables, landscape and turf, horticulture therapy and home horticulture. A section of this project includes a pilot project to develop a Global Information System for Decision Support (http://www.forages.css.orst.edu/HortBase). One of the concepts in this project is the use of 3 dimensional teams to create electronic files (incorporate technical, information science and communications specialists).

University of California – Davis

Each of the major sections of UC Davis have their own web site (range eco-systems, fruit, vegetables, ornamentals, weeds, post harvest, small farms, agronomic crops).

The Vegetable Research and Information Centre (VRIC) was launched 5 years ago to coordinate research and extension activities and facilitate public and industry access to information. The VRIC is a virtual centre – it does not exist physically but only electronically.

During the set up phase, consultants were used to survey university and industry staff to find strengths, weaknesses, extension and research needs. An advisory committee was set up to provide management advice on what work is done and take account of various industry sectors and regions. The centre employs a 0.5 time administrator. Key responsibilities and activities of the VRIC are:

- publish an annual report highlighting accomplishments of UC Davis;
- distribute a newsletter and provide information to county based extension programs;
- write and publish extension bulletins;
- organise state wide industry short courses;
- provide administrative support for liaison with commodity boards and industry groups;
- identify and maintain a database of UC Davis personnel and vegetable projects;
- implement an electronic communications network among participants;

- organise campus seminars and develop materials for use in student recruitment;
- actively target special funds for priority research.

A series of task groups have been formed to manage delivery of services by the VRIS. This includes publications, web page, biotechnology, annual reports, special projects, evaluation and food safety. Where task groups have good participation and leadership they have performed well.

Promotion of the centre has been via a small brochure, visits to industry commodity boards, presentations and display boards and industry conferences, and links to other web pages and search engines. There has only been limited indirect involvement of farmers in development. The VRIC is not strongly linked to commercial companies.

Interaction of site users with site staff for problem solving has been limited. County agents do not want to handle email inquiries from the site because of too many requests from students, overseas and non commercial people. A screening process is required, possibly through subscription. Plant pathology disease subscription services have been used in the past.

Currently VRIS is receiving approximately 14,000 hits over 3 months. The site is now commencing an evaluation process using a 0.5 time analyst to identify where hits are coming from.

County Extension Agents

The attitude of county extension agents to electronic services varied considerably. Those with a strong emphasis on localised applied research and interaction with farmers saw limited value in web sites. Where funding for traditional extension services were adequate, there was little incentive to move from traditional 1:1 extension methodologies.

Pest Control Advisers in California use computer based information heavily. In Oregon, county advisers were delivering specialised irrigation scheduling services linked with local research centres. In states with well developed web sites, county extension agents were delivering newsletters and other timely information via the Internet as well as traditional means (mail, fax etc).

Potato Commissions or Associations

State potato and vegetable commissions provide a range of information and training services. Michigan Potato Industry Commission was using the Data Transfer Network Corporation (and fax) to get weekly newsletters and information to growers. Wisconsin Potato & Vegetable Growers Assoc are currently setting up their web site to service grower members.

Potato Growers

Large corporate potato growers were using individual farm managers who were generally under the technical direction of their company agronomist. Technology transfer to their staff was generally via winter training schools where they would bring in specialists (especially on machinery set up and maintenance). Company agronomists relied heavily on personal contacts with regional university staff to access new technology.

Early adopter family run farms were more likely to be using electronic services, particularly the DTN network for weather and price information. Growers in Michigan were observed using advanced on farm computer crop recording and management systems (for pest, disease scouting and chemical records). The new precision agriculture systems observed in North Dakota rely heavily for "on farm" computer systems to link field records, input applications, crop yields, mapping and field records in a detailed crop performance monitoring system.

Processing Companies

Lamb Weston were using a web site to promote their company and products to customers, but were not using it as an information medium with contract growers. They relied on growers obtaining new technology from other sources such as potato commissions, grower associations, chemical and fertiliser resellers and consultants. Their field staff have a limited role in technology transfer, but the company hired consultants to assist in adoption of improved production practices.

Mc Cains were using their network of agronomists to provide information to growers and foster adoption of new technology. These agronomists were using tools such as newsletters, winter workshops and the 500 (500 cwt/ac) club to foster adoption of new management and production technology. They are now starting to look at the potential of electronic mediums to deliver information to their growers.

Some processing company staff saw the web sites as being run by the universities, unresponsive and not geared to grower needs.

THE TECHNOLOGY TRANSFER ENVIRONMENT IN THE US - ROLE OF ELECTRONIC SERVICES

The Channels

Information and new technology is being delivered to the US potato industry through numerous avenues, including:

- university research staff delivering specific pieces of technology
- county extension agents (linked to the university system) providing a range of generalist, applied research, and in some cases specialist crop services
- state potato/vegetable commissions that are funded by industry levies and are closely tuned to grower needs
- field staff of processing companies
- consultants/agronomists employed by processing companies and growers
- specialist field scouting or service staff associated with pest, disease, irrigation monitoring and aerial crop monitoring
- chemical, fertiliser, and other input suppliers

Traditional Extension Channels still Dominate

Electronic information services will not replace traditional extension activities

Attitudes to using electronic information services as an extension tool varied considerably across the US. County agents who had adequate funding to maintain many 1:1 services with farmers saw electronic information services as a waste of time. In regions where funding and resources were in shorter supply, there was a much more favourable attitude to using electronic services.

To date, government funded extension services available to the US potato industry have not been placed under the economic pressures and down sizing experienced in Australia. This means that there has been less incentive to adopt strategies that deliver information to farmers with less time input.

Similarly, the potato processing companies and large corporate potato growers are continuing to rely on the use of field officers, consultants, direct links with university research staff, workshops and field days to convey new technology to growers and farm managers. Despite this traditional approach, all acknowledged that electronic systems had the potential to deliver information more efficiently, and provide a range of new crop management services that improve productivity and profitability.

In many circumstances, electronic information services are being used as an additional channel to deliver newsletters, printed information or critical warnings cheaply and quickly. They have not replaced traditional workshops, seminars, mail and fax systems.

Education studies (California) have shown that information retention achieved by students using electronic information systems is similar to that from traditional teaching methods.

There is no substitute for "kicking dirt" and getting growers to touch, feel and observe new technology "in the flesh".

Computer Use Levels

A 1996 USDA survey showed that more than 2m computers are in use on farms across the US, with 13% of farmers having access to the Internet. Levels of computer ownership will have grown significantly since this survey 2 years ago.

By comparison, the NFF Farmwide Internet Demand Survey conducted in November 1997 indicated that 71% of Australian farmers owned computers, and 29% had modems.

An important audience difference is that US farmers tend to be better educated than Australian farmers (approximately 5% of Australian farmers have graduated from university).

Anecdotal information gathered from people servicing US potato growers indicated that while many farm families had computers, few were using them to access information. The majority of use was for farm record keeping, accounting and word processing, with poor keyboard skills being a potential barrier to computer use. Most Internet access was likely to be undertaken by younger members of the family, and this was often for entertainment purposes.

University of Wisconsin estimated that approximately 10% of growers were using their specialised potato web site.

Despite this perspective, Universities with well developed web sites are reporting very high levels of "hits" (eg Michigan State University site receives 30,000 hits /day), and rapid growth of use rates (some doubling every 6 months) for their web services. Much of this traffic may be urban users and students accessing information.

The US population appears to have a more advanced computer use culture than Australia. Virtually every major company is now using a web site to promote and market their products, and web addresses feature heavily in their TV and print media advertising.

Major advertising companies are recognising the marketing power of the Internet

Major manufacturers and advertising companies view the web as a major new commerce opportunity and anticipate rapid development. The largest advertising agency in the US, Procter and Gamble recently announced it intends to move from 1% of advertising budget ($US 3bn annually) on the web to 80% within 5 years. A key factor influencing commercial interest in the web is the impending merger of pay TV, phone and Internet into a single system.

The majority of US potato growers are not using the wealth of information available from University and other web sites. Commercial service companies are just beginning to recognise the potential of electronic information systems and are designing new services and products to deliver to their clients via this medium.

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University of Wisconsin provided access to current research data. As new data was gathered in the field, it was updated into the project report within approximately 10 days of interpretation and statistical analysis. This enabled interested farmers, chemical companies and researchers to access new information rapidly after it had been generated.

Weather Based Crop Management Information

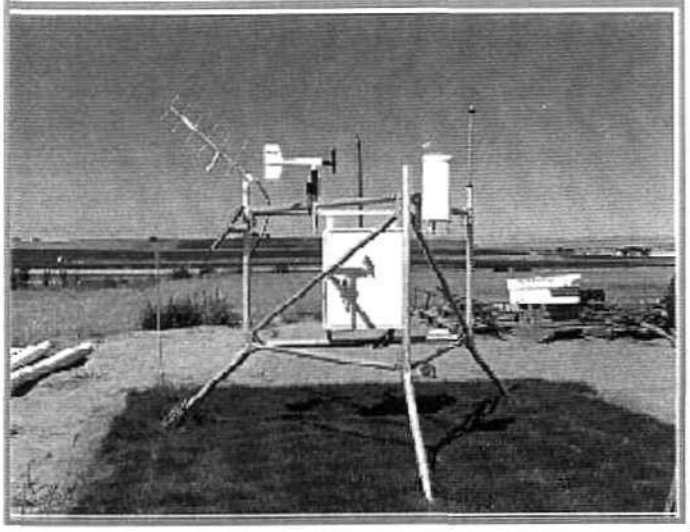
A number of sites provided crop management information based on weather data gathered from networks of weather stations. This was generally limited to

- disease outbreak forecasting – principally late blight
- evapotranspiration for irrigation scheduling
- frost warnings (Florida)
- chilling accumulation for stone fruit

In some circumstances, this information was provided in raw data form that required interpretation by the grower. Many services needed to improve the user friendliness of information, and present it in a way that was easy to read, comprehend and use.

The University of California makes its weather data base (collected mainly for research purposes) available to individuals who wish to use it. Western Farm Services is currently establishing a network of weather stations across California with the intention of providing a commercial pest and disease monitoring and warning services to growers on a subscription basis.

Weather stations are an important component of crop management services



Besides potatoes, disease forecasting models are now available for grapes, tomato, lettuce, strawberry, celery and carrots.

New satellite remote sensing systems that can monitor crop canopy temperature and humidity have the potential to replace ground based weather stations (Wisconsin). This may overcome some of the reliability and communication costs associated with running a chain of weather stations.

Questions and Answers – Getting Advice

Few web sites offered access to specialists to assist in answering technical questions. Most web masters received email from users of their site and either tried to handle the general inquiries themselves (if they had a horticulture background), or forwarded them on to a specialist who could assist. A major concern was that inquiries could be from anywhere in the world, and providing this service may not necessarily benefit industry in the state or country providing the service.

The Potato Association of America web site offers a "list server" question and answer service by email. Targeted mainly at researchers and county agents, individuals can pose questions on the system (emailed to all participants) and await responses from whoever feels like answering. Some evaluation of credibility of the information received is required in this system.

The US Air Force AFAMS web site maintains a database of specialists who are linked to it. This can be searched to generate a list of people with the area of specialist skills required. These can then be contacted by email to obtain the desired information

Crop Expert Systems

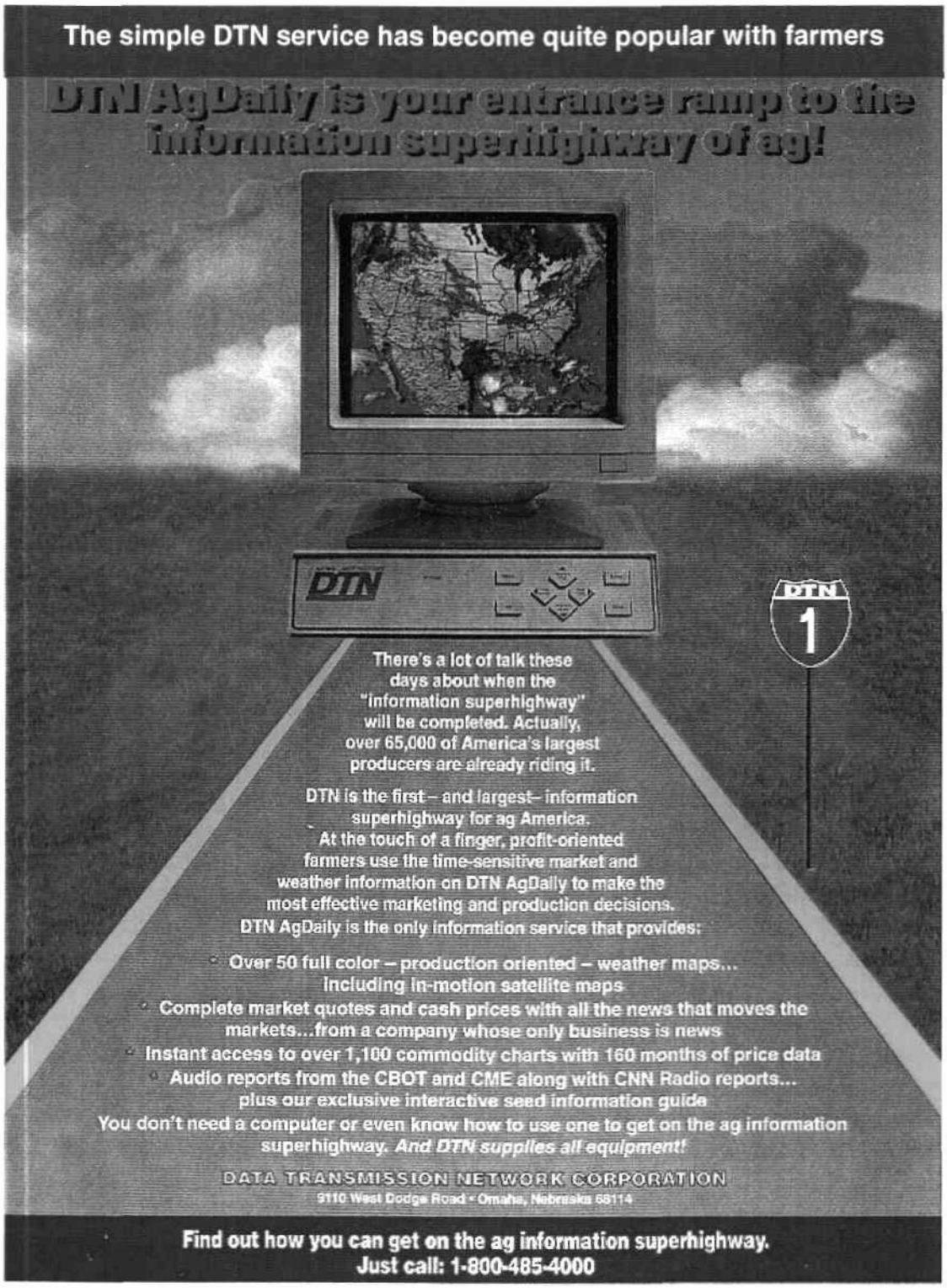
University of Florida were active in design of expert crop production systems. These are powerful tools that enable the impact of a management decision to be evaluated in terms of yield or $'s. One has been developed for soybeans, and another was being developed for citrus.

Expert systems are complex, require accumulation of large volumes of data on the phenology of the crop and its interaction with environmental factors. The size of these systems and current computer technology usually limits their application to CD Rom. Linkages with GIS mapping systems enable record keeping to be integrated into the system. An interesting tool calculated the level of copper protection available on citrus trees (dependent on weather conditions) and predicted when another spray was required.

Data Transfer Network Corporation

The Data Transfer Network (DTN) Corporation is based in Omaha, Nebraska and provides an information service to farmers utilising satellite systems in the same way as pay TV. Many potato growers were using this service, and could access various streams of information for a subscription fee of approximately $200 /yr.

Weather and market information dominated this service. Organisations such as the Michigan Potato Industry Commission had an email page on the system to communicate with grower members subscribing to DTN. They could update information on DTN as frequently as they wished, and were using it mainly for a weekly newsletter of events, upcoming meetings, seasonal conditions, disease warnings etc.



Growers could down load information whenever they wanted. DTN enabled information to be sent to subscribers in exactly the same way as on the web. Its main attraction with growers was a very simple menu system to click up and down through various tiers of information.

Purchasing Farm Needs

Some web sites acted as a marketing point. Michigan generated a list of hay sellers by location to assist supply of feed during droughts. Oregon's seed certification site listed seed potato growers along with volume X variety approved (also listed growers and crops that failed the certification process).

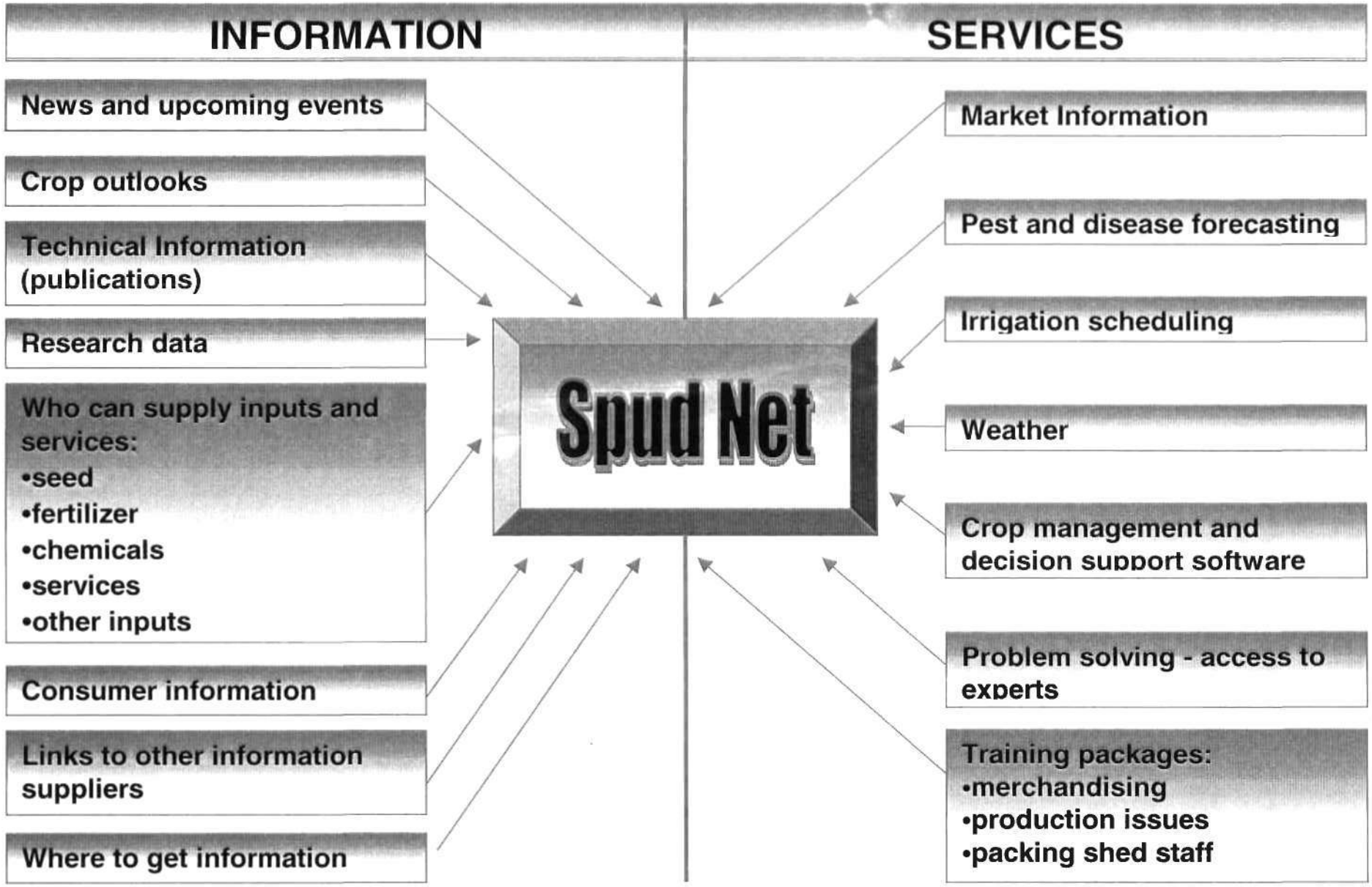
Video Conferencing

The transmission of digital images from still cameras or video is emerging as a powerful tool for diagnostics and communication. University of Michigan were using a digital video system for phone communication on a regular basis. Equipment and software for this system cost approximately $1,000 per computer. Communication software packages are now available with the capability of transmitting fax, email and digital images.

This tool may have significant applications for potato growers. It provides the capability of a grower or agronomist to transmit "live" digital video images from the field to a diagnostic specialist, and could provide the basis for new services. This has a great deal of potential when combined with the low earth orbiting satellite networks and global roaming facilities (eg Iridium Corporation).

Changing technology is moving web sites from being electronic libraries to a rapid communication system with the capability to deliver significant crop and business management services. The convergence of pay TV, web and telephone services will revolutionise access to new information services.

What Can Electronic Information Systems Deliver?



KEY COMPONENTS NEEDED FOR A SUCCESSFUL ELECTRONIC INFORMATION SERVICE

The Vision

It is important to set a clear objective for what electronic information services might be and deliver for the Australian potato industry. Many sites visited had been driven by interest in computing technology rather than the service or products they were delivering to users. It is essential to have a customer focus.

SpudNet has the potential through careful linkaging to be the Australian potato industry's portal to information from around the world. Objectives need clear definition so the service is designed to deliver what various customers and industry want.

Targeting Customers

Consideration needs to be given to delivering services to a wide array of people working in and servicing the potato industry. Traditionally we think of these people as being growers, agribusiness services, researchers, processors and wholesalers.

Many US web sites cater to a wide range of other customers who are not directly involved with an industry, including consumers, students, home gardeners. While these may be low priority customers in the initial development of SpudNet, consideration needs to be given to servicing them. A web site could offer a low cost option for generating a positive public image for the Australian potato industry and promoting its products. An example is the Idaho Potato Information Centre which is principally focussed on promoting the potato industry.

Business Structure

Most potato web sites in the US operate within the University network and are paid for from university funds. Little thought has been given to establishing a web site as a business, or structuring services in a commercial manner.

Both universities and industry commissions did not have a high priority for commercialising information services because their funding for these services was derived from government or grower levies. Australian thinking on the commercialisation of information services is far more advanced due to the moves by various state agriculture agencies toward corporatisation.

There are some commercial information supply businesses (eg DTN and Western Farm Services), but these are only just beginning to emerge as a force in the information market.

SpudNet must be established to function in a commercial manner if it is to avoid becoming a long term drain on Australian potato industry levy funds.

Generating Revenue

Commercialisation of electronic information services will create new systems for collecting revenue from users, and overcome the current difficulties of establishing web sites as self funding businesses.

Methods of revenue collection observed include:

- subscriptions for access to information (there has been a history of difficulty in marketing electronic information to farmers on a subscription basis – critical to have a continual flow of new information).
- fees for specific services delivered (eg $x/ha for disease forecasting services).
- charging of services against credit cards (already available on appropriately secure web sites – eg PIRSA now has this facility).
- advertising (the volume of advertising on some commercial web sites detracts from their effectiveness as an information source).
- fees for links – commercial companies pay a fee for having a link to their web site incorporated on SpudNet – would need disclaimers to qualify that the company was not being endorsed by SpudNet.
- fees for timed access to a web site (in the same way as 0055 phone numbers) that is charged through the phone or Internet service provider. This is not yet possible, but development by the pornography industry may make this possible in the near future.
- fees on a pages used basis (charged in the same way as time).

Promotion and Advertising

Very few of the university web sites had a promotion program to advertise the address and content of the site. They relied almost entirely on linkages with search engines to bring users to their web site. This is a very important issue as many users waste considerable time searching through garbage to find web sites that contain the information they want.

With the establishment of an Australian electronic information service, it will be essential to promote the address (via articles in industry newsletters, brochures, display boards at conferences, stickers etc) of the web site so users can find it easily. An option to consider is the loading of a SpudNet icon on computer main menus so users can be automatically taken to the web site address.

Monitoring Performance

Most web masters were monitoring the total volume of "hits" occurring on their site. However this data is of limited value. Very few sites were evaluating where "hits" were coming from or the type of information being extracted. This could be a major manual task where a web site was receiving 1,000's of hits per day. New software can completely automate the process and generate tables, graphs and maps with quantitative information on customers

At sites visited, there was virtually no market research occurring to evaluate the effectiveness or suitability of information products or services from a customer perspective. There is a need to work through a continuous process of:

- incorporating customer ideas in the design of an information product or service
- pilot trialing the product
- evaluating customer reaction to the product after it has been launched
- redesigning and improving the product

Skills for Design of a Web Site

A range of skills are required to put a web site together:

- technical, industry and agronomic information
- strong, innovative management
- computer skills for design of electronic aspects, links and search engine connections
- graphic design for visual imaging
- cataloguing for arranging information in a logical order to enable efficient searching
- knowledge of user preferences to ensure it meets market demand.

While many web sites are put together by individuals, team interaction using the above skills usually results in a better designed site.

Staffing of web sites varied considerably with size. Anecdotal information suggested that a person operating a web site as a side interest could comfortably manage approximately 250 pages (depends on frequency of update etc). UC Davis had a series of web sites servicing different industry areas. Each of these employed a half time person to act as web master, coordinator and developer of the site. Michigan used a full time person to coordinate their main horticulture web site, promote and train people for loading information.

As sites become larger, information retrieval and management becomes a critical issue. University of Florida were looking to build a thesaurus or connections between concepts or pieces of information to speed and improve the search process.

A key strategy in managing any web site is "farming" responsibility for sections to "owners" of the information. A management team may have an overview and quality control responsibility.

Area of Expertise Teams

Michigan State University were using "Area of Expertise" teams to put specialty information together on particular crops (eg asparagus). They are self directed groups (with chair and vice chair and industry representatives) who make decisions on what is placed on the network in relation to the particular crop. They are provided with a specified volume of server space and approximately $15k of funding to gather and load data. Many were using students to assist with the loading process.

"Crop Advisory Teams" were also in use at Michigan. These teams were responsible for alerts, and newsletters featuring timely information on seasonal issues for their area of crop responsibility. They are prepared each Monday morning through a phone hook up of county agents, and printed by Monday lunch time. A meteorologist was included in these teams to generate weather outlook X crop pest/disease outlooks.

People Owning and Managing Information

A key problem often experienced is getting people motivated to provide and maintain information for web sites. This may require some "carrots" in the form of either dollars or recognition.

Where possible, the person creating information should be encouraged to have responsibility for keeping it up to date. This not only minimises the work load on the web master, but ensures new information that only a technical specialist has knowledge of is loaded on the system. Management systems need to be put in place to ensure regular reminders are issued for updating information.

Loading of information onto the system can also be managed electronically. The US Air Force web site encouraged people to load their own information onto the web site. However other users of the web site could not gain access to this information until it had been through a quality assessment process with the web site management team.

Software Systems

Software systems available for web sites is continually changing, and most software has a "market life". Michigan and Florida sites that have been operating web sites since the early 1980's have used data bases for managing information (originally D Base). This has proved a good strategy and has enabled them to adapt their large information data bases to new web site software without major re-keying tasks.

The choices of Adobe Acrobat vs HTML software for printing vs screen presentation of data was discussed with several site operators. Florida was using a database to store, sort and search for information, and creating Acrobat or HTML files "on the fly" depending on the needs of the user. This enabled the best software to be used for each end use.

The software arena is changing rapidly with numerous new packages becoming available that assist management of a web site (eg Domino, Exchange, Java, Encarta). Specialist input will be needed in this area to enable the most effective packages to be selected for SpudNet.

Providing Links to Other Web Sites With Valuable Information

Searching for information can be frustrating. An important function is linking to other web sites with related or useful information. Some sites make a special feature of this (eg University of Oregon and Potato Association of America) and have a large range of links to other potato information sources in the US.

Linkages save the site user a lot of time searching for other web sites with related information.

There are a number of important considerations when establishing a link to another web site.

- does this web site have sound reliable information, and is information managed in a responsible manner?
- what are the legal implications of referring an inquirer to another web site if that site provides unreliable information?
- it could be useful to inform the person that they have moved to another web site
- addresses change, and there is a need to use software to regularly check that links are working properly.

Al Mosley from Oregon State University manages an effective highly linked web site for the potato industry from this office

Companies like Baradel Consulting have introduced a specialised search engine for Australian agriculture (available from http://www.kewl.com.au/~grovesc/search.htm) to help reduce the amount of irrelevant information generated in searches. This search engine enables farmers to access high quality sites listed in "The Australian Farmer's Guide to the Internet".

Baradel Consulting have also produced a report for RIRDC (June 1998) on options to make Internet searching easier for Australian farmers (available from RIRDC at http://www.rirdc.gov.au/reports/HCC/bdl2a.doc). It addresses issues of site presentation, navigability, user training and search facilities.

Information "Push" Technology

The Pointcast Corporation in the US has introduced new technology that "pushes" information to customers. The customer can select from a menu of topics to continually receive updated information on specific topics of interest (automatically loaded onto the screen when computer is operating). However network administrators are concerned this has the potential to clog up Internet systems.

Archiving of Older Information

An effective information archiving strategy is critical for long term maintenance of web site records. These records form an important foundation for developing new information services. Some sites were using subject X year archiving systems.

Apart from counting "hits", few web sites were investigating who was accessing what information, or whether the information suited customer needs. There is a critical need to incorporate routine performance assessment, customer market research, and end user needs into the design and maintenance of SpudNet.

STRATEGIES FOR ESTABLISHMENT OF ELECTRONIC INFORMATION SERVICES

Following visits to many web sites and discussions with personnel managing them, following are some key observations that will impact significantly on the success of an electronic information service.

Developing a Vision

There are several key elements to the Vision for an electronic information service:

The service must not be simply an information library that users can tap into to obtain information. This would create an interesting but largely ineffective source of information for the Australian potato industry. To have maximum impact, an electronic information service must:

- reach out to growers, service providers and other users, and "drive" information to them via email, news bulletins, warnings, or other services. New information "push" technologies now make this possible.
- have a human perspective and enable inquirers to access people that can provide answers to questions or tailor information to their needs.
- network and harness the expertise and knowledge of researchers and current potato industry service providers across the nation.

Industry must also make a decision about who will be customers of the service and its target audience. Will it be:

- potato industry service providers???
- the top what 20?% of growers capable of using web services???
- organisations and people in the potato marketing and distribution chain???
- students and the general public wanting information about the Australian potato industry???
- academics???
- consumers of potatoes???

A further important consideration is how electronic information services link with conventional extension strategies.

Client and Market Research

Many of the electronic information services provided in the US were developed with minimal client and market research. For electronic information services to have maximum effectiveness, it is essential to use an iterative process of product design, user assessment followed by ongoing product development. Many information products observed in the US were user unfriendly, and could have achieved much more impact through user input to their design.

Make Systems Easy to Use

The operating system must be simple so that people with limited computing skills can use it. Some of the features that may assist this include:

- having a SpudNet icon appear on screen when a computer is first "booted up" so users simply click on this to activate appropriate software and gain access to its network.
- wherever possible use simple graphically designed click buttons rather than text based click buttons.
- present complex data in easy to use graphic front ends that show clearly what is happening
- make it easy to navigate around the web site.

How will conventional extension activities link with electronic information services?

Key Issues for Success

In interviewing many people associated with web sites across the US, following are some key success factors identified:

- keep web page design simple and avoid too many colour photos as they slow on screen access to information.
- start the web site off simply with basic information on research and gradually expand the range of services from this base.

- wherever possible provide interactive services that give growers predictive management information.
- identify customers, undertake market research, and accommodate their needs in design of the service.
- a web site is only as good as its information – it needs continual updating.
- centre information around commodities or topics.
- have a strategy for handling emails and other inquiries – they may be requesting information or sometimes providing updated information held on the site.
- provide training and motivation to suppliers of information to the web site on how to prepare information and material.
- form teams with expertise in a particular area who would be responsible for sourcing and evaluating information on that topic (including scanning in info from other sources) and links relating to these.
- check all hot links (preferably monthly) to ensure they were still operational - software is now available to make this job easier.
- ensure that information put on the web site meets standards and that suppliers of the information have their email addresses listed (so inquiries can be directed back to them).
- set up archiving systems for old information so that it is not lost.

Spudnet must not be a static library of information simply waiting for people to access it. It should have capacity to "drive" information out to growers and service providers in formats that are designed to customer needs. It must also have a "human" face that clients can interact with and obtain information tailored to their information needs.

ITINERARY

The following itinerary details organisations and locations visited, people met and their relative position during this study tour.

DATE	LOCATION & ORGANISATION	PERSON	POSITION
Sat – Sun July 25 & 26	Travel Adelaide – Sydney – Los Angeles- Chicago - Fargo		
Mon – Wed July 27 - 29	Potato Association of America 42nd Annual Conference Fargo, North Dakota	Conference proceedings plus special meetings with: Dr Willie Kirk Michigan State University Allan Stewart Mc Cain Foods, New Brunswick	
Thurs July 30	Conference field visit to Red River Valley	R.D. Offutt Farms, Park Rapids ND Lamb Weston RDO French fry plant, Park Rapids Valmont Irrigation Accu Pulse system (Richard Panowicz) Monsanto Nature Mark varieties Dr Nyle Wollenhaupt precision agriculture systems	
Fri July 31	Travel Fargo – Chicago – Lansing		
Fri July 31	Michigan State University, Lansing	Ms Cindy Cook	Associate Extension Program Leader
Mon Aug 3	Michigan State University, Lansing	Dr Luke Reese Randy Heatley Sandra Allen Dr Roger Brook	Manager Agriculture & Natural Resources Computer Service Extension Specialist Educational Program Coordinator – Dept of Horticulture Extension Engineer
Tues Aug 4	Michigan Potato Industry Commission, Dewitt MI Keilen Farms	Ben Kudwa Dwayne Keilen	Executive Director Potato & onion growers
Tues Aug 4	Travel Lansing – Detroit – Madison		
Wed Aug 5	University of Wisconsin, Madison WI Caloma Farms, Caloma WI Hancock WI	Dr Walt Stevenson Steve & Andy Diercho Hancock Vegetable Research Station	Professor & Extension Pathologist Potato growers
Thurs Aug 6	Travel Madison – Chicago – Orlando - Gainesville		
Thur Aug 6	US Air Force Orlando FL	Maj Chuck Schwarz	Chief Modelling & Simulation Information Systems
Fri Aug 7	University of Florida Gainesville FL	Dr Howard Beck Prof Fedro Zazeuto Dr Jiannong Xin	Office of Information Technologies Director, Information Technologies Information Technologies
Fri Aug 7	Travel Gainesville - Orlando		
Sat Aug 8	Travel Orlando – Chicago – Denver - Boise		
Sun Aug 9	Travel Boise - Pasco		

DATE	LOCATION & ORGANISATION	PERSON	POSITION
Mon Aug 10	Wheather or Not Inc Pasco WA United Agri Products Pasco WA Agri Northwest Tri Cities WA Lamb Weston Inc Richland WA Professional Ag Services, Pasco WA	Dr Dallas Batchelor Greg Jackson Dr Steve Whitesides Greg Harting Martin Moore Phil Schoening Keith Ker Tom Muhlbeier Michael Stevenson	Crop consultant Marketing Product Development Manager Laboratory Manager Manager Agricultural Services Director, International Agriculture Aerial Imaging Specialist Irrigation Monitoring
Tues Aug 11	Travel Pasco - Ontairio		
Wed Aug 12	Malheur Experiment Station Ontairio OR	Monty Saunders Dr Eric Eldredge Brad Coen Lynn Jensen	Farm Manager Faculty Research Assistant Malheur County Potato & Onion Specialist
Wed /Thur	Travel Ontairio - Corvallis		
Thur Aug 13	Oregon State University Corvallis OR	Dr Oscar Gutbrod	Potato Seed Certification Officer
Fri Aug 14	Oregon State University Corvallis OR	Sandy Smith Dr Al Mosley	Seed Certification Specialist Assoc Professor, Dept of Crop & Soil Sciences
Fri Aug 14	Travel Corvallis - Portland		
Sat Aug 15	Travel Portland – Sacramento - Davis		
Mon Aug 16	University of California Davis CA	Dr Ron Voss Kitty Schlosser Naomi Hirsch Dr Desmond Jolly	Director, Vegetable Research & Information Centre Web Master – Vegetable & Weed Info Centres Web Master Fruit & Nut Information Centre Director Small Farm Centre
Tues Aug 17	University of California Davis CA	Dr Frank Zalom Dr Dennis Pendleton Michael Reid David Chaney	Director Statewide IPM Project Director, Public Service Research program Associate Dean, Div of Environment Education Coordinator, Sustainable Ag Res & Education Program

DATE	LOCATION & ORGANISATION	PERSON	POSITION
Wed Aug 18	University of California Davis CA	Dr Dan Sumner Dr Mike Murray Dr James Grieshop Dr Terry Salmon	Director, Agriculture Issues Centre County Director & Vegetable Farm Adviser, Colusa county Specialist Community Education Director, North Region, Div Agriculture & Natural Resources
Wed Aug 18 to Fri Aug 21	Return Travel to Australia	Davis – Sacramento – San Francisco – Sydney - Adelaide	

REFERENCES

BANKSTON, Jeff, Building NT 4 Web Servers 2nd Edition. Published by Coriolis Group Books, 1997

BUDNICK, Larry, Windows NT – Web Server Book. Published by Ventana, 1997

CAMPIDONICA, Mark, How to find agricultural information on the Internet. University of California Cooperative Extension Service. Pub'n 3387, 1997

HOBUSS, James E, Building Access Web Sites. Published by Prentice Hall, 1997

HOROVITZ, Bruce, USA Today, Monday August 17, 1998. Section B "Summit will be 'defining' movement of net advertising."

JAMES, Henry, The Farmers Guide to the Internet. Published by TVA Rural Studies, University of Kentucky, Lexington, Kentucky, 1996

MURRAY, Mike

A contrast of the Australian & California Extension & Technology Transfer Processes.

The integration of county based extension and applied research functions: The California experience.

A description of non-agricultural programs delivered by California Cooperative Extension.

WEB SITES REFERRED TO & INVESTIGATED AS PART OF THIS STUDY

Organisation	Content	Web Address
	University Web Sites	
University of Wisconsin Madison WI	Weather satellite imaging Plant pathology home page	http://bob.soils.wisc.edu/wimnext/sunwater.html http://
Michigan State University Lansing MI	Horticulture web site MSU Extension server Precision agriculture	http://www.canr.msu.edu/fldcrp/web-site.htm http://www.msue.msu.edu http://www.msue.msu.edu/fldcrp/prec-equipment.htm
United States Air Force AFAMS, Orlando FL	Agency for Modelling & Simulation	http://www.afams.af.mil
University of Florida Gainseville FL	Florida Agricultural Information Retrieval System Florida Cooperative Extension Programs	http://www.agen.ufl.edu http://www.ifas.ufl.edu
University of Oregon Ontario OR	Irrigation Scheduling Service Blitecast service	http://mac1.pn.usbr.gov/agrimet/chart/ontoch.dat http://www.primenet.com/
University of Oregon – Carvallis OR	Seed Certification Potato web site Potato variety database Hortbase Global Information System	http://www.oscs.orst.edu http://www.css.orst.edu/crops/potatoes http://www.orst.edu/dept/coarc/spudmain.htm http://www.forages.css.orst.edu/hirtbase/
Washington State University Prosser WA	Computer modelling of potatoes	http://www.tricity.wsu.edu/
University of Texas	Aggie Horticulture Program	http://aggie-horticulture.tamu.edu/
Cornell University		http://www.cals.cornell.edu/
University of California – Davis CA	IPM site Vegetable Research & Information Centre Fruit & Nut Research & Information Centre Postharvest Outreach program Agriculture & Environment Sciences Sustainable Agriculture Research & Education Program Division Agriculture & Natural Resources California Farm Bureau	http://www.ipm.ucdavis.edu http://vric.ucdavis.edu http://fruitsandnuts.ucdavis.edu http://postharvest.ucdavis.edu http://www.aes.ucdavis.edu http://www.sarep.ucdavis.edu http://www.ucce.north.ucdavis.edu http://www.fb.com/cafb

Service Organisations		
Harvestmaster, Utah	Manufacturer of crop monitors	http://www.harvestmaster.com
Lamb Weston Inc Richland WA	Company web site	http://www.lambweston.com/
Wisconsin Potato & Vegetable Growers Assoc Madison WI	Assoc home page	http://www.alphawd.com/test
Vidalia Onion web		http://www.web-tec.cpm/
Fintrac Global Agribusiness Information Network	Marketing of agricultural commodities	http://www.fintrac.com/
Crop Protection Website	Crop-Net organisations & associations	http://www.crop-net.com/
The Potato Association of America	National research and extension group	http://potato.tamu.edu/variety/paa.htm

APPENDIX 1.

NEW TECHNOLOGIES IN THE US POTATO INDUSTRY

Snippets of Information About New Technologies Emerging in the US Potato Industry

Satellite Imaging to Replace Weather Stations

The traditional way of predicting potential disease outbreaks is through using weather stations to monitor in field climate and crop micro climate. It is now possible to use satellite sensing and imaging to predict in canopy micro climate, with these techniques in final stages of ground truthing.

Satellite imaging will enable remote disease prediction without costly and sometimes unreliable weather stations. Insolation rates can also be easily monitored also making it possible to calculate evapotranspiration for irrigation scheduling.

Web site for further information: HTTP://bob.soils.wisc.edu/wimnext/sunwater.html

Revamp of WISDOM Software

A new version of WISDOM potato crop disease management software is currently being written and will incorporate the following features:

- expand the range of photos to 1,000 with disease/pest descriptions.
- manage crop data on a field basis.
- have built in warnings on rotations and poor chemical use practices.
- incorporate GPS mapping of disease, pest and weed outbreaks (assumes scouts will use GPS logging of these outbreaks to 1m resolution).
- link to satellite monitoring of canopy temperature.
- enable comparison of current season's data with graphs from previous seasons and between modules.
- have record keeping facilities for chemical use – to meet likely legislation requirements.

Precision Farming Systems

Precision farming systems are now to the point of commercial evaluation by large potato growers.

Soil testing was carried out on a 1 ha interval to identify variation across the paddock. Based on this information, early season N and K are applied using a special applicator on a cultivator linked with GPS navigation equipment. Our significantly higher costs of soil testing (as low as $7 /test in US) will make the economics of Precision Farming Systems questionable in Australia.

Difficulties are still being experienced with accurate operation of application machinery, and the reliability of the recording systems.

Quadris – a New Systemic Fungicide

The fungicide QADRIS (manufactured by Zeneca Corp) has emerged as a major new product for use in carrot, potato and other crops. Applied in rotation with Bravo, Quadris is giving outstanding control of alternaria and cercosporia. Quadris has systemic and eradicant activity, has been applied to 1,000 ac of potatoes this season and registration is expected in Wisconsin by early 1999.

Accu-Pulse for Centre Pivots

Valmont Irrigation have been developing a chemical application system that attaches to a centre pivot. This equipment minimises the public presence of aircraft or ground rigs applying chemicals, and avoids additional wheel tracks.

The Accu Pulse system consists of a separate boom slung under the main irrigator arm. It uses a specialised computer controlled valving system to apply a pulse of spray through special hydraulic accumulator nozzles at approximately 60 psi. These pulses are applied at 23.5" intervals as the centre pivot rotates with water application rates of up to 30 gall/ac. A range of fungicide and insecticide products have been applied through the units.

Valmont have 17 units operating across major potato production districts in the US, but do not intend to export the units until they are further proved. Cost is approximately $23,000US for a 120 ac pivot. Anticipated life of the units is 7 seasons.

Observations of the unit are that it dumps spray material on in coarse droplet sizes, and there is a need to examine coverage carefully. The irrigation process for the centre pivot must be switched off, a disadvantage in hot weather when the pivot may need to operate continuously to deliver sufficient irrigation water.

Tailored Water Application by Centre Pivots

Computer controlled water application is now available on centre pivots to vary water application on different soil types. System controls water application nozzles in sections of 4. A valving system is controlled by computer and uses compressed air actuation of valves to vary water application as the pivot moves over different soil types.

Agri Northwest, a large corporate farming operation growing 14,000 ac of potatoes in the Colombia Basin is assessing soil type by sand content to decide on water application rate.

New Regulations on Heavy Metals

Excess nutrients entering the environment is becoming a major issue in the US, particularly in Washington State where there has been considerable negative press about heavy metals in fertilisers.

Canada now has standards that limit the annual application of a range of heavy metals (lbs/ac/yr), including zinc. Washington state has adopted similar standards and is looking to develop a national standard for US.

Nitrates in groundwater has been a major issue for some time, but other emerging issues include:

- P mobility into ground water
- P in run off water
- heavy metals in fertilisers
- disposal of processing plant waste

Breeding of Red Pigmented Potatoes

Red and purple pigmented potatoes offer an opportunity to provide natural food colourings and dyes. New varieties with both red skins and flesh are being bred with the intention of developing this new niche market in:

- dyes and food colourings
- red crisps
- neutriceuticals with special health benefits

Monsanto Nature Mark Varieties

Monsanto are now marketing a range of genetically modified potato varieties in the US. They are lines of the varieties Russet Burbank, Superior and Atlantic with resistance to Colorado Potato Beetle. Other resistances to PVY, Leaf Roll and glyphosate are currently under development.

A key issue about these genetically modified varieties is they have quite different agronomic characteristics which need to be taken account of. This includes:

- greater dormancy requiring seed conditioning before planting
- higher tuber set, requiring changes to plant spacing
- greater vigour that requires a reduction in N application rates.

Monsanto have a major program of regional field trials and field tours informing growers about these new varieties. Further information is available from their Internet site on www.naturemark.com

APPENDIX 2.

THE US POTATO INDUSTRY IN PERSPECTIVE

Apart from a period of decline in the 1980's, the area of potato production in the US has remained relatively static since the mid 1950's at approximately 560,000 ha. However over this period, the nation's average yields have increased from approximately 23 t/ha to 45 t/ha.

Comparison of the US and Australian Potato Industries – 1996*

FACTOR	USA	AUSTRALIA
Area planted (ha)	589,350	45,400
Production (M tonnes)	22.59	1.39
Value (farm gate $Am)**	$A4,192m	$489m
Exports ($Am)***	$A947m	$A29m
Imports ($Am)***	$A405m	$A22m

*Source: ABS Agstats and Agriculture Statistics Board, USDA
** Values are in $A based on an exchange rate of $1A = $0.60US
*** Exports and import values include all processed products

The US potato industry produces approximately 16 times the tonnage of the Australian industry, and is valued at in excess of $4bn annually. The US potato industry produces approximately 7% of the world's potatoes, and is ranked 4th behind China (45.8 mt), Russia (39.9 mt), and Poland (24.9 mt).

Canada is also a significant potato producer, planting approximately 142,000 ha and producing 3.92 m tonnes annually.

The area planted to potatoes in the US in the mid 1950's (561,000 ha) is approximately the same as that planted in the mid 1990's (582,000 ha), although planting declined to approximately 470,000 ha in the early to mid 1980's.

Despite plantings remaining relatively static, US potato production has increased dramatically through a doubling of yields, from 20.2 t/ha in 1957 to 39.7 t/ha in 1996.

Much of this yield increase has been due to increased areas of irrigation, and other improvements in production technology. There are still significant areas of potatoes grown under natural rainfall in the north eastern states (high summer rainfall incidence). Despite lower costs /ha, naturally rainfed potatoes are becoming uneconomic through difficulties in achieving quality specifications and unreliable yields.

Potatoes are grown in 35 states of the union. Idaho is by far the largest producer with 30% of national production, followed by Washington (18%), and 4 states each with approximately 4% of national production (Colorado, North Dakota, Oregon and Wisconsin). More than half of the national production (55%) is concentrated in the north western states.

Domestic markets for US potatoes have been growing steadily. Per capita consumption has increased 10 kg/head over the past 20 years, from 54.4 kg/head/yr in 1978 to 64.7 kg/head in 1996. Virtually all of this increased consumption has occurred in frozen and dehydrated product, with fresh potato consumption being relatively static at 23 kg/head.

APPENDIX 3.

SOME VISIONS FOR SPUDNET

Following are some thoughts on how SpudNet may serve the Australian potato industry in the future. This is not Dick Tracy at work. Technology identified in each of these scenarios is available today.

It's the year 2003. SpudNet has been established as the one stop information shop servicing the Australian potato industry. It provides a wide array of services for growers, industry service personnel, processors, marketers, retailers and consumers of potatoes.

Scenario 1. The Potato Paddock

Potato farmer Bill Smith is inspecting one of his potato crops and notices some unusual yellow coloured plants in one corner of the paddock, and drives over to investigate. Bill is unsure what is causing the yellowing of the plants, and pulls his small communication computer from the glovebox of the ute.

Bill dials up SpudNet via the communication computer and a low cost satellite link. Once in SpudNet, he accesses a crop problem identification database that matches symptoms against colour images shown on the communication computer screen and is able to identify the problem.

Control of this problem is likely to cost $20,000 and Bill thinks it prudent to get a second opinion. Using the communication computer, Bill dials an "on line" specialist (located anywhere in Australia) to discuss the problem. To assist the identification process, Bill uses a small digital video camera located on the side of his communication computer to beam images to the "on line" specialist.

With the problem confirmed, Bill uses SpudNet to access label and other information and makes a decision about fungicides to be applied. He then calls the chemical application contractor to order the fungicide application, and makes a few notes about the treatment in his paddock recording system.

That night in the office, Bill sets his communication computer up to automatically down load paddock record data via an infra red link onto the office computer. This also updates his quality assurance records.

Scenario 2. The Supermarket

Supermarket manager John Brown is starting a new 22 year old produce section manager, and recognises the need for training this person. He is aware SpudNet has a special interactive training package on potato merchandising, calls up and down loads the information onto the store's computer system.

The training package contains numerous video clips, images, product management suggestions, and self assessing process for the trainee. Using this information, John is able to schedule a short effective weekly training program for his new produce manager for the next 4 weeks that is part of an accredited training program for supermarket produce managers.

Scenario 3. The Household

Jeanie Rivers is planning a special dinner party for 7 friends, and is interested in including a potato dish on the menu. She uses her online TV and web server to search the Internet for potato recipes and information.

Internet search engines link Jeanie with SpudNet, and she is able to search through a wide array of information on potato recipes, cooking information, potato varieties and nutritional information.

A recipe is chosen, and Jeanie down loads a video clip on preparing her potato dish that provides step by step instructions on how to prepare the chosen dish.