

TECHNOLOGY TRANSFER SUB-PROGRAM

Exploring Options for the Transfer of Technology
from the Canada-Ontario Agricultural Green Plan:

Final Report of the Technology Transfer Committee

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Canada-Ontario Agricultural Green Plan

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Executive Summary

Background

The Technology Transfer Committee (TTC) was formed in 1994, by the Agreement Management Committee of the Canada-Ontario Agricultural Green Plan, to address concerns related to the transfer of technology and information resulting from Green Plan.

The goal of the TTC was to work, in co-operation with the existing systems for technology transfer in Ontario, to help ensure that the environmentally sustainable agricultural technology, generated within Green Plan, was effectively and efficiently transferred to Ontario farmers and to the wider community.

Activities

Towards this end, the TTC liaised with those who transfer technology to Ontario farmers to inform them of the type of information being generated within Green Plan; to determine their needs with respect to the type of information required and the manner in which it would be best transferred; and to identify opportunities for the development of partnerships to facilitate the continuing transfer of information to Ontario farmers.

In co-operation with Green Plan program leaders, the TTC prepared an inventory of the information that would be available for transfer, and identified the linkages among the results from the Green Plan projects and other related sources of information.

The committee undertook to demonstrate, evaluate and recommend the most appropriate processes to transfer sustainable technology to the Ontario agricultural sector.

The TTC initiated thirteen projects, each designed to advance one or more of the committee's objectives. These projects spanned a range of activities to investigate the application of new communication technologies for transferring agricultural information or to facilitate the exchange of information among stakeholders.

The results of these projects are presented in this report in summary form. The reports were prepared on behalf of the TTC solely for its use. The views expressed by the authors do not necessarily reflect the position of Agriculture and Agri-Food Canada, The Ontario Ministry of Agriculture, Food and Rural Affairs, or the Technology Transfer Committee. Individual copies of complete reports can be obtained from persons who were members of the Technology Transfer Committee.

What We've Learned

The following observations are offered by the Technology Transfer Committee, based on information and experience gained through the projects that it sponsored. We hope that they will be of value to people who may be involved in the planning of research and development programs or of technology transfer programs in Ontario, in the future.

Scheduling of Technology Transfer Activities

Throughout its existence the TTC was frustrated by the fact that results of research and development projects would not become available for transfer until after the termination of Green Plan, with the result that there was no funding to support transfer of the new information generated within the program. The TTC strongly believes that the original design of research and development programs in the future must provide sufficient time and funding to allow for transfer of their results.

Specifically, we believe that the technology transfer component of future programs should address the following.

- c The goals and objectives of the technology transfer component must be clearly defined at the outset, along with the roles and responsibilities of the agencies and persons involved.
- c The technology transfer component should be fully integrated with the program's communications component.
- c Sufficient time must be allowed between the deadline for receipt of final project reports and the expiration of program funding to allow for the transfer of the technology generated by the program to the target audience.
- c Sufficient funding must be allocated for the purpose of technology transfer, (minimum of 10% of the funding for the program depending on the nature of the program).
- c Expectations for local and provincial technology transfer¹ activities should be described in the Request for Proposals for all program components.
- c Program technology transfer activities should be integrated with those of related programs and existing technology transfer channels.
- c Technology transfer activities should be coordinated on a province-wide basis.

Patterns of Information Flow

Agricultural information in Ontario now flows in very complex patterns, involving a diversity of individuals, organizations (both public and private; profit and non-profit), media, technologies and target audiences. Technology transfer systems need to be designed to deal with this complexity.

Market Research

Technology transfer is now driven by the demands of the clientele. To successfully reach the target audience, technology transfer activities must meet both the audience's needs for information and its expectations regarding delivery vehicle. Prior to initiating design or development of any communication product, it is essential that market research be conducted into the potential audience(s), and into the nature of the proposed transfer media and associated

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The TTC project report entitled *Transferring Technology - a Guide to Communications Planning in the Agricultural Industry* describes an integrated approach to developing appropriate technology transfer activities.

industries, to determine the market potential and the most appropriate media to transfer technology to the specific audience.

Evaluation of New Communication Technologies

Communication technologies are evolving rapidly. New developments in electronic information management and communications need to be evaluated continually to determine their potential use in the process of transferring agricultural technology.

Full Cost Accounting of Technology Transfer Activities

On the surface, a number of the newer methods of distributing information electronically appear to offer significant savings in costs over traditional methods. However, such estimates often overlook the staffing costs associated with providing the subject matter expertise required to design, develop and maintain such transfer methods. In order to ensure that the product will be a cost effective means of transferring information to the target audience, relative to other communication methods, the full costs of proposed new technology transfer processes (design, development, production, distribution, maintenance and support) should be assessed before design or development is initiated.

Integrated Production and Distribution

For a variety of reasons, many Ontario farmers will continue to need to receive information through traditional technology transfer channels. The production and distribution of documents through electronic media should be integrated with traditional transfer methods to minimize production costs.

Commercial Sponsorships

Opportunities exist to support the production and distribution of information resource materials through sponsorships from agricultural businesses, providing that a plan to properly market commercial sponsorship is developed. Currently, the agricultural sector is fragmented and highly competitive in its approach to seeking sponsorships. A more coordinated approach throughout the sector could result in larger and more sustainable funding.

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Introduction

The Green Plan Technology Transfer Committee (TTC) was established to deal with concerns related to the transfer of technology and information resulting from the Canada-Ontario Green Plan. The TTC had broad representation from the agricultural and rural communities and added members as the need arose.

The TTC initiated a range of activities related to technology transfer, including research, development, liaison and facilitation. This report summarizes the various projects and activities associated with the TTC as they relate to its terms of reference.

The information in this report falls into four main categories:

1. Description of the Technology Transfer Committee, its Terms of Reference, methods of operation, and membership.
2. Projects and activities of the TTC, including project objectives and contributions to committee objectives listed in the Terms of Reference.
3. Summary and observations.
4. Summaries of research or development projects (with contacts for more information).

Background

The Canada-Ontario Agricultural Green Plan was developed to encourage and assist the farmers of Ontario to implement environmentally sustainable farming practices. Technology transfer was a major component of Green Plan, through its sub-programs, including the Environmental Farm Plan, Rural Conservation Clubs, Wetlands/Woodlands/Wildlife, The Stewardship Information Bureau and the Best Management Practices books. These programs have made valuable contributions toward assisting farmers to evaluate and adopt previously existing technology. However, from the outset of Green Plan, there were a number of unresolved questions relating to the transfer of new information arising from Green Plan activities.

The TTC, was formed by the Agreement Management Committee of Green Plan (AMC) in 1994. Initially, AMC appointed an ad hoc group, consisting of three members of that committee, to address concerns related to the transfer of the information generated within the various programs of Green Plan. As the responsibilities of TTC evolved over time and the complexities of its tasks became apparent, its membership was gradually increased to provide representation from a wider range of interests and a broader range of expertise. (See Appendix A for membership details.)

A system to transfer information to farmers and other sectors of the agricultural industry is well established in Ontario and has served the industry well. However, members of AMC raised concerns regarding several specific gaps in that system relative to the transfer of information arising from Green Plan. The following issues required clarification:

- c The relative priority for transfer to be assigned to the three types of information² that was anticipated and to specific subject matter areas.
- c The process for evaluation of project results and assessment of their practical application.
- c The appropriate target audiences for each type of information.
- c The appropriate communication channels for each audience and type of information.

The TTC was charged with the task of assessing the nature of the information that was expected to become available from Green Plan activities with specific reference to the following issues:

- c options for evaluating the information.
- c preferred methods for transferring this information.
- c the respective roles of Green Plan program managers, the agencies represented on the Canada-Ontario Environmental Sustainability Accord (COESA) and the private sector, with respect to the evaluation, summarization, integration and/or distribution of the information and subsequent recommendations for farmers.

² The AMC noted that the information anticipated from Green Plan projects could be roughly divided into three categories:

- a: that which added to the scientific understanding of the processes through which agricultural activities affect the environment.
- b: that which could be implemented at the farm level almost directly.
- c: that which assisted governments (federal, provincial or municipal) in developing policies or programs related to agriculture or land use.

Terms of Reference

Goal of the Technology Transfer Committee

To work, in co-operation with the existing systems for technology transfer in Ontario, for the benefit of the agriculture and food industry in Ontario, by ensuring that information related to sustainable technology for agriculture, generated by Green Plan-funded research and demonstration projects, and related programs, is effectively and efficiently transferred to Ontario farmers and to the wider community.

Objectives

1. Liaise with those who transfer technology to Ontario farmers to:
 - c determine the needs of those who transfer technology to Ontario farmers, with respect to both the type of information required and the manner in which it will be best transferred (workshops, surveys, literature reviews and personal contact).
 - c inform those involved in transferring technology to Ontario farmers of the type of information being generated within Green Plan, through workshops, reports and personal contact.
 - c identify and develop opportunities, within existing systems for technology transfer, for the development of partnerships among governments, agribusinesses, producers and others, to facilitate the continuing transfer of information to Ontario farmers.
 - c identify barriers to the transfer of technology within existing and emerging systems.

2. Liaise with Green Plan program leaders to:
 - c prepare an inventory of the information that will be available for transfer.
 - c identify linkages among results from the Green Plan programs and projects, as well as other related sources of information.
 - c develop guidelines for the reporting of Green Plan project results to facilitate their transfer to the target audiences.

3. Demonstrate, evaluate and recommend to the Accord Committee of COESA the most appropriate processes for ensuring the effective and efficient transfer of information related to sustainable technology to the Ontario agricultural sector.
 - c evaluate new methods and tools for transferring information.
 - c assess the suitability of these technologies for meeting the information needs of Ontario's agricultural sector.
 - c identify the types of information and the target audience for which the various communication technologies are best suited.
 - c document the process and resources required to implement and maintain technology transfer programs using these communication tools.

Approaches

The Technology Transfer Committee may use any combination of the following:

- c **research and development**, through third party contracts, initiated and overseen by task teams, appointed by the committee, based on Requests For Proposals approved by the committee.
- c **facilitation**, by providing forums through which stakeholders can exchange information and develop co-operative programs.
- c **technical recommendations** regarding possible courses of action for technology transfer.

Membership of the Technology Transfer Committee

- c Agriculture and Agri-Food Canada (AAFC)
- c Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
- c Canadian Wildlife Service, Ontario Region, Environment Canada (CWS)
- c Ontario Ministry of Natural Resources (OMNR)
- c Ontario Farm Environmental Coalition (OFEC)
- c Ontario Federation of Agriculture (OFA)
- c Stewardship Information Bureau, University of Guelph (SIB)

Technology Transfer Committee Activities

To fulfill its mandate, the TTC initiated a number of projects, designed to advance one or more of the committee's objectives (See Table 1). Summaries of the research and development projects are presented in Appendix B of this report.

Table 1: Technology Transfer Committee Projects and TTC Objectives They Addressed

Project	<u>Committee Objective 1:</u> Liaise with those engaged in technology transfer (See page 4)	<u>Committee Objective 2:</u> Liaise with Green Plan program leaders (See page 4)	<u>Committee Objective 3:</u> Explore methods of technology transfer (See page 4)
Development of an Agricultural Information Integration and Exchange System		X	X
Internet Pilot Project: Green Plan Home Page	X	X	X
Best Management Practices Web Site Feasibility Study	X		X
Marketing and Distribution of Publicly Developed Software Applications: Electronic Publication 75 Pilot Project			X
Best Management Practices on CD-ROM			X
Technology Transfer Partnerships in Environmental Enhancement: Best Management Practices Pilot Project	X		
An Approach to Technology Transfer Within the Canada-Ontario Green Plan	X	X	
Transfer of Agricultural Technology Generated Through the Canada-Ontario Green Plan	X	X	
Technology Transfer System Integration	X		X
Green Plan Technology Transfer Workshop	X	X	
Green Plan Final Workshop	X	X	
Green Plan Summary Bulletin	X		
Green Plan Media Releases	X		

Project Objectives and Contributions to Committee Objectives

Project: Development of an Agricultural Information Integration and Exchange System Project Objectives

To test and demonstrate the use of currently available knowledge-based technology to facilitate the transfer of new technology to farmers by:

- c organizing and linking information from different sources and at different levels.
- c developing and implementing efficient procedures to select relevant information.
- c provide easy access pathways facilitating the transfer of new technology to the farmer.

Contribution to Committee Objective 2 (Liaise with Green Plan program leaders):

- c Green Plan research program leaders provided information about the nature and content of the almost 40 individual research projects. This was used to demonstrate a method to integrate research information with the body of existing knowledge and to explore means of selection and exchange of information with the farm community.

Contribution to Committee Objective 3 (Explore methods of technology transfer):

- c development of a prototype Web site offering a framework of agricultural activities, which encompasses the province's agricultural research and information structure and publications, and offers links to external agencies. The information is organized within topic groupings, using the committees and subcommittee structure of Ontario Agricultural Services Co-ordinating Committee (OASCC). Users can search for information using a number of methods of information access.
- c development of several small expert systems with hypertext markup language (HTML) interfaces, to assist users in selecting information which is specific to their needs.
- c development of a flexible view capability, designed to produce a user-oriented view of the information, eliminate links which are not relevant, and update the user view as required without affecting the document collections. Characteristics of each document in the system are used to create dynamic views to the system specific to each user.

Deliverables:

Web site: <http://ozone.crle.uoguelph.ca> under which users can access Agweb or Manure Wizard.

Manure Wizard is a C application, running a small set of rules related to manure production, storage, application and use, that generates a report specific to the user's situation, and a recommendation as to whether or not the user should seek more information.

Weed Assist is a decision support system for weed identification and control recommendations that illustrates how applications such as the electronic version of OMAFRA Publication 75 (EP 75) can be integrated with Internet information transfer.

Report entitled, *Providing Environmental Data on the WWW*. September 1997. 21 pages
(For a more complete summary, refer to Appendix B.)

Internet Pilot Project: Green Plan Home Page

Project Objectives

- c To investigate and document the process required to provide an electronic, one-window, public access to information about the Canada-Ontario Agricultural Green Plan and to the results of Green Plan projects, through establishment of a Green Plan Home Page on the Internet.

Contributions to Committee Objectives 1 and 2: (Liaise with those engaged in technology transfer and Green Plan program leaders)

- c development of a home page design and launching of the Green Plan Web site, providing users with access to background information about the development of the Green Plan, details of the Canada-Ontario Agreements, organizational charts for Green Plan and the Research Sub-Program, the structures and membership of 20 Green Plan committees, general information about Green Plan, details of the eight major sub-programs, summaries and complete text of completed research projects, and links to other related Web sites.

Contributions to Committee Objective 3: (Explore methods of technology transfer)

- c guidelines on several aspects of Web site development, design and maintenance, including: location of documents, identification of document source and ownership, site organization, appearance, accessibility, ease of use, visual appeal and content, use of graphics and other advanced features, readability, currency of information and promotion.

Deliverables:

Green Plan Web Site (<http://res.agr.ca/lond/gp/gphompag.html>)

Report entitled *Internet Pilot Project*. March, 1997. 13 pages

(For a more complete summary, refer to Appendix B.)

Project: Best Management Practices Web Site Feasibility Study

Project Objectives

- C To determine the potential for development of a privately funded Internet Web site to present Best Management Practices (BMP) information, through investigating the following: considerations for the business model, characteristics of potential users and sponsors, site content and navigational strategies, requirements for site administration and maintenance, and cost.

Contribution to Committee Objective 3 (Explore methods of technology transfer):

- C identification of features desired by farmers using the Internet for a Web site offering information about environmentally sustainable agricultural practices (specific focus, comprehensive, credible and up-to-date, ease of access and navigation, searchable database, links to other sources of related information, discussion groups, personalized interface, “question and answer” feature, confidentiality of user information).
- C recommended strategies for developing commercial sponsorships for the Web site and for site promotion.
- C recommendations for site design criteria, related to site navigation, information processing and architecture.

Deliverables:

Report entitled *Best Management Practices: World Wide Web Site Planning Report*.
March, 1997. 36 pages

(For a more complete summary, refer to Appendix B.)

Marketing and Distribution of Publicly Developed Software Applications: Electronic Publication 75 Pilot Project

Project Objectives

- C To determine the feasibility of and the procedures for marketing, distributing and supporting publicly developed software, using "Electronic Publication 75" (EP 75) *Guide to Weed Control*, as a test case, including:
 - < determination of the time necessary to bring an application to market.
 - < development of a model to predict marketing and distribution costs.
 - < development of a model to predict market potential and revenues.
 - < listing Critical Success Factors for future software application marketing projects.
 - < preparation of a software marketing guide.

Contribution to Committee Objective 3 (Explore methods of technology transfer):

- C development and evaluation of a process for implementing and supporting the marketing and distribution of publicly funded software applications through test-marketing EP 75.
- C production of guidelines for the development of marketing and distribution plans to effectively bring publicly developed software applications to the marketplace. Six key steps must be addressed in the marketing process: market research, product design, product development, Beta testing, distribution, support and maintenance.
- C marketing plan for EP 75, outlining the activities and time required to achieve each of the six steps, and summary of the experience as a case study. Addenda to the report include a generic copy of the licensing agreement, the registration card and the advertising package.

Deliverables:

Report entitled *EP 75: Summary of Research Results*. August, 1996. 14 pages

Report entitled *Marketing and Distribution of Publicly Developed Software Applications: Final Report*. December, 1996. 10 pages

(For a more complete summary, refer to Appendix B.)

Project: Best Management Practices on CD-ROM

Project Objectives

- C To investigate and document the process required to develop interactive multimedia products.
- C to explore the suitability of CD-ROM as a medium for transferring agricultural technology, through production of a prototype CD-ROM of the Best Management Practices (BMP) book, *Water Management*, and related Environmental Farm Plan (EFP) material.

Contribution to Committee Objective 3 (Explore methods of technology transfer):

- C design, development and production of an interactive CD-ROM version of the *Water Management* BMP, containing all of the content of the original book, plus EFP Worksheets and Infosheets, a Glossary and a Legislation Section related to water quality.

- C the following recommendations are offered to assist those considering the development of similar products in the future to help ensure production of a high quality CD-ROM,
 - < conduct market research into the potential audience and into the nature of the medium and the associated industry prior to initiating product design or development.
 - < ensure that the task team is familiar with the CD-ROM industry prior to initiating product design and development (terminology, platforms, types of suppliers, costs, types of interactivity, etc.).
 - < define the product as fully as possible, including the breadth of content and the manner by which it is to be integrated before the Request for Proposal (RFP) is developed.
 - < evaluate the full cost of developing, producing, distributing and supporting the product before development is initiated, to ensure that a CD-ROM will be a cost effective means of reaching the target audience, relative to other communication methods.
 - < hire an multimedia consultant to facilitate project design and administration, in consultation with the task team. The consultant should be able to help clarify needs, specify competitive costs and value for services, and help choose a suitable supplier.
 - < chose a supplier carefully from among those with a proven track record. Virtually no supplier has the combination of experience in producing educational products and technical knowledge of agricultural subject matter. Task team time must be allocated accordingly to compensate for deficiencies.
 - < ensure that the task team works closely with the supplier to ensure product quality and mutual understanding of expectations. The task team should apportion tasks with time lines; insist upon quality control points; compare competitive products; inform supplier of revised expectations; and participate fully in product testing.

Deliverables:

Report entitled *Best Management Practices: CD-ROM Pilot Project*. March, 1997. 7 pages
Prototype CD-ROM entitled *Water Management Best Management Practices*

(For a more complete summary, refer to Appendix B)

Technology Transfer Partnerships in Environmental Enhancement: Best Management Practices Pilot Project

Project Objectives

- c To examine administrative, legal, funding, and control issues, related to the pooling of resources for transferring technology from the research and development level to farmers.
- c To develop and recommend strategies for developing, organizing and funding partnerships to facilitate future transfer of Green Plan funded technology.

Contribution to Committee Objective 1 (Liaise with those engaged in technology transfer):

- c establishment of commercial sponsorship, from input suppliers in the farm sector, that assisted with development, publication and distribution of six BMP books, amounting to advertising revenue of over \$100,000.
- c identification of issues needing to be resolved, to sustain a sponsorship marketing effort:
 - a) Sponsors require defined distribution (scheduled, targeted, verifiable, and cost effective).
 - b) The content of advertising suitable for use in technology transfer books often does not fit sponsors' marketing strategies and budgets, which are built around product campaigns.
 - c) Sponsors need to be involved in product development at the concept stage and thereafter.
 - d) Market research is needed to characterize the audience, potential sponsors and competitive publications.
 - e) The opportunity to advertise must be positioned relative to the customers' situation, competitive publications, and the sponsors marketing program.
 - f) Negotiations will be required to establish the price (value) of such advertising.
 - g) Sponsorship efforts have to be synchronized with advertisers' budget cycle.

Deliverables:

- Report entitled *Best Management Practices Partnerships: Marketing Strategy Report*. October, 1995. 14 pages
- Report entitled *Best Management Practices Partnerships: Summary of Marketing Activity*. April, 1996. 20 pages
- Report entitled *Best Management Practices Partnerships: Partnership Marketing Strategy*. June, 1996. 30 pages
- Report entitled *Commercial Sponsorship of Government Publications: Issues and Lessons from the Best Management Practices Partnership Project*. April, 1997.

(For a more complete summary, refer to Appendix B.)

Project: An Approach to Technology Transfer Within the Canada-Ontario Green Plan

Project Objectives

- c To compile and categorize the projects that were undertaken as part of Green Plan and other programs with similar objectives, since the conclusion of SWEEP, from which technical information was or will be collected.
- c To indicate the linkages among related projects.
- c To recommend improvements to the system of technology transfer in Ontario to promote the transfer and adoption of the information generated from these projects, using the area of manure management as a case study.

Contribution to Committee Objective 1 (Liaise with those engaged in technology transfer):

- c identification of barriers within the existing system for transferring agricultural technology in Ontario to the effective flow of information or to the adoption of sustainable technologies.
- c indication of the features that would need to be included in an information system to overcome these barriers.

Contribution to Committee Objective 2 (Liaise with Green Plan Program Leaders):

- c listing of 187 agricultural/environmental research and demonstration projects that were conducted as part of eleven programs (or sub-programs) since 1987, categorized according to the main environmental issue addressed by the project, using the 23 categories established for the Environmental Farm Plan. Projects related to manure management were further categorized by the manure management strategies which were being investigated to address specific environmental concerns.

- c abstracts of the results of completed projects and the objectives of those still in progress.

Deliverables:

Report entitled *An Approach to Technology Transfer within the Canada-Ontario Green Plan*.
July, 1995. 120 pages

(For a more complete summary, refer to Appendix B.)

Project: Transfer of Agricultural Technology Generated Through the Canada-Ontario Green Plan

Project Objective

- C To outline an integrated system for transferring the information and technology within the Canada-Ontario Green Plan, using concerns related to manure management as a case study.

Contribution to Committee Objective 1 (Liaise with those engaged in technology transfer):

- C identification of gaps in the current information base for manure management.
- C listing of extension resource materials, available in Ontario in 1995, along with an assessment of the topic covered and the level of detail presented in each resource.
- C a review of the system for transferring technology in Ontario, noting areas of concern in light of the identified information needs of farmers in Ontario and current trends in the province, relative to technology transfer.
- C description of the essential features that should be included in a system for technology transfer, noting the implications for those involved in transferring information, and outlining the requirements for maintenance of the information base and the system itself, and for the production of extension resource materials.

Contribution to Committee Objective 2 (Liaise with Green Plan Program Leaders):

- C listings of Green Plan research and demonstration projects related to manure management, categorized according to the issues addressed and the OASCC committees to which the results could be forwarded.
- C listings of other recent Canadian research and demonstration projects related to manure management.
- C development of a sample framework for organizing information related to manure management.

Deliverables:

Report entitled *Transfer of Agricultural Technology Generated Through the Canada-Ontario Green Plan*. February, 1997. 100 pages

(For a more complete summary, refer to Appendix B.)

Project: Technology Transfer Systems Integration

Project Objectives

- C To determine the effectiveness of different communication methods and techniques in achieving a desired level of change in environmentally related behaviours in a target group.
- C To assess the feasibility of developing a manual which will guide technology transfer professionals and managers in the selection of communication methods, techniques and media for technology transfer.
- C To develop such a manual if feasible.

Contribution to Committee Objectives 1 and 2: (Liaise with those engaged in technology transfer and Green Plan program leaders)

- C identification of factors influencing the adoption and continued use of innovative technologies and categorization of the factors according to:
 - < the type of behavioural change required (adoption, optional vs. compulsory).
 - < characteristics of the target audience (innovativeness, decision-making unit).
 - < characteristics of the technology (benefits, compatibility, complexity, testability, observability).
 - < characteristics of the media used to promote the innovation (mass media vs. personal, familiarity, accessibility, social networks, change agents).
 - < characteristics of the messages used to promote the innovation (“how-to” vs. principle-based information).
- C development of a technology transfer manual for the agricultural community, providing resources to assist users in assessing the characteristics of target groups, and in developing strategies to communicate to those groups using a variety of integrated messages through multiple media.

Deliverables:

Report entitled *The Feasibility of a Technology Transfer Manual for the Ontario Agricultural Community*. January, 1996. 32 pages

Manual entitled *Transferring Technology - A Guide to Communications Planning in the Agricultural Industry*. March, 1997. 60 pages

(For a more complete summary, refer to Appendix B.)

Project: Green Plan Technology Transfer Workshop

Project Objectives

- c To provide a forum, through a one-day workshop, for communication and information exchange between the people associated with Green Plan and those involved in the administration of agricultural technology transfer in Ontario:
 - < to explore opportunities for the transfer of Green Plan generated technology.
 - < to increase awareness, among those involved in the administration of agricultural technology transfer in Ontario, of the information being generated within Green Plan.
 - < to discuss the changing needs of Ontario farmers with respect to both the type of information required, and the manner in which it can and should be transferred
 - < to begin to explore the potential role of partnerships among governments, producers and agribusinesses in facilitating the transfer of information to Ontario farmers.

Contribution to Committee Objectives 1 and 2: (Liaise with those engaged in technology transfer and Green Plan program leaders)

- c The workshop, held December 12, 1995 at the Holiday Inn, Guelph, was attended by 42 people, representing a variety of interests, including government, university, business and producers. Through presentations and discussion groups, it provided a forum for the exchange of information among people associated with Green Plan and representatives of selected stakeholder groups.

Deliverables:

Report entitled *Canada-Ontario Green Plan Technology Transfer Workshop*.
April, 1996. 9 pages

Project: Final Green Plan Workshop

Project Objectives

- c To increase awareness of the information available as a result of Green Plan and to encourage the adoption of the technology developed within Green Plan, through co-sponsoring a wrap-up workshop in conjunction with the Green Plan Research Sub-Program.

Contribution to Committee Objective 1: (Liaise with those engaged in technology transfer)

- c the workshop, held in March, 1997, provided Green Plan program managers with the opportunity to present a summary of the achievements of their programs and to initiate discussion of their application within agriculture. Contractors of projects that were active in 1996 presented a summary of their accomplishments, as did co-operators in selected projects in the Rural Conservation Club and Wetlands/Woodlands/Wildlife sub-programs.

Project: Green Plan Summary Bulletin

Project Objectives

- c To increase awareness within the agricultural sector of the range of activities conducted under Green Plan and of the resulting information through production of an 8-page Green Plan Bulletin outlining the progress of the program, sub-programs and selected projects.

Contribution to Committee Objective 1: (Liaise with those engaged in technology transfer)

- c a bulletin summarizing the overall accomplishments of Green Plan and the seven sub-programs, and highlighting the achievement of selected projects within each sub-program was prepared and distributed to over 2000 people, including innovative farmers, farm media and advisory staff in government, university, conservation authorities, and agri-business.

Deliverables:

Bulletin entitled *Special Agricultural Green Plan Issue of Innovations*. March, 1997. 8 pages

Project: Green Plan Media Releases

Project Objectives

- c To increase the awareness within the agricultural sector of the information available from Green Plan research through production of a minimum of 10 articles, suitable for publication in farm magazines or similar publications, outlining the results of selected projects and their potential application in Ontario agriculture.

Deliverables:

Articles, based on the projects listed below, were prepared and distributed through the communication channels of OMAFRA and AAFC.

- < *Impact of Manure Application Methods on Water Quality, Focussing on Nitrogen and Bacteria Transport in Soil*
Discusses the role of macropores in the contamination of tile drain water by liquid manure and outlines the effects of soil moisture content, application methods and tillage; offers management tips to reduce the risk of contamination.
- < *Variable Rate Technology for Nitrogen Application*
Explains and encourages the use of check strips to predict optimum nitrogen application rates and the use of yield maps to define application patterns
- < *Crop Rotations and Cover Crop Effects on Erosion Control, Tomato Yields, and Soil Properties*
Encourages the use of crop rotation and cover crops in tomato culture by describing the beneficial effects on soil conditions, crop yield and crop quality.

- < *Transformations in Soil: Crop Response to Nitrogen in Manures with Widely Differing Characteristics*
Describes the effect of the characteristics of different types of manure on their ability to supply nitrogen to crops and notes implications for application management.
- < *Closed Loop Recycling - Composted Biodegradable Organic Urban Waste Application on Agricultural Lands*
Outlines the effects of the application of composted municipal wastes on cropland on crop emergence, growth, yield, pest problems and soil conditions; offers suggestions regarding the appropriate time and method of application, tillage, and the use of fertilizer nitrogen.
- < *Assessment of the Influence of Manures for the Control of Soilborne Pests Including Nematodes, Fungi and Bacteria*
Compares the value of different manures for controlling Verticillium wilt and potato scab in potatoes; encourages use of a bioassay to predict the suitability of manures for this use; notes the possible usefulness of this approach in controlling soilborne diseases in other crops.
- < *Constructed Wetland Facility (Belle River Conservation Club)*
Describes the design, construction and operation of a three stage wetland facility to dispose of contaminated waters from a dairy operation.
- < *Effect of Cover Crops and Reduced Tillage on Nitrogen Management*
Examines the effects of cover crops and tillage systems on nitrogen management and nitrate leaching losses in corn.
- < *Management of Streams and Agricultural Drains to Improve Wildlife Habitat*
Draws on the experiences of several Wetlands/Woodlands/Wildlife projects to promote techniques for protecting streambanks in ways that will reduce erosion and improve habitat for fish and other wildlife, while minimizing the conflicts with agricultural activities.
- < *Green Plan Summary*
Summarizes the history and accomplishments of Green Plan and the seven sub-programs.

Appendix A: Membership of the Green Plan Technology Transfer Committee

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Appendix B: Summaries of TTC Research or Development Projects

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Project Summary: Development of an Agricultural Information Integration and Exchange System

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Abstract

The Canada-Ontario Green Plan research projects have collected large quantities of new data related to agricultural resource management. Researchers, extension workers and farmers are facing the increasing challenge of accessing and interpreting the new information within the context of the existing recommendations. Internet tools can facilitate the organization, storage and selective extraction of information.

Introduction

As the number of government advisors and industry specialists available to assist farmers decrease, it becomes increasingly important to develop alternative methods for organizing and managing information and distributing it to the farm community. This project was established to evaluate the use of the World Wide Web and associated software tools to create an improved system for agricultural information integration and exchange.

The specific objectives were to:

- c establish the linkages between information at the levels of awareness (e.g. BMPs), technical (e.g. scheduled and ad hoc extension publications), and research reports.
- c retain information at the greatest level of detail.
- c develop and implement efficient procedures to select relevant information and provide easy access pathways through two-way communication.

Methods

This project uses hypertext markup language (HTML), other Internet tools, and relational database technology to demonstrate a method to integrate research information about agricultural operations with the body of existing knowledge and to explore means of selection and exchange of information with the farm community. As an example implementation, the project used the large volume of research information (available in printed and digital format) from the almost 40 projects, which were the research component of the Canada-Ontario Green Plan. Many of these projects also delivered the “raw” data in digital format for incorporation into a standard format comprehensive database.

Results and Discussion

Progress in building a sustainable World-Wide Web presence

Agriculture and Agri-Food Canada has been pro-active in building and maintaining a presence on the World-Wide Web. Other agricultural ministries and organizations, such as the Ontario Ministry of Agriculture, Food and Rural Affairs, have developed similar information systems (as have many others in the United States and overseas.)

This project created a prototype Web site (Swayne et al, 1996) which provides a framework of agricultural activities, encompassing the province's agricultural research and information structure and publications. The site also offers links to external agencies. The information is organized within topic groupings familiar to the farm community.

Users can choose among several methods of information access, including:

- C broad level filters to select levels of information (research, technical, awareness),
- C standard browse and keyword searches,
- C network structure to facilitate selection of subsets of information specific to user needs,
- C several small expert systems with HTML interfaces to select information which is even more specific to the needs of the user.

Manure Wizard is a “C” application (a computer programming language) running a small set of rules related to manure production, storage, application and use as a source of crop nutrients. A consultation produces a report specific to the user's situation and a recommendation as to whether or not the user should access a more comprehensive expert system for increased information. The role of the expert system is to increase precision without losing detail.

Weed Assist is a weed identification and treatment decision support system that is an example of information transfer for a well-defined task, pest management. It was implemented by Hess (1996) for retrieval of chemical factsheets and pesticide recommendations from decision tables. New factsheets can be substituted as they become available. The document stream can be pruned to remove superfluous material. The decision tables, as they are presented, can be made into interactive selective mechanisms (as has been done in Weed Assist). This prototype provides a direct illustration of how another initiative advanced by the Green Plan Technology Transfer Committee (i.e. EP 75, an expert system to provide pesticide recommendations) could be integrated with Internet information transfer.

Managing an agricultural information integration and exchange system

The underlying storage format has been designed for efficiency of access and ease of update. Attributes of each document are recorded in a meta-database. There are three broad categories of document: information documents, navigation documents and data documents (i.e. research measurements). The metadata describes the origin and function of each document and its relationship to other documents. The metadata is also used to create dynamic views to the system specific to the individual user, which become a fourth document class. This flexible view

capability, called TreeWidget, is designed to produce a user-oriented view, eliminate links which are not relevant, and update the user view as required without affecting the document collections. This approach to information display is being evaluated for use on the Green Plan Web site which was developed with assistance from the TTC.

Two-way information flow

To some extent, the two-way flow of information has already been achieved. At a simplistic level, the filters and keywords are the information used by the system to select a subset of information specific to the user. At a more sophisticated level, the expert systems and the TreeWidget profile provide a means for precise specification of individual farm conditions and information. Currently, user information is deleted after it is interpreted. User-supplied information could be retained to identify developing areas of concern or to target areas requiring improved information. In general, however, it will be necessary to protect the identity and confidentiality of individual farmers by aggregating information by geographic region (e.g. county) or class of farm. Also checks are needed to avoid the accidental or malicious use of the system to create false input. It would also be important to know whether the data represent actual farm situations or hypothetical scenarios.

Conclusions

The current system offers improved management and integration of agricultural information and constitutes a viable alternative for dealing with information overload and reductions in advisors and extension personnel. The prototype Web site is currently running on a server at the University of Guelph and may be adapted and transferred to a Web site maintained by Agriculture and Agri-Food Canada to provide ongoing access to the information generated from the research component of the Canada-Ontario Green Plan.

In the future, as the two-way flow of information is further developed, the system may assist in evaluating Best Management Practices, and provide feedback on the impact of farming on the environment. The approval needed to input the information to a monitoring (farmer survey) program is not a technological problem but a legal one.

References

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Swayne, D.A., Adrian Harding, Mark Mayo, Bruce MacDonald and Bruce Bowman. 1996. *Agricultural Waste Management: A Unique Application for the World Wide Web*. Proceedings of the Fourteenth IASTED International Conference, Innsbruck, Austria. Applied Informatics, pg 224-228.

This report was prepared on behalf of the Technology Transfer Committee for its use. The views expressed by the author(s) do not necessarily reflect those of Agriculture and Agri-Food Canada, The Ontario Ministry of Agriculture, Food and Rural Affairs, or the TTC.

Project Summary: Internet Pilot Project: Green Plan Home Page

Green Plan Web Address <http://res.agr.ca/lond/gp/gphompag.html>

Background

One of the primary objectives of the Technology Transfer Sub-Program was to identify and investigate new approaches for organizing and distributing agriculture/environmental information to the client base. There was also a need to organize environmental/agriculture information from Green Plan projects, and other related programs, and to make it readily available to the public on a continuing basis after the completion of these programs.

Objectives:

To investigate the feasibility of using the Internet to:

- c provide one-window public access to information about the Canada-Ontario Agricultural Green Plan and the results of Green Plan projects.
- c reduce the cost of distributing final reports by providing them in digital format available for downloading by the user.

Web Page Development

Efforts were initiated by May, 1995 to organize relevant Green Plan documents and convert them into the HTML format and to develop a Home Page design. In parallel with the development of the Green Plan Web site, the author developed a companion Web site for the Pest Management Research Centre (PMRC). The file sets were uploaded to an internal AGRINET server at AAFC in Ottawa, in October, 1995, and both Web sites made their debut on the World Wide Web on November 1, 1995.

Target Audience

The target audience for the Green Plan Web site is the following, in order of priority:

1. Agriculture sector — producers, agribusiness professionals, extension staff.
2. Education sector — teachers, students and consultants.
3. Environmental special interest groups.

Web Site Content

The Green Plan Web site is available in both official languages and is organized under the following major categories:

1. Background information on the development of Green Plan.
2. The Canada-Ontario Agreements. The *Canada-Ontario Environmental Sustainability Accord* (COESA) and the *Canada-Ontario Agreement On The Agriculture Component Of The Green Plan* are available for downloading from the Web site.

3. Program organization and committee memberships for the overall Green Plan and the Research Sub-Program.
4. General information, such as Green Plan Newsletters and Upcoming Events.
5. Descriptions of the eight major sub-programs, in varying levels of detail, depending upon the availability of information:
 - C Best Management Practices (BMP)
Includes introductions to the first 11 BMPs, along with graphic images, a colour brochure describing the BMPs and ordering information.
 - C Environmental Farm Plan (EFP)
Includes the background to EFP, the Environmental Farm Agenda and abbreviated overviews of the 23 worksheets in the EFP.
 - C Rural Conservation Clubs (RCC)
Includes the organizational background, objectives and selection criteria for the program, as well as short descriptive overviews of 36 farmer-based Clubs exploring innovative technologies for sustainable agriculture.
 - C Research
Information from the Accord Management Committee Meetings provides the background for the development of the three Research Sub-Programs:
 1. Manure/Nutrient Management (Closed Loop Recycling)
 2. On-Farm Research
 3. Development of an Integrated Resource Monitoring Capability

An in-depth context for the development of the Research Sub-Program, prepared by Dr. Bruce MacDonald, AAFC, provides a broad perspective of agricultural/ environmental activities leading up to the Green Plan Program.

Short descriptions of 31 Research Projects plus six supplementary projects are provided. As final reports are approved, their executive summaries and PKZIPPED WordPerfect versions of the reports will be available for downloading from the Web site. Pictures with suitable narratives from each project are currently being prepared and will be incorporated into this section.

- C Stewardship Information Bureau (SIB)
The Stewardship Information Bureau, a separate sub-program of Green Plan, developed its own Web site at: <http://sib.lrs.uoguelph.ca/sib3.htm> Links from the Green Plan Web site to this repository of current sustainable agriculture information are provided.

- c Wetlands/Woodlands/Wildlife (3W)
The background, objectives, and committee membership for the 3W program are provided, along with short descriptions of the 10 demonstration projects on agriculture-habitat enhancement.

- c Technology Transfer Committee (TTC)
The Terms of Reference, committee membership, and short descriptions of the projects of this committee are provided.

6. Links to Other Related Web Sites

Links to approximately 300 agriculture-related Web sites, organized by category, are included in this section. These links are frequently reviewed and new categories and links are added as we become aware of them. Since a number of these sites are themselves large repositories, users find this service an excellent way to find information.

Program overviews from all Ag-Environmental Programs conducted in Ontario, since 1986, were also identified, organized and converted into HTML. This very extensive overview, which resides on the PMRC site, is fully integrated with the Green Plan site, to provide a convenient one-window approach for users.

Considerations in Developing a Web Site

1. Location of Documents

One of the great features of the Internet is that ONE copy of a document in ONE location can serve a global audience. However, there is still a tendency in some quarters to have copies of the same documents on different servers, often for prestige, or political reasons. As a result, we now place the document URL across the top of some pages, so that if they are copied to other servers, viewers will still be able to identify their true source.

In cases of very heavy access traffic to a site, there are ways of electronically “mirroring” the site on another server to improve accessibility.

2. Ownership of Web Documents

Ownership of material on Web sites is often a sensitive issue because of protection of intellectual property. On our Web sites, we consider all of the information to be in the public domain, and we only require that users acknowledge the source of the information when quoting or reproducing it elsewhere. We also include a disclaimer, so that no one can hold the Crown liable for consequences arising from the use of information provided on our Web sites.

3. Home Page Design Issues

One must provide a clean, concise, yet attractive overview of the organization, while providing rapid access to information of interest to the user. A number of issues, relating to the design of Web sites, have substantial impact upon their ultimate success. Some are personal taste issues. Others are more technical in nature.

c Site Organization

The Home Page should load quickly and provide a representative overview of what the user can find at the site, including some “teaser” information. For bilingual Web sites, it is best to create separate Home Pages for each official language, with links between them, and then advertise the existence of both versions of the Home Page.

When designing a Web site, it is easy to build in many layers of information because of the ease of implementing hypertext links. Web designers must always be aware of information accessibility. If Web pages load slowly, users will not tolerate wading through many layers (pages) to reach the information they require. At each step along the way, the Web designer should provide quick routes back to the Home Page, or to other intermediate levels which will allow them to modify their browsing.

c Use of Advanced Features - Frames, Graphics, Java Applets

There are a number of tradeoffs to consider in Web design, especially in the use of visual-enhancing tools, which often require more powerful computer processors, as well as fast access lines to the servers.

Graphic images on our sites are limited to about 30K in size to improve ease of access (except in certain instances where it is necessary to read text from the images). By specifying the width and height sizes of the image in the HTML tag, the text can load quickly, flowing around the designated placement site for the graphic, and allow the user to obtain information while the graphic loads. Some Web sites employ graphics which progressively load, with only scant definition of the graphic in the initial pass, and becoming better defined with each additional screen refresh. If an image is to be used in different places on Web documents, the same image should be used throughout as much as possible, since the Web browsers “cache” images, and once cached, they reload very fast.

Frames allow the simultaneous viewing of two or more separate Web pages on the computer screen. This feature permits retention of a directory or site map of the Web site in constant view (on the left side of the screen) as the user moves through the site. The big disadvantage is the relatively large number of online users who still have their video resolutions set at SVGA (600 x 800) or less, and who have 14" monitors. The amount of information visible on these screens is very limited, completely negating any advantage offered by frames. As yet we have not implemented frames on our site, but are considering limited use of them in the future for improving site navigation.

The use of an Internet **animated scripting language**, Java, has become quite widespread. Although it can enhance visual effects on Web sites, it is often used for trivial applications, not necessary for presenting Web information. Since Java relies largely on the manipulation of graphic images to simulate motion, it increases the load on computer memory and on the access lines to Web servers.

These concerns may disappear within 3 - 5 years, as bandwidth of transmission lines increases and as cheaper, more powerful computers with advanced graphics capabilities come into more widespread use.

c Appearance

Home Pages should be aesthetically-pleasing without appearing cluttered or too busy. To keep the interest of repeat viewers, it is necessary to make small, but noticeable improvements on the top level pages on a regular basis. It is very important to let viewers know that the site is constantly being monitored and improved, so that there will be something new each time they come back.

The use of background colours on Web pages helps break the monotony of the grey default backgrounds used by HTML browsers. Although several hundred shades are available, only a few of the lighter blues, greens and yellows are suitable as page backgrounds. Although it is possible to use textured backgrounds, care must be taken to ensure that the text remains easily readable.

Keeping Web Sites Current

Given present economic realities, it is an increasing challenge to keep track of what is in the inventory as the Web site grows, let alone ensuring that it is still relevant. We use a small caption at the bottom of all of our Web pages (e.g. "*Last Revised: March 13, 1997*") to remind us (and the viewer) when we last updated the document.

Advertising our Web Site URLs (Uniform Resource Locator)

There are almost an infinite number of ways and places to now advertise Web site addresses to attract the target audiences.

- c Most Web sites which act as clearing houses for Web URLs (e.g. YAHOO) or which are search engine sites (e.g. Lycos, AltaVista, or Excite) include a utility for leaving one's Web URL, along with a short description of the site.
- c Other sites that present subject matter similar to one's own usually are open to showing reciprocal links.
- c Automated search engines, called "Web Crawlers", systematically "crawl" through the World Wide Web recording and indexing Web sites. To improve the chances of one's site appearing on more site lists, it is important to have "key words" or phrases that these crawlers can easily index. There is a special "META" tag in the HTML language which allows the WebMaster to place these important words and phrases to be indexed.

- c The WebMaster can monitor relevant USENET discussion groups and reply to the newsgroup (as opposed to an individual) suggesting that the answer to the question raised can be found at the Web site. Including the hypertext-linked URL in the reply will display it globally to people following the newsgroup.

Measuring Successes of a Web Site

Counters are used to keep track of those accessing the Home Page. Since July, 1996, there have been about 1500 hits on the Green Plan Home Page, and about 2400 on the PMRC Home Page. The WebMaster has a separate E-Mail address, which appears at the bottom of the Home Pages, and to which questions and comments can be forwarded.

We have received many favourable comments back from users who find our Web site a very valuable resource on Ag-Environmental information. The comprehensive overview, on our companion PMRC site, provides true one-window access to information about all such agricultural/environmental programs conducted in this province since 1986, which together had an input value exceeding \$100,000,000.

This project should serve as a model for other jurisdictions to follow in organizing similar information, thereby adding to the global database of such information. The Internet offers a low-cost solution to solve the lack of coordination and sharing of information that has continued to exist, even in this “supposed” age of information.

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This report was prepared on behalf of the Technology Transfer Committee for its use. The views expressed by the author(s) do not necessarily reflect those of Agriculture and Agri-Food Canada, The Ontario Ministry of Agriculture, Food and Rural Affairs, or the TTC.

Project Summary: Best Management Practices Web Site Feasibility Study

This document reports the investigation of Interchange Interactive Communications (the contractor) into the following questions:

- c Can a World Wide Web site offer value in communicating Best Management Practices information developed under the Green Plan?
- c What considerations shape the business model for such a Web site?
- c What relevant information can we learn about producers for whom the site would be created?
- c What relevant information can we discern about organizations most likely to be sponsors?
- c What content and navigational strategies correspond with user and sponsor needs?
- c What administrative, control and support requirements correspond with the business model, needs analysis and content and navigational strategies?
- c What would be the approximate cost to implement and maintain such a site?

To answer these questions, the authors of this report conducted the following activities:

- c Interviews with agribusiness advertisers and with farmers identified as Internet users.
- c Research on Web advertising rates and models.
- c Scan of secondary research on benchmarks and trends in Internet usage among farmers.
- c Survey of other Web sites potentially competing for our target producers and sponsors.

Following this investigative phase, the project team collaborated on the synthesis of information and ideas into a set of design recommendations for the site. Key recommendations include:

- c An “inclusive” approach to content from BMP publications and other sources.
- c Personalization of site navigation features to deal with potential for information overload.
- c Confidentiality provisions for producers.
- c Facilitated discussion groups.
- c Help and search resources.
- c Remote-access content update and administration features.
- c Labelling of information sources.
- c Sponsored features and utilities.

Overall, the authors conclude that the World Wide Web offers a promising tool to promote sustainable agricultural practices in Ontario. This report identifies potential synergies between the interests of farmers, farm organizations, government agencies and agribusiness and offers recommendations on how these can be harnessed in a World Wide Web site.

The report leaves two key questions for the commissioning body to address:

- c Are sufficient resources available to carry the proposed initiative forward?
- c Do government agencies recognize an on-going role for themselves in supporting technology transfer through the proposed Best Management Practices Web site initiative?

Report prepared by: Quarry Communications

This report was prepared on behalf of the Technology Transfer Committee for its use. The views expressed by the author(s) do not necessarily reflect those of Agriculture and Agri-Food Canada, The Ontario Ministry of Agriculture, Food and Rural Affairs, or the TTC.

Project Summary: Marketing and Distribution of Publicly Developed Software Applications: Electronic Publication 75 Pilot Project

Introduction

Many software applications are developed by the public sector to satisfy internal needs. Some of these applications will also satisfy the needs of individuals and businesses. Marketing and distribution of these applications to the public, at a fair price, could provide some of the revenue needed for on-going maintenance and enhancements.

Objectives

The objectives of this project were to determine the feasibility of marketing and distributing publicly developed software, and to create a model against which the feasibility of marketing future software applications could be tested.

“Electronic Publication 75” (EP 75) was selected for use in this pilot project. This software application was developed by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), based on the book *Publication 75: Guide to Weed Control*.

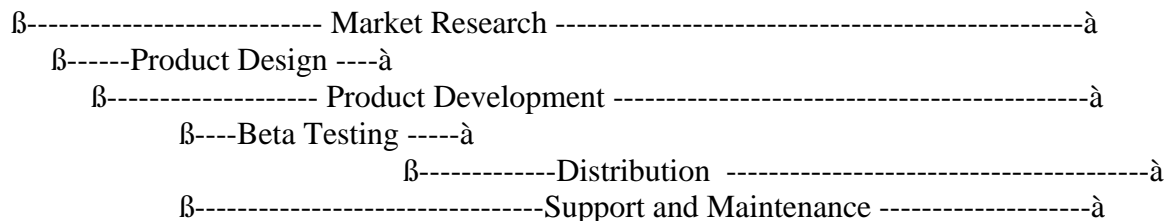
Background

Time Line to Market

Any software product that is released to market must pass through the following stages:

1. Market research
2. Product design
3. Product development
4. Beta testing
5. Distribution
6. Support & maintenance

Each stage of the product’s life cycle must cover various issues, all of which are focussed on meeting the requirements of the target user. These stages can be represented in the following diagram:



Market Research

To sell a product, the producer must know what features users want in the product and how much value they place on those features. For the product to be successful, potential users must be clearly defined. Based on the description of the target user, the potential number of users should be determined through some demographic research.

Market research should focus on representatives from the target group to determine their requirements and an indication of what they would pay for the product. Where possible, the input of major stakeholders in the target market should be solicited as they hold the greatest potential for sales revenue. User price preferences and the estimated number of potential users will help to determine how complex a product one can afford to develop.

Monitoring the requirements of the target group is an ongoing process since these can be influenced by various changes in the users business like legislation, economic issues, etc. It is essential to maintain communication with target users that have an interest in the success of the product.

Product Design

Based on the input received from the survey of potential users and the knowledge of the industry, a list of software requirements is created and formulated into a design document. The design document is the key to success for the product since it defines the focus for the project and the deliverable items. **No development** should take place until a clear design is available and the project team has a consensus as to what the product will do. It is much cheaper to make a change to the design document than it is to change the product once development work has started. Studies have indicated that changes to a product that is still in the design stage are 10 to 1000 times cheaper to implement than if the product has entered the development stage.

The design document lays out as many details as possible about how the product will work and how it will look to the end user. For a software product, this involves itemizing how the processes work, the data items and the user interface (including screens and reports). User and designer features must be prioritized as to which features are “Required”, “Optional” and “Not necessary”. From this grouping, a decision can be made as to what features to include in the product and the timelines required to deliver them. (Features that will not be included initially may be kept for possible inclusion at a later stage).

Product Development

In the product development stage, the items laid out in the design document are implemented. This stage will require the resources to develop, test and document the product for the user. The level of effort required in this stage is proportional to the amount of previous developmental work that can be incorporated into the product.

It is imperative that the design criteria be followed exactly to ensure that there is no variation within the entire project team regarding what is to be delivered. Some changes are to be

expected, based on new ideas for improving the design of the product for both the user and the development team. Where changes to the design are made, the design document should be updated to reflect those changes. In deciding which changes to allow in the design, cost, user requirements, ease of implementation and effect on time lines must be weighed against each other.

Beta Testing

Once a workable product has been developed, it should be tested in various configurations to ensure that the features promised in the design document are delivered. Testing must happen in a timely manner and can be used to generate some market awareness. The breadth of the Beta program is based on the number of different configurations the product will be subjected to.

Once there is a confidence that the product is close to the final stages of the Beta tests, work on the product release announcements can begin.

Distribution

This stage involves distribution of both marketing material and the product itself. The marketing campaign strategy will have been developed when product design and market research were completed. Distribution involves making the user community aware of the product's release (including price, where it can be purchased and what the product features are) and delivering the product to users, once it is released.

Information should be collected regarding users of the product. This may be gathered either when orders are processed or when product support is provided or both.

Support and Maintenance

Once a product is released into general use, problems will arise regarding its performance. Users must be able to contact someone for help in solving their problems or for information about the product. Where problems are found with the program, a mechanism must be in place to repair it and redistribute the updated product to users. This may or may not involve a cost for the user.

EP 75 Experience

Background

Bringing EP 75 to market has been a long process that has gone through a number of transitions. The EP 75 project has lasted for more than five years and the product has undergone a large amount of redesign. EP 75 was originally developed using the resources of OMAFRA's Management Services Branch with input from various specialists within OMAFRA. The focus of the project was to deliver an expert system to help producers make good decisions regarding weed control.

The EP 75 package contains nine 1.44 MB diskettes, a printed User Manual, a copy of Publication 75 and of Publication 505, *Ontario Weeds*. The software requires a minimum

hardware configuration of a 386DX/25 processor with 8 MB of RAM running Windows 3.1 or Windows 95.

Target Market

In the EP 75 project, the target market for the original product was the producer, with some secondary focus on the retail segment of the Agricultural sector of the economy. This focus was picked based on the target audience for OMAFRA's efforts and the tie back to Publication 75.

- c Primary: 300 agriculture chemical retailers.
- c Secondary: 4,000 producers with personal computers and over 500 acres in production.
- c Tertiary: crop consultants, extension personnel and educational institutions.

Market Research

A large amount of information was solicited from the target user community through focus groups and the involvement of "experts" in the testing process during the evolution of the product. This involvement led to a large number of recommendations on features to be built within the product.

The price was kept in the "affordable" range to increase penetration. No real data was gathered to assess the perceived value of the product prior to release.

Product Design and Development

Much effort had been devoted to refining early unreleased versions of the product. The time to market coincided with the emergence of Windows as a standard operating environment on the PC desktop. The product designed for a DOS environment was discontinued prior to its full release.

Little redesign was done to the product. Maintenance of the original design has resulted in a slightly slower product that is proving difficult to maintain as new features are added. Also, because tenders were awarded for the development of the product based on discrete time blocks, the product is continually having changes "bolted" on, rather than being redesigned periodically.

The costs to redesign segments of the product takes away from the maintenance and development budget. Some redesign should happen prior to each revision of the product to ensure that the system remains efficient.

Beta Testing

In the case of EP 75, an excellent job of testing the application was carried out prior to the original release of the product. A large number of inconsistencies were spotted prior to release. This is reflected in the relatively small number of support calls that were logged during the first year of distribution for EP 75. There was a very real "buy in" by those who volunteered time to test the product and their input made EP 75 a better product.

Distribution

With the selected target audience, the strategy was to market the product via farm shows and in press releases to industry papers and journals. OMAFRA had the contacts to place these releases and the press picked up on the announcement. All distribution in year one was handled based on orders submitted by the end users.

Part of the distribution process is to gather a list of registered users. In the case of EP 75, a very labour intensive process was implemented in the original design, which involved producing a set of disks for each person who wanted to buy the product. As a result, the cost to produce and distribute each copy of the product has been excessive. If EP 75 is to become a revenue generating product, the labour component for distribution MUST be minimized to maximize the margin recovered from each sale. By forcing the user to register their product (e.g. through some incentive), the distribution process can be automated and contracted out to disk duplication firms that can do the same job for 5-10% of the costs incurred in the first release.

Support and Maintenance

For EP 75, the decision was made to handle each support call individually. If the product reaches expected levels of distribution, a more formal help desk will be required. All support calls should be channeled through a voice mail system, with support being delivered on a call-back basis. All calls should be returned in a timely manner. Industry support desk response times vary from immediate to 4 hours, on average. The faster the average response time the more cost associated with each support call.

The help desk will need a database of the incidents reported and the resolution to the problems. This will allow the help desk to do some preparation prior to calling a client back.

Currently, maintenance to the product is based on informal feedback (and additional testing) provided by the product team. This approach should be enhanced to include input from users through a like/dislike survey.

Report Prepared by: Orbex Computer Systems

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Project Summary: Best Management Practices on CD-ROM

Objectives

- c To investigate and document the process required to develop interactive multimedia products.
- c To explore the suitability of CD-ROM as a medium for transferring agricultural technology through production of a prototype CD-ROM of the Best Management Practices book, *Water Management*.

Activities

A task team was assembled to direct the project and to advise the consultant and supplier. Task team membership included a representative from the Green Plan Technology Transfer Committee, the BMP project and the BMP *Water Management* task team, along with an OMAFRA information technology specialist, and an education consultant. An independent multimedia consultant was engaged to help develop a Request for Proposal, select a supplier, and facilitate ongoing management of the project.

Tasks included: developing a story line, selecting visuals and other media for the CD-ROM, and reviewing and approving drafts and other deliverables as the project progressed. The task team also hoped to develop a marketing plan, test final deliverable with target audience(s), and report findings to Green Plan Technology Transfer Committee.

Target Audience

Two potential target audiences were identified for the product that would be developed:

- c The education sector including secondary and post-secondary teachers, students and consultants.
- c The agriculture sector including producers, agribusiness professionals, extension staff, and environmental special interest groups.

Choice of Subject Matter

The *Water Management* BMP was selected for the pilot project for a number of reasons.

- c Students and teachers had been making significant demands on print inventory, and a CD-ROM appeared to have potential to be an appropriate and marketable vehicle to satisfy their needs.
- c The subject matter of the BMP lent itself to including a wide array of related topics, (e.g., management of on-farm wastes, nutrients, pests, irrigation, and natural areas).
- c Because the book had been produced relatively recently, the technology used in its production made it more easily adapted to an electronic format than were some of the earlier books.
- c A complementary video on groundwater had already been produced.

Learnings

1. Concept Development and Product Design

Market research into the potential audience, the nature of the medium, and the industry is essential prior to developing a high quality CD-ROM.

Audience

A good understanding of the target audience will determine the type of navigation and the product that should be produced.

Compare the concept for the CD-ROM with the capabilities of the Internet, and preview similar products. Judge audience expectations accordingly. Include as much interactivity as possible in the original concept.

Students and farmers have distinctly different needs that made it difficult to develop a CD-ROM that satisfies both audiences. Students need comprehensive information, including background, comparisons with urban situations, graphics, quizzes, and (ideally) teacher's guides. Farmers are solution-oriented, looking for quick answers to specific questions.

Market Potential

Statistics relating to the computer hardware owned by Ontario farmers are necessary to determine the market potential for agricultural CD-ROMs.

Task Team Knowledge

The task team should become familiar with the CD-ROM industry, including terminology, platforms, types of suppliers, costs, types of interactivity, prior to initiating product design and development.

A book needs considerable redefinition and repackaging by the team to create a high quality CD-ROM. Significant time and knowledge, on the part of the task team is required to develop the appropriate level of interactivity. Our task team entered the project with several misconceptions, notably that the book could simply be "flipped" into CD-ROM format and that linkages and search engines were implicit in the medium. Transferring a book to a CD-ROM is relatively simple. However, this does not use the full potential of the medium. Simply copying a book to a CD-ROM uses the medium more as storage than as an educational tool appropriate to the high standards of EFP and BMP printed products.

2. Request for Proposal (RFP)

The RFP's effectiveness is in part determined by the degree to which you can define the product in advance. This includes breadth of content and how it all works together.

After meeting with three potential suppliers, the team felt it necessary to get expert help in the development of an RFP and engaged the services of a multimedia consultant. Such a

consultant should have some familiarity with the target market, and be able to direct the team to a group of appropriate suppliers.

The task team should be familiar with the vocabulary of CD-ROM to ensure mutual understanding among the consultant, client and supplier. The more one understands the medium, the sharper the RFP. (For example, our original RFP did not specify the importation of EFP and other BMP materials.)

A price range should be included in the RFP so that bids are comparable.

3. Supplier Selection

Choose from among suppliers with a proven track record in educational materials. Many of our potential suppliers came from the advertising sector, not from publishing, and were not experienced with educational products. None was familiar with the agriculture sector. Because the technology was still in its infancy, many of the bidders did not have appropriate demonstration models that we could evaluate.

Meet with a short-list of suppliers, and as much as possible, ensure that each understands the other's expectations. None of the bids met our needs exactly - the proposals ranged from relatively simple conversions to elaborate re-creations of the book complete with video and sound.

The multimedia consultant should explain each of the proposals clearly to the task team. Where proposals are vague, the consultant should obtain clarification from the bidders.

Insist on a breakdown of expenses (programmers, designers, administrators, etc.).

4. Creating the CD-ROM

Allow the team sufficient time to develop the architecture — the supplier won't do it. A well-designed architecture will reduce the number of hot-linked (HTML) words. The task team devoted considerable thought and time to development of the architecture for the product and linkages, requiring several meetings with the supplier.

Once architecture has been determined, demand to see full-length drafts, to reflect how the final product will look, and to show whether any text and/or visuals have been lost. Sometimes text was lost in conversion of Quark files to CD-ROM. The "drafts" we previewed were always a very small portion of the final product.

Challenge the supplier to stay up-to-date with developments in communication technology. The technology available changed during the project, and so did our platform. Most high-end CD-ROMs are produced in MacroMedia Director, which supports elaborate graphics but requires manual programming for simple functions, such as searching and keywords. The Working Committee chose to switch from MacroMedia Director to HTML, which is

more easily programmed and Internet-friendly. The change in platform meant we were working with different personnel, and had to acquaint them with our expectations. We also had to redefine the final product in light of the capabilities of HTML. We chose to import EFP Worksheets and Infosheets to increase interactivity value for farmers. We also added Glossary and Legislation sections, and after much discussion, abandoned the attempt to include a Search Engine.

Summary Recommendations

1. **Conduct market research.** Specifying the target audience, media, educational intent, and subject matter should clarify the feasibility of the project for the intended audience.
2. **Train staff.** Personnel developing multimedia products will require training to increase their understanding of the vehicle and skills in developing multimedia educational products.
3. **Assess cost effectiveness.** While the CD-ROM may reduce distribution costs, the savings may be outweighed by the cost of developing an interactive electronic package. There can be a high staffing cost associated with providing the subject matter expertise required to design, develop and maintain such transfer methods. In order to ensure that the product will be a cost effective means of transferring information to the target audience, relative to other communication methods, the full costs of proposed new technology transfer processes (design, development, production, distribution, maintenance and support) should be assessed before design or development is initiated.
4. **Choose consultants carefully.** Due to the highly technical and rapidly changing nature of this industry, consider acquiring expertise to facilitate project design and administration. The firm or person(s) hired should have the necessary qualifications to: clarify needs, specify competitive costs and value for services, and help choose a suitable supplier.
5. **Choose suppliers carefully.** This industry is in its infancy. Few firms have the direct experience with technology transfer in non-traditional education settings. Fewer still have this expertise and experience with agricultural and rural clients. Virtually no one has these attributes plus technical knowledge of the subject matter. Allocate staff time accordingly to compensate for deficiencies.
6. **Work closely with supplier to ensure product quality.** Apportion tasks with timelines. Insist upon quality control points. Look at comparable and competitive products. Inform supplier of revised expectations. Participate fully in product testing.

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Project Summary: Technology Transfer Partnerships in Environmental Enhancement: Best Management Practices Pilot Project

Project Objectives

This project was undertaken to develop and recommend strategies for developing, organizing and funding partnerships to facilitate the transfer of Green Plan funded technology.

Background

The Best Management Practices (BMP) program was established in 1991, by the Ontario Ministry of Agriculture, Food and Rural Affairs, and Agriculture and Agri-Food Canada. Managed by the Ontario Federation of Agriculture, the publication series provides farm resource information that integrates business and environmental management principles. Fourteen books in the series have been developed. Farmers interested in making changes in their management practices are the main audience for the publications. The books feature text that is easily read and helpful graphics to ensure effective communication.

Market research, conducted under the BMP program, substantiated the appeal of BMP publications as sponsorship vehicles. In 1994/95, a study by Decima Research quantified the high recognition factor and perceived value that the books had achieved among farmers in a relatively short period of time. In 1995, a commercialization study, by Deloitte & Touche, characterized corporate interest in supporting the document series.

Activities

In 1995/96, the Technology Transfer Partnerships for BMPs Project supported the development and implementation of a sponsorship marketing plan for BMP publications, utilizing two books as a pilot project, *Irrigation Management* and *Integrated Pest Management*. Through this project, financial support was sought from input suppliers in the farm sector, to assist with development, publication and distribution of these books.

Results and Observations

This pilot marketing effort obtained corporate sponsorship support totalling almost \$100,000 for the two publications and a third one under development at the time, *No-till: Making It Work*.

In total, advertising was solicited for eight BMP titles during 1995 and 1996. At completion, six of the eight publications will be distributed carrying commercial messages from one or more farm input supplier.

The Technology Transfer Partnerships for BMPs Project and subsequent efforts in 1996/97 identified a number of issues that any sustained sponsorship marketing effort would need to resolve, including:

- i) distribution: Sponsors require advertising that has a measurable impact; that implies well defined distribution, i.e., scheduled, targeted, verifiable, and cost effective.
- ii) content Very little money is devoted to corporate image marketing; sponsors' advertising budgets are usually built around product campaigns.
- iii) development Sponsors need to be involved early in publication development, ideally at the concept stage, if partnership potential is to be maximized.
- iv) market research Sponsorship sales need supporting research to quantify the relevant characteristics of the audience, sponsors and competitive publications.
- v) positioning The opportunity to advertise in a technology transfer publication must be positioned relative to a) the customers' situation, b) competitive publications, and c) the sponsors marketing program.
- vi) pricing Advertisers are accustomed to a rate card based on circulation and rates for competitive publications. Advertising in technology transfer publications represents an unknown vehicle for them. It may be necessary to negotiate advertising rates, on a case by case basis, for some time, until the market value of advertising in technology transfer publications is established.
- vii) timing Marketing programs receive their allocation within a well established budget cycle. Efforts to obtain sponsorships have to be synchronized with that cycle.

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Project Summary: An Approach to Technology Transfer Within the Canada-Ontario Green Plan

Objectives:

- C to compile and categorize the projects of Green Plan and other recent programs with similar objectives from which technical information was or will be collected.
- C to indicate the linkages among related projects.
- C to recommend improvements to the system of technology transfer in Ontario to promote the transfer and adoption of the information generated from these projects, using the area of manure management as a case study.

Results:

Information, including titles, principal researchers, objectives and abstracts (or expected results), was assembled from 187 projects, within eleven programs or sub-programs. The activities undertaken within these included: literature reviews, surveys of farmers' attitudes or farming practices, scientific studies, computer software development and on-farm demonstrations. Projects were grouped according to the one issue that provided the main focus for the project using categories similar to those used in the Environmental Farm Plan Workbook. (Much of this compilation is posted on the Green Plan Web site, <http://res.agr.ca/lond/gp/gphompag.html>)

Manure management may represent the ultimate challenge in transferring sustainable technology, since it presents the difficulty of designing an affordable system for collecting, storing, transporting and applying manure which minimizes the risk of contamination of air, surface water and groundwater, at all stages in the system, without significant agronomic or operational problems. There is little strategic guidance for dealing with this complexity in the recommendations currently available to farmers, who seem faced with an impossible set of demands, in the absence of a harmonized set of environmental targets.

Within Ontario, the Ontario Agricultural Services Coordinating Committee (OASCC), the eight Research and Services Committees which report to it, exist to provide coordination of agricultural research and the formulation and delivery of recommendations. Since OASCC was formed changes have occurred in Ontario relative to discovery, development and transfer of technology, such that much of the information being generated in the province is not reported through OASCC nor integrated into the recommendations offered to farmers.

Technology transfer in Ontario has tended to follow the traditional adoption/diffusion model of extension, in which information is perceived to flow in steps from researchers/developers through a recommending body, to public sector extension personnel or private sector sales representatives, and then to farmers. In the past, the level of information available and the system that delivered it, suited the times and technology was transferred very effectively. Because technology is now being developed or adapted at almost all levels of the technology

transfer system in Ontario (i.e. research, extension, private sector and farm) and at a many sources external to it, information flow is increasingly multi-directional and less coordinated.

Farms have become so diverse and so specialized, that each farmer's informational needs are unique, in respect to both the questions to be answered and the level of detail sought. Even to experiment with a new technology can necessitate a large capital investment for a farmer and thus pose a large risk for him or her. Increasingly, farmers will require a set of information complete enough for them to visualize how the entire system can be made to work, profitably, on their farm before they will try it.

Ontario farmers rely heavily upon personal contact to obtain detailed information. As a result, the amount of information now available and the level of detail being requested are beginning to seriously tax the system for extending information in Ontario.

The current system for technology transfer in Ontario represents a solid base upon which to make improvements. The extension system has served Ontario agriculture well, and continues to do so despite the limitations noted above. Much of the information required by our clients can be transferred using existing agencies, organizations and communication technology, with appropriate modification and supplementation, provided that the limitations are soon addressed.

Those transferring technology to farmers must have access to the best available information in formats that will facilitate widespread usage. To ensure that this will occur, it is likely that funding will have to be provided specifically for the tasks involved. For each issue area, an individual or group should be assigned the task and held accountable to ensure that as information becomes available, it is:

- < assembled at a central location, preferably in both printed and electronic formats.
- < reviewed and integrated with previous information, noting whether it supports current recommendations or necessitate change.
- < presented, as draft recommendations, to the appropriate OASCC committee for review.
- < available to extension personnel and private sector sales staff, in a readily usable form.

Design of projects on related topics should be coordinated to facilitate integration of their results. Collection of a standard dataset should be encouraged, as appropriate. As much as possible, this should be encouraged for on-farm demonstrations, as well as research projects.

Extension materials should be designed to meet the needs of specific client groups, with regard to the level of detail and format. In such materials, either printed or electronic, the pathway by which a user can obtain more information must be clear. All extension materials related to a particular topic should be available, or accessible, through the same location.

Production recommendations and related information should be organized and presented in ways that facilitate use of a systems-approach in considering and applying new technology, including

the potential impact on other parts of the farm system and on the environment and the costs and benefits of alternate technologies, relative to both farm and environmental goals.

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Project Summary: Transfer of Agricultural Technology Generated Through the Canada-Ontario Green Plan

The overall objectives of the Canada-Ontario Green Plan support for agriculture were directed towards achieving sustainable agri-food systems. Green Plan funded many research and demonstration projects to address a range of environmental concerns for which suitable technology or information was lacking. However, the process of integrating the information developed within these projects with the existing body of knowledge, and transferring the recommendations to farmers was never clearly defined. The project described in this report was initiated by the TTC to provide the committee with information needed to develop such recommendations. Because of the complexity of manure management systems and their effects on the environment, the TTC selected the transfer of technology related to manure management as the area to be examined in this study. Although the examples in the report relate to manure management technologies, most of the comments and concepts presented in this report are applicable to other agriculture/environmental concerns.

Specific tasks conducted as part of this project included:

- C identification of barriers to implementation of environmentally sustainable technologies.
- C compilation of identified needs for additional information or technology transfer.
- C indication of the extent to which Green Plan research or demonstration projects are expected to enhance the knowledge base or the technology transfer process.
- C assessment of the extension resource materials available.
- C review of the system in Ontario for transferring technology related to manure management.

Barriers to Implementation of Environmentally Sustainable Technologies

A lack of information has limited development or implementation of environmentally sustainable technologies to address a number of manure management issues. On many farms, there also are significant financial and operational barriers to changing manure management practices, unrelated to the availability of information.

Identification of Information Needs

In recent years, a number of activities, coordinated through Green Plan, OASCC or OMAFRA, were undertaken to identify research and information needs related to manure management in Ontario. Together, these activities resulted in a comprehensive list of issues for which additional information was required. The process might, however, have benefitted from more coordination among the groups involved to reduce duplication of effort.

In Ontario, research is increasingly being conducted on contract by institutions or organizations not represented in the OASCC committee structure. A standard process by which OASCC committees and sub-committees can offer input into or obtain information from such projects

should be established. Similarly, it will be important to develop effective means of gathering and transferring non-proprietary information generated on farms and by agri-businesses.

Research and Demonstration Programs

Most of the issues that were rated as being of high priority are being addressed to some degree within Canada, if not Ontario. Thirty-one research or demonstration projects, conducted under the Canada-Ontario Green Plan and similar programs since 1987, addressed aspects of manure management. In addition, the national Green Plan has supported many projects on manure management in other provinces. Still other sources have provided funding for a number of projects that address issues not fully covered within the Ontario Green Plan.

There continues to be a lack of information related to the cost and benefits of technologies for reducing the environmental impact of manure. The environmental costs of livestock manures are even less well documented. Despite the difficulties inherent in obtaining economic information related to manure management, this should continue to be a priority area for research and technology transfer activities.

Extension Resources

Information related to livestock manures is available to farmers through a number of sources, within both the private and public sectors in Ontario, supported by an extensive array of resource materials. Few of the available resources provide the type of information or the level of detail required to compare options, to design and manage an integrated, sustainable system, or to implement the technology described. To obtain this level of guidance, therefore, farmers have little choice but to contact directly people with expertise in the subject.

In Ontario, a number of groups, including OASCC committees and the OMAFRA Publications Committee, are involved in the development and publication of materials for farmers. The respective responsibilities of these groups, in relation to initiation and production of extension resources, need to be defined more clearly to improve coordination and to reduce duplication of effort. Lines of accountability for implementing committee recommendations related to technology transfer also need to be clarified.

Technology Transfer in Ontario

Farm management is an exercise in compromise since it is a process of harmonizing multiple goals that are sometimes in conflict (e.g. agricultural, financial, environmental and social). Each farm situation is unique and development of appropriate solutions for its technical problems requires a set of information unique to that farm. For an information source to become the one of choice, clients must perceive the information it contains to be current, relevant, specific, reliable, credible, comprehensive and at the appropriate level of detail. The information delivery system itself must be seen to be readily accessible, easy to use, useful, interactive and sufficiently flexible as to allow the clients' needs and priorities to be reflected in the recommended solutions.

A system for transferring agricultural technology is well established in Ontario and has generally served the agricultural industry well. Traditionally, the transfer of information has relied heavily on personal contact between advisors and farmers. To date, most of the transfer of sustainable technology for manure management has been facilitated by advisors in the public sector. In the future, technology transfer will likely make more use of electronic channels of communications, with a concurrent reduction in the level of personal advisory services available directly to individual farmers, from at least some sectors of the system. (It should not be assumed that the private sector will automatically assume more of this role, especially for information or technology that has not been commercialized.)

Despite the rapid advances in communication technology, the need to deliver information to some clients through traditional channels, including personal contact with advisors, will not disappear for some time. Provision must be made to ensure that such advisors are adequately trained and supported with up-to-date, readily useable information packages.

As the role played by computer-based information systems in technology transfer increases, it will be essential that sufficient resources, especially human, be provided to maintain the reliability of the information system itself, and the currency of the information contained within it. Maintenance of the system must include continual revision of the information base and extension resource materials, in light of recent research and on-farm experience, within Ontario and elsewhere. Currently, the task of compiling research information is hampered because it is dispersed among a number of databases. Higher priority should be given to the establishment and maintenance of a truly comprehensive database for Ontario research, with links to relevant information from other provinces and countries.

Much useful information, about a wide range of important topics has been generated within the Research Program and the Rural Conservation Clubs Program of Green Plan, and much valuable experience in addressing other environmental concerns has been gained through the Wetlands/Woodlands/Wildlife Program. However, the activities planned within each of these programs to distribute project results may not be sufficient to ensure effective and efficient transfer of Green Plan results to farmers across Ontario.

A specific project should be undertaken to summarize and integrate information from related projects into recommendations for sustainable agricultural practices, and subsequently into extension resource materials. Sub-projects would be needed to address each major issue area addressed by Green Plan research and demonstration projects. Given the limited staff resources within both senior levels of government, it is likely that the task of preparing summary documents would need to be contracted to appropriately qualified writers from the private sector, working under the guidance and supervision of task teams comparable to that developed the BMP books.

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Project Summary: Technology Transfer Systems Integration

Phase I:

The objective of Technology Transfer Committee was to determine the effectiveness of different communication methods and techniques for encouraging specific target groups to implement in environmentally sustainable farming practices. In Phase I of the project, TTC contracted with IME (Information Management and Economics, Inc.) to conduct a literature review of studies related to technology transfer and the diffusion of innovations. The objectives of this review were to:

summarize the state of knowledge about the relationships among the characteristics of a technology, client groups, media and methods of communication and the type of behavioural changes that affect adoption of a technology or innovation, and

assess the feasibility of developing a manual to guide technology transfer professionals and managers in the selection of communication methods, techniques and media for technology transfer.

The review briefly summarizes the adoption/diffusion process, the innovation decision process and the factors affecting the adoption of innovations. The research into the diffusion of innovations and technology transfer suggests that the factors that affect the rate of adoption, the timing of the adoption and whether the innovation becomes institutionalized as part of the adopter's behaviour or is discontinued, can be considered in four main categories:

- < the type of behavioural change required (adoption; optional vs. compulsory).
- < the characteristics of the target audience (innovativeness; nature of decision-making unit).
- < the characteristics of the technology (benefits, compatibility, complexity, testability, observability).
- < the characteristics of the media and messages used to promote the innovation. (mass media vs. interpersonal; familiarity; accessibility; social networks; change agents; "how-to" vs. principle-based information)

IME concluded that the current state of knowledge about how these factors affect diffusion does provide the basis for the development of a technology transfer guide for the Ontario agricultural community.

Phase II

In Phase II of the project, TTC contracted with IME to prepare a manual to help those engaged in technology transfer to develop effective and efficient communication plans and strategies for the transfer of new agricultural technologies and innovations. The report from IME describes the steps necessary to plan an execute a communication strategy for technology transfer, including market research and analysis. The concepts are derived from the review of the literature related

to technology transfer and diffusion of innovations, and from other related fields, such as market research and communications. (A bibliography and a list of selected resources on the Internet are provided.)

The report presents the development of a technology transfer strategy as a five stage process:

1: Audience Evaluation

The first stage in developing a communication strategy for technology transfer is to conduct an evaluation of the target audience to gain a comprehensive understanding of those with whom one wishes to communicate. One must be able to define the target audience, and its sub-groups, in terms of demographic characteristics, personality, communication behaviours, and attitudes towards the type of innovation being promoted. The report discusses the questions to be considered under each of these categories, and outlines alternative qualitative and quantitative research approaches for assessing target audiences (e.g. focus groups, in-depth interviews, written surveys, telephone surveys).

2: Analyzing the Innovativeness of the Target Audience and Assigning Priority to Sub-groups

The individuals in most communities do not all adopt an innovation at the same time and can be classified in adoption categories based on their innovativeness and when they adopt a new idea. Generalizations about the differences between early adopters and late adopters can be sorted into three main categories, based on: socioeconomic characteristics, personality variables and communication behaviours. These generalizations provide guidance for the development of the audience evaluation strategy, message targeting and communication vehicle selection.

3: Message development and media planning

By analyzing the information gathered in the previous steps, regarding the demographics, personality and communication preferences of the target audience, (in the context of the innovation-decision process) one can develop effective messages for each target group and select the appropriate media. The characteristics of each group will define the attitudes or other traits that need to be addressed in the communication plan to overcome perceived barriers to the adoption of the innovation. The report presents a number of generalizations that can be used in selecting communication channels, depending of the innovativeness of the target group and its stage in the innovative-decision process.

4: Implementation

The communication strategy should be implemented starting with the most innovative sub-group within the target audience. Depending on the level of knowledge of the group, the initial messages may need to be designed to increase awareness of the innovation and understanding of the means by which it works. In subsequent stages, the emphasis will be on ensuring that information is available to the target group to support them in the decision, implementation and confirmation stages of adoption.

5: Evaluation

Assessment of the impact of the communication strategies is an essential part of successful technology transfer. This evaluation should be conducted throughout the entire process so that the strategy can be adjusted in response to unforeseen circumstances.

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