

**ONTARIO HORTICULTURAL CROPS RESEARCH AND
SERVICES COMMITTEE**

2006 REPORT

TO

**Ontario Agricultural Services Co-ordinating
Committee**

December, 2006

TABLE OF CONTENTS

Introduction	1
Mandate	1
Executive Summary	2
OHCRSC Priorities	2
OHCRSC Recommendations	5
Subcommittee Reports	
Agroforestry	7
Apiculture and Pollination	23
Apple	32
Berry Crops	40
Crucifer Crops	47
Ginseng	52
Grape and Wine	58
Greenhouse Floriculture	64
Greenhouse and Protected Crops	80
Low Acreage	88
Nursery, Landscape and Turf	96
Potatoes	105
Root, Bulb and Leafy Vegetables	108
Sweet Corn, Pea and Bean	112
Tender Fruit	117
Tomatoes	124
Membership	132
Acronyms	137

INTRODUCTION

The Ontario Horticultural Crops Research & Services Committee (OHCRSC) is one of nine committees (Animal, Field Crops, Horticultural Crops, Food Processing, Rural Development, Agriculture and Food Engineering, Agricultural Economics and Business, Pest Management, Soil Water and Air) reporting to the Ontario Agricultural Services Co-ordinating Committee (OASCC). The OHCRSC endeavours to compile the reports of 16 commodity sub-committees with 2 additional working groups. They are: Agroforestry, Apiculture & Pollination, Apple, Berry Crops, Crucifer Crops, Ginseng, Grape & Wine, Greenhouse Floriculture, Greenhouse and Protected Crops (including mushroom working group), Low Acreage & Special Crops (including Asparagus working group), Nursery/Landscape & Turfgrass, Potato, Root, Bulb and Leafy Vegetables, Sweet Corn and Pea and Beans, Tender Fruit, and Tomatoes. The membership is made up of industry, government and universities representatives. The main OHCRSC is made up of 36 members with an additional 400 members participating in the sub-committees. Horticultural Crops, through its sub-committees, identifies and prioritizes research needs for crop production, including pest management, and makes recommendations to address research gaps, re-allocation of support or re-direction of current research effort.

MANDATE

Main Committee:

- To review reports submitted by commodity committees.
- To assess the requirements for horticultural crops research and services.
- To establish priorities for horticultural crops research and services.
- To assess progress in horticultural crops research and services.
- To present reports and recommendations to OASCC describing the needs for horticultural crops research and services including information in relation to:
 - cost-benefit;
 - research and service facilities and personnel required in the investigation(s);
 - location best suited for the investigation(s);
 - how funds might be obtained or freed to conduct new research and services;
 - operation of subcommittees.
- To consider and approve chairs, vice-chairs and members of subcommittees.

Terms of Reference:

- To prepare research and service summaries and to recommend research and services priorities in Ontario for appropriate horticultural crops.
- To disclose problems that face the appropriate industry which require investigations.
- To coordinate research and services planning and cooperation.\
- To assess and suggest priorities for new programs and recommend which programs presently underway should be expanded or terminated.
- To estimate, where possible, costs involved in the conduct of new research and services programs and to supply cost-benefit information.
- To suggest, where possible, how funds might be obtained or freed to conduct new research and development

Ontario Horticultural Crops Research and Services Committee (OHCRC) Executive Summary

The Ontario horticulture industry represents approximately \$2 Billion farm gate value with \$1 Billion in fruit and vegetable production and \$1 Billion in Greenhouse floriculture and nursery production. This represents over 40% of the total Canadian production of horticultural crops. The sector contributes significant value beyond the farm gate through value-added processes, although this is much harder to quantify.

The OHCRC report is a compilation of the executive summary reports that were presented by the 16 subcommittees at the OHCRC annual meeting December 5, 2006 in Guelph. The subcommittee reports provide a brief overview of the state of the industry, emerging issues, current research priorities and recommendations to further these research and service priorities. Due to length of the report, it is not possible to include all the information that is discussed or distributed at the subcommittee level. I would encourage anyone that has an interest in a specific commodity to contact the respective subcommittee chair for further information on industry issues, research and service updates that were reported, committee activities, subcommittee membership and responses to recommendations and action taken from 2005. This information is a great resource on the current activities and progress in research and technology in the Ontario horticulture sector.

A summary of the OHCRC priorities related to pest management was presented to the Ontario Pest Management Research and Services Committee (OPMRSC) on December 8, 2006. Minor use priorities for pesticide registration for horticultural crops were discussed at the subcommittee level and this information is forwarded to the OMAFRA Provincial Minor Use Coordinator to assist in identification of provincial minor use priorities that are taken to the National Minor Use Priority meeting each year in March. Further information on the minor use process and priorities is available at: <http://www.omafra.gov.on.ca/english/crops/minoruse/>

OHCRC RESEARCH PRIORITIES - COMMON THEMES

The focus for the 2006 meetings was on Service Priorities and therefore research priorities were not discussed in detail at the main committee meeting. Specific Research priorities for each commodity can be found in the subcommittee sections of this report. The following summary highlights some of the common research areas across the horticulture sector:

Innovation in Pest Management

Without question this is one of the biggest needs of the horticulture sector.

Pest management issues continue to be the “Achilles Heel” of the horticulture sector that can impact competitiveness, market access, environmental stewardship, food safety, plant health and human health. Sustainable IPM systems are an integral risk management strategy for the competitiveness of the horticultural sector. Research is needed on development and commercialization of Alternative and Reduced-Risk crop protection products, research on IPM strategies for resistance management and new and emerging pest complexes, strategies to deal with plant health issues including invasive species and biodiversity, field validation of predictive models for Ontario conditions, and development of rapid diagnostics, monitoring techniques and thresholds. It was interesting to note that many of these needs including pesticide reduction, breeding for insect and disease resistance and work to obtain reduced risk crop protection materials was highlighted in the Vineland Renaissance report as key needs for the sector.

Environmental Management (Nutrient Management, Water quality and quantity management, Energy, Climate Change)

Due to the diversity of crops and production systems in horticulture there is an ongoing need for research into nutrient use efficiency and practices and technologies that can assist horticultural producers to continue to enhance environmental management practices. For many crops it is important to integrate nutrient, water and pest management strategies and there can be significant influence of one on the other and ultimately on the overall quality and shelf life of horticultural produce and/or bioactive compounds. There was also concern raised by a number of the subcommittees about the uncertain impact of the *Clean Water Act* and potential restrictions on nutrient use and pesticide application. The Great Lakes Charter is under negotiation and there is concern regarding

potential impacts on availability of water for irrigation. Regardless of the charter there is significant research that could be undertaken on reducing irrigation requirements through more efficient irrigation scheduling or improving water treatment technologies that would increase adoption of recirculation.

Increases in energy prices have significant impact on greenhouse production. It has renewed interest in research on energy efficiency and alternate renewable fuels. The increase in fuel costs also impacts the price of fertilizer, plastic pots and transportation for all horticultural crops. Climate change can provide some significant challenges to crop production with extremes in weather patterns and potential emergence of different pest complexes. Best practices need to continue to be developed and implemented. If interest continues in looking at ecological goods and services there will be further interest in development and validation of models to help quantify carbon sequestration. Perhaps more important for the horticulture sector is adaptive research focused on addressing changes in pest complexes that can emerge with changing climatic conditions.

Innovation in Production Systems including:

- Cultural Practices

- Genomics /Variety/Cultivar Development– Identification and evaluation of new germplasm to minimize production inputs, increase product quality and expand Value-added opportunities.

- Propagation

- Mechanization/Engineering

- Organic Production

- New crops

The need to continue to foster innovation of on-farm production practices and technologies that can have a significant impact on minimizing inputs, extending the season, developing new crops, adapting to climate change, enhancing crop quality, enhancing nutritional or health benefits can contribute significantly to a viable horticulture sector in the longer term.

Enhanced efforts in breeding are especially important to fruit and vegetable crops and is definitely an area that research can enhance the competitiveness of Ontario growers. With 40% of the national horticultural production in Ontario new varieties and cultivars suitable for Ontario conditions can present many opportunities in traditional and non-traditional markets.

Marketing, Branding and Promotion

Increasing market share through the technologies/strategies for season extension, value-added products, niche markets, marketing strategies to improve profitability, and utilization of by-products is definitely emerging as major need for many horticultural crops. Promotion efforts to expand domestic markets to compete with imports and to buffer fluctuations in export markets was also identified.. Promotion of the benefits of buying local produce and research to validate health benefits will be an important research need as the society looks to fruits and vegetables as our medicine cabinet. Market Intelligence research to assess global trends to capture market opportunities and develop market strategies to remain globally competitive are also important needs. Industry economic data to support economic development opportunities and to understand the potential economic impact of issues that effect the industry (. Eg. Economics of plant health issues.) were also identified.

Post Harvest Storage and Quality

Development and Validation of Storage technologies and packaging to maximize shelf life, product quality and health benefits

Food Quality and Food Safety

Health Benefits (4) As Hippocrates said in 400 BC, “Let Food be your medicine and medicine be your Food”. Horticulture for Health is an emerging trend and opportunities to expand research efforts in this area could contribute to increased consumption of fruit and vegetables. . Nutraceutical and Functional Foods research to benchmark nutrition of fruits and vegetables, in particular domestic/locally grown produce and furthering the linkages between fruit and vegetable impacts on human health were discussed. Production practices can also influence on some bioactive compounds in crops and research in this area would help to identify how to maximize

these compounds in produce. Production/processing technology to minimize contamination (chemical/microbial) and the increasing necessity is also needed.

The area of traceability in relation to food contamination issues emerged as a new need. Commodity organizations are also looking for support for information and exercises that can increase their preparedness in the event of emergency situations.

OHCRSC SERVICE PRIORITIES – COMMON THEMES

Service Priorities

In 2006, OHCRSC was directed by OASCC to focus on Service Priorities. There are specific commodity- related service priorities mentioned in each subcommittee report, but the following would represent some of the common service priority areas:

Development and implementation of IPM programs and IPM training.

Across all commodities the need for ongoing development and delivery of integrated pest management systems is seen as a critical service need. Increased monitoring, ongoing development of new and emerging pest complexes, enhanced grower, consultant and scout training areas where continued emphasis needs to be placed. Better understanding of reduced-risk products and how to integrate these into an IPM program is an area where more effort is needed. Specifically more grower workshops on these topics was highlighted as a need.

Research & Development (Human Resource) Capacity

This continues to be the area where there are large gaps in addressing research and service needs of the horticulture sector. There are large gaps in expertise that need to be filled to address some of the key needs of the industry, particularly in pest management (nematology, pathology, entomology).

The Vineland Renaissance report does identify some of the key areas of expertise that will be needed to sustain horticultural research. The OHCRSC subcommittees have been stating the need for nematology, entomology and pathology research for several years. Specific needs are identified in the OHCRSC recommendations and in the subcommittee reports. The need for increased technical expertise (extension staff) was also identified in some reports.

Policy/Regulatory

Funding for Plant Health Issues -currently, compensation for crop losses related to plant health issues is ad hoc. The industry is looking for longer term commitment to plant health compensation by government.

Accelerate Access to Reduced-Risk crop protection materials -this is an ongoing need that underpins the success of the horticulture sector to compete with other jurisdictions. These issues are further explained in the subcommittee reports but also dealt with in more detail through the Ontario Pest Management Research and Services Committee.

Resources to address import/export issues – While some of the needs may be related to marketing and promotion there are a number of technical/regulatory issues that make it difficult to compete with imports coming into Canada or market access to export markets.

Diagnostics, Testing and Certification Programs

There are a number of specific needs identified in the subcommittee reports related to diagnostics and lab services including better integration and awareness of diagnostic services available to growers, more rapid turn around, and validation and interpretation of new diagnostic tests. With the renewal of the OMAFRA/U of G agreement in 2008 it is hoped that some of these needs are taken into consideration.

/certification programs for tree fruit cultivars, plant certification programs for export markets and ginseng seed certification were also identified as service needs.

Improved access and dissemination of research results

A more coordinated and integrated approach to making sure that Ontario growers have access to research from Ontario and other jurisdictions is seen as a critical need by the industry. Development of better databases and expanding linkages to other research communities including health, environment, natural resources, etc. are needed. While research funded under the OMAFRA/U of G contract is reported to ICAR (Inventory of Canadian Agricultural Research) there are many projects funded by industry or other institutions that are not being reported or tracked in a way that can benefit the horticulture industry.

Support for development of research networks was proposed to increase interaction within the research community and industry.

Lack of high-speed Internet in rural Ontario is still seen as an issue for access to information by growers.

Communication and Training

Continued development of extension-based newsletter, web-based information and workshops/training for growers, IPM scout and consultants was recognized as occurring but needs ongoing support. Grower meetings, and focus groups on specific issues were also suggested as format that growers like to participate in and want to see more organized. Training of Nutrient Management consultants related to nutrient management plans for vegetable waste was a specific training need identified.

Access to unbiased financial information for growers was mentioned by several subcommittees.

Other service priorities included enhanced awareness of GIS systems and incorporation into production systems. Emergency preparedness training was also an area that is emerging as a need in some segments of the horticulture sector.

Shortage of skilled labour is a chronic issue for horticultural producers. Education programs at the college level are needed to ensure a highly trained workforce.

Support to the Vineland Renaissance Project

A number of subcommittees encouraged support of the vision of this report. The full report is available on the OMAFRA website at: <http://www.omafra.gov.on.ca/english/about/vinelandreport.pdf>

RECOMMENDATIONS

Recommendations for each subcommittee are included in their reports and subcommittee chairs will be following up with target agencies to obtain responses. The following are some recommendations that were felt needed to be addressed at the main committee level and communicated to OASCC. While the focus of the 2006 research meeting was on Service Priorities, the following is the standing list of recommendations related to Research priorities. Some of these will merit further discussion as the OMAFRA/University of Guelph agreement looks at negotiation of a new agreement in 2008.

1. **Research funding** – the chair was asked to communicate that concerns were raised at the subcommittee meetings about research station access fees and overhead at the University of Guelph and it that there may be merit in revisiting the fee structure to ensure that the costs that have been allocated in some situations are not creating barriers to research being undertaken. There is also concern about the decrease in research funding for sustainable agriculture and integrated pest management research in the OMAFRA/U of G contract
2. **Innovation in Pest Management** – A renewed thrust in further development of innovative technologies and IPM strategies in all horticultural crops is needed to keep pace with the number of new and emerging pests facing the industry. In addition there is need to determine how to best manage reduced risk products and ensure that IPM programs are constantly evolving. Industry is looking for assistance in ensuring that trained resource personnel within the industry can be sustainable.

3. **Diagnostic Testing** - there is increasing concern about the trend of growers/agribusiness sending pest samples out of the country for diagnosis due to concerns about turn around time. This could have serious consequences in the event of quarantineable pests. In addition, delays in crossing the border have been linked to deficiencies in adequate diagnostics. There are innovative technologies that can be pursued that can help address these issues, but they need to be validated for Ontario. More integration of diagnostic services and more awareness of services available were also needs that were identified.
4. **Research Capacity and Expertise** – In order for the horticulture sector to continue to pursue innovative research and market opportunities and deal with plant health issues there needs to be a renewal of research capacity and technical expertise at the federal and provincial level. (Examples of expertise that had been identified includes nematology, entomology, insect toxicology, pathology, sprayer technology, nursery crops research) There was discussion of this at the 2006 meeting and there will be further efforts made by chair of OHCRSC and OPMRSC to engage the various institutions and stakeholders to continue to demonstrate the need for renewing research capacity in key areas. Many of the needs identified by the OHCRSC are similar to the needs that were reported in the Vineland Renaissance Project Report.
5. **Enhanced Communications and Training**– There is an incredible amount of information generated through the research projects undertaken by both government, and industry. Knowledge management and knowledge transfer can be enhanced to make sure that this information is getting to growers and/or for commercialization of new technologies. The linkages now go way beyond the agriculture sector and this information exchange between health, resources, environment, etc. needs to be enhanced. With the disbanding of CARC and the uncertainty of databases such as the Inventory of Canadian Ag. Research, new knowledge databases need to be considered. Increased outreach and education are referenced in many instances. There is a need for increased grower education in the form of short courses and continuing education at the college level to provide the training needed for a skilled labour force for the horticulture sector. There appears to be a readiness to undertake emergency preparedness training for the horticulture sector.

ACKNOWLEDGEMENTS

The leadership provided by each of the OHCRSC subcommittee chairs and the participation of subcommittee members representing grower groups, industry, researchers and government personnel is a key element of success for this research priority setting process. Many of these subcommittees not only use the reports to communicate research and service priorities, but also look issues can be addressed through the collective expertise at the subcommittee level. Responses to recommendations provided by the various individuals and agencies back to the subcommittees are also sincerely appreciated.

The support of others in helping set up meetings and compiling this report is sincerely appreciated. A huge thank you to Michelle Smith, OMAFRA, Crop Technology Branch for her diligence in pulling this report together and to Stuart Budd and Khatera Safi, OMAFRA Research and Innovation Branch for supporting the organizing of the annual meeting.

Respectfully submitted on behalf of the OHCRSC,
Annette Anderson,
Chair

AGROFORESTRY

Annual Report of the Agroforestry Sub-Committee

Overall summary for all sectors

The EOMF is a partnership-based organization dedicated to the improving how landowners manage and use their natural resources. They work with federal, provincial, municipal as well as private agencies and individuals. The 2006 Agroforestry Subcommittee meeting is the second one we have participated in. We remain committed to future efforts in this area.

Several significant environment programs associated with the Agricultural Policy Framework have been announced by Agriculture and Agri-Food Canada (AAFC) which are of particular interest to the Agroforestry Sub-Committee. They include: the Canada-Ontario Environmental Farm Plan (EFP) and Greencover Canada (GC). There are agroforestry-related aspects within each program. With these programs in place, Ontario Soil and Crop Improvement Association and the Grand River Conservation Authority are working closely with farming groups to help farmers across the province implement beneficial management practices such as riparian buffers and windbreaks / shelterbelt projects. It is anticipated that this will result in a modest increase in tree cover in southern Ontario.

Agroforestry research at the University of Guelph (UG) has been historically funded through the OMAFRA-UG research agreement, administered through the Department of Environmental Biology. The research program at UG was initiated in 1984 and the funding commitment at that time rose to \$250,000 per year by 1987 (through a variety of programs, including Land Stewardship 1 and 2). Funding was reduced to \$30,000 per annum from 1995 to 2005; as of April 1, 2006, the OMAFRA-UG funding commitment to agroforestry research has been terminated.

UG agroforestry researchers are dismayed at the current lack of support for agroforestry, especially at a time when new agroforestry programs are being established in other provinces in both western and eastern Canada and new initiatives in agroforestry are burgeoning at the federal level. OMAFRA in Ontario is investing considerably in agroforestry extension and it is logical that this should be coupled with a moderate program of agroforestry research at UG.

At the sub-committee level, the institutional committee members (GRCA, SONG, OSCIA and maple syrup producers) endorsed a recommendation to the OHCRSC that OMAFRA investigate ways in which to continue to invest in agroforestry research and development (possibly through the OMAFRA-UG agreement).

It was brought to the notice of this sub-committee that the milder regions of the Ontario tobacco belt, the Niagara Peninsula and Southwestern Ontario are in need of new valuable crops. Heartnut, hazelnut and chestnut production could fill this void. Another nut resource that is sadly neglected is the black walnut which grows widely across Ontario. The Hammonds Product Co. in Stockton, Missouri has collection sites in the 11 surrounding states and processes millions of tons for the nut meats and shell. They cannot get enough raw product to satisfy the demand for either meats or shell. They have expressed an interest in getting the nuts collected in Ontario and sent to them. This opportunity needs to be explored and could lead to an Ontario processing plant in the future. It was also emphasized by the SONG that there is an urgent need to boost the nut processing aspects in Ontario.

In 2005, the final draft of the BMP for Agroforestry was completed by the Consultant, Eastern Ontario Model Forest, and submitted to OMAFRA. In 2006, staff from OMAFRA's Resource Management and Crop Technology Branches have been working on editorial aspects of the books. This includes organizing the materials into two volumes, selecting and incorporating visuals, editing text material and other work. At this time, Volume 1 of the BMP is nearing completion and the emphasis is now shifting to Volume 2. It is expected that Volume 1 will be published by December 31, 2006 and Volume 2 will be published by March 31, 2007.

Approximately \$100,000 was secured from Grenville Community Development Corporation, OMAFRA and others to upgrade the maple production facility and to obtain some financial support for operation of the facility. The plan

calls for the development of a joint venture agreement with partners in the community to develop a sustainable program focusing on education, research and demonstration activities. The planning program has a very significant focus on Agroforestry but extends beyond that to forestry, eco-tourism, water resources management and other activities. A modern maple syrup processing facility will be part of rejuvenated facility at the Kemptville Campus location. Several specific educational activities are planned for 2007.

Minor Use registration of herbicide, Devrinol, has been completed for 2006 by OMAFRA/ Agriculture Canada. Single product / single season trials are much easier than large multi-product trials. R&D and Services for Christmas trees are now linked with the Nursery and Landscape Conifers and the subcommittee reporting system. The Nursery and Landscape committee has accepted that Christmas trees are not different from landscape conifer crops. Most new Christmas tree cultivars are non-native species. The difference is the season of marketing and the time of year trees will be exported. Export permits and precautions for potential invasive pest and disease problems are regulated by CFIA. The primary benefit to Christmas tree growers is the use of pest control products and herbicides already registered for landscape nursery conifers. Services by Agroforestry continue to provide advice on nutrient management, weed control, cultivar select and market potential, irrigation, pest control.

- **Recommended web site:** <http://www.aftaweb.org/>
- <http://www.ontariosoilcrop.org/>
- <http://www.grandriver.ca/>
- www.eomf.on.ca

Issues Scan

Environment

University of Guelph:

Nitrate-N leaching losses:

In 2006, analysis of water collected from tile drains for NO₃-N indicated losses from the intercropping and conventional agricultural systems were 56.73 and 103.51 kg NO₃-N ha⁻¹, respectively. These data were derived from a paired mini watershed area of 17,200 m². The input N via fertilizer was 104 kg ha⁻¹ in both watersheds and mineralized N over the period of leachate collection (March-August, 2006) was 116.1 and 104.4 kg ha⁻¹ for the intercropping and monocropping systems, respectively. Nitrate-N leaching was reduced by 46.78 kg N ha⁻¹ (45%) in the intercropping watershed compared to the monocropping watershed.

Quantification of *E.coli* in tile-drain effluent:

The analysis of tile-drain effluent from both systems suggests that there is significant reduction of *E.coli* (29% less) in the effluent leaving the tree-based intercropping system when compared with effluent leaving the conventional agricultural system. The daily mean total CFU (colony-forming units) counts in the intercropping and conventional agricultural systems were 1.5 x 10⁷ and 2.1 x 10⁷ over 50 days after application of *E.coli* NAR. As suggested in the literature it appears that the deep-rooted tree roots are effectively filtering bacterial colonies.

Grand River Conservation Authority:

As a group, Conservation Authorities provide a number of agroforestry services to landowners including tree and shrub planting, tree and shrub sales, site planning as well as site assessment and monitoring. In 2005/2006, Conservation Authorities forestry services planted about 1.7 million trees and shrubs on 2,500 acres of land (preliminary estimate). Reforestation/tree planting services are available at 30 Conservation Authorities across the province. Extension staff from these authorities meet on a regular basis to foster a common approach to issues. Conservation Ontario, Grand River Conservation Authority and the Canadian Pork Council are working in partnership to deliver a two-year project demonstrating the benefits of establishing tree shelterbelts within the

Ontario pork industry. The benefits of shelterbelts around hog barns include odour control, improved aesthetics, decreased energy costs and wildlife habitat. Ten sites have been established across the province to demonstrate shelterbelt design around barns and the establishment of shelterbelts on black plastic mulch. As a further benefit, training on shelterbelt design for odour control is being provided to forestry extension staff across the province. It is hoped that funding will be extended for a third year to allow program staff to facilitate development of further farm demonstration sites, hold additional training workshops for extension staff, and develop extension materials.

Ontario Soil and Crop Improvement Association:

The Canada-Ontario Environmental Farm Plan (EFP) and Greencover Canada (GC) are administered by the Ontario Soil and Crop Improvement Association. EFP and GC are clustered alongside two additional environmental cost-share programs that are similarly delivered by OSCIA- the Canada-Ontario Farm Stewardship Program (COFSP) and the Canada-Ontario Water Supply Expansion Program (COWSEP). All of these initiatives are scheduled to be available through to March 31, 2008.

Between April 2005 and October 16, 2006, more than 7,300 producers have voluntarily participated in EFP workshops. By March 31, 2006 we were about 40 per cent above projected participation numbers of 4,000 per fiscal. The growing number of cost share opportunities is certainly a major reason for the interest. A Third Edition EFP, deemed appropriate through peer review, is one of several eligibility requirements for each of the cost share programs delivered by OSCIA:

- i) Canada-Ontario Farm Stewardship Program (COFSP)
- ii) Greencover Canada
- iii) Tier 1 of Canada-Ontario Water Supply Expansion Program
- iv) Nutrient Management Financial Assistance Program (expired)
- v) Oak Ridges Moraine Environmental Enhancement Program (ORMEEP)
- vi) Greenbelt Farm Stewardship Program (GFSP)

Items ii), v) and vi) have funding categories for beneficial management practices (BMP) that deal with tree establishment. All of the programs identified (with the exception of NMFAP which has already expired) are scheduled to be available through to March 31, 2008, or until funds are committed, whichever occurs first.

a) **Greencover Canada (GC)**

GC provides 50 percent federal cost share for eligible BMP which deal with riparian management and tree shelterbelt/windbreak planning and establishment (specifically categories 10, 11, 19, 26 and 30 as identified in the GC brochure). A total of up to \$20,000 per farm business is available. Of a total of approximately \$11 million available for on-farm projects, only 17 per cent has been allocated to date across 679 projects. The top five participating counties, in order of GC project numbers to date, are: Huron (62), Kent (45), Bruce (42), Essex (39) and Middlesex (38). BMP provincial project numbers, per category, are as follows:

- i) Category 10–Riparian Area Management
 - 360 projects* averaging \$2613 in federal cost share per at 50%. This is about 5% of the total project allocations across all three federal programs.
 - May include some tree and shrub planting in practice code 1005
 - Category ranks as number eight most popular BMP in the list of 36 (according to the number of projects)
- ii) Category 11- Erosion Control Structures (Riparian)
 - 125 projects* averaging \$3,521 in federal cost share per at 50%
 - No tree planting in this category
- iii) Category 19- Shelterbelt Establishment

* includes conditional approvals, final approvals to proceed and paid projects

- 187 projects* averaging \$1,923 in federal cost share per at 50%

* includes conditional approvals, final approvals to proceed and paid projects

- iv) Category 26- Grazing Management Planning
 - Only 4 projects* averaging \$1,650 in federal cost share per at 50%
 - Not much interest here expressed by producers
- v) Category 30- Riparian Health Assessment
 - Only 3 projects* averaging \$1,833 in federal cost share per at 50%
 - Not much interest here expressed by producers

A special agreement between OSCIA and Conservation Ontario was created to provide on-site technical assistance at no charge to producers requesting it for GC projects. In return, the participating Conservation Authority is provided a modest sum by OSCIA through the GC program, to help with some of the incremental costs associated with providing the technical assistance. This, combined with a range of existing and planned promotional activities, will hopefully lead to accelerated participation across GC over the next sixteen months.

It has been recognized that the lower participation in GC (as compared to BMP participation overall in COFSP and Tier 1 of COSEP) may be attributed to a program design that provides cost share only on establishment. It comes as no surprise that producers typically engage in adopting environmental actions that promise at least some short-term return on investment. Riparian practices, and to a lesser degree shelterbelt practices, certainly offer environmental benefit, but don't necessarily boost farm returns (at least not for many, many years). It is expected that several investigations funded by either federal or provincial research programs, will soon be underway in Ontario (and other parts of Canada) that will probe the merits of establishing compensation for ecological goods and services for the types of BMP advocated in GC. Hopefully the findings will be taken into serious consideration the next time national programs are developed in efforts to engage more producers in improved management of these natural features.

b) *Oak Ridges Moraine Environmental Enhancement Program (ORMEEP) and Greenbelt Farm Stewardship Program (GFSP)*

Both ORMEEP and GFSP are separate cost share program opportunities contracted to OSCIA to deliver alongside the cost share programs supported by the Agricultural Policy Framework. These top load programs will surely boost producer interest in all affected categories- including those offered by GC.

ORMEEP is funded by the Oak Ridges Moraine Foundation and provides \$1.26 million to top load federal funding to a combined 90 per cent across nine selected BMP categories (which include GC 10, 11 and 19). Up to \$45,000 of ORMEEP funding is available per farm business. There are an estimated 1,000 producers who farm on the Oak Ridges Moraine, which spans parts of eight counties. The ORMEEP was launched in April 2006 and will provide retroactive funding to eligible projects in accordance with the retroactive policy for the individual federal programs. To date, approximately two dozen projects have received ORMEEP allocations; many more are anticipated in the months ahead.

GFSP is funded by Friends of the Greenbelt Foundation and provides \$1.26 million to top load federal funding to a combined 75 per cent across 22 selected BMP categories (which includes all five GC categories). There is up to \$10,000 in GFSP funding available per farm business. There are an estimated 5,000 producers across the Greenbelt, which spans across portions of 15 counties. The GFSP was launched in October 2006, and provides retroactive funding to eligible projects to May 1, 2005. To date, approximately 104 projects have received GFSP allocations; many more are anticipated.

c) *Greencover Canada Demonstration Projects*

Ten demonstration projects have been awarded up to \$70,000 each of GC funding to help measure performance of riparian and shelterbelt practices, and assist with promotion of them in the farm community. The projects are funded through to March 2008. Of particular interest to the Agroforestry Research and Services Sub-Committee are projects: "Ecological Performance of Buffers", "Direct Seeding of Native Trees" and "Effectiveness of Buffers".

OMAFRA Agroforestry Specialist:

Environment Canada has expressed interest in potentially supporting Agroforestry research and demonstration initiatives which fit their mandate. This presents an opportunity for a new and effective partner relationship supporting Agroforestry. Interests include pollution control, reduction in use of fossil fuels and bio-energy research and demonstration. The University of Guelph-Kemptville Campus is keenly interested in partnering with OMAFRA, Environment Canada and industry stakeholders on project initiatives seen as high priority.

OMAFRA's Agroforestry Specialists and other Specialists in OMAFRA continue to stay abreast of the status of the health of Ontario's forests and work with their partners to raise awareness of landowners regarding the health of forests. This includes information on the status of exotic pests found in Ontario such as Asian long-horned beetle, emerald ash borer and the wood wasp (*sirex noctilio*). The annual regional woodlot conferences provide an excellent venue for updating land owners, resource management consultants and others regarding forest health.

For 2006, reduction of livestock odour continued as more producers realize the benefits of shelterbelts around large intensive facilities such as poultry, pork and beef feedlots.

Spray drift reduction and crop protection was the new focus of windbreaks and shelterbelts for 2006. Fruit and vegetable horticulture was the main audience at the Horticultural conference at Brock University. Information was incorporated into Publication 360, the BMP guide for fruit producers. Field windbreaks and establishment of new treed fencerows was encouraged at all farm workshops. Rural road shelterbelts for snow management continued to gain interest by Municipalities and by MTO. The challenge is to get people thinking about snow management during the warm spring tree-planting season. City businesses also increased their interest in visual barriers, noise reduction, and aesthetics using trees.

Production Systems

Agroforestry land-use systems have tremendous potential to create sustainable production systems by positively influencing environmental (nutrient management, source water protection, water, soil and air quality), ecological (ecosystem health, biodiversity, energy capture), economic (product diversity – economic return from product diversity) and social (positive impacts on soil, water and air, aesthetic quality, sustained rural livelihoods) dimensions of any given ecosystem.

The Ontario nutculture industry's goal is before the year 2020, to see nutculture in Ontario worth at least \$20M/year. Nutculture R&D in Ontario began early in the twentieth century. Today, they have just a few commercial nut farms in Ontario, based mostly on nut types and products unusual in the marketplace. The nuts commonly mentioned include a number of kinds of walnuts, hickories, oaks, hazels, nut pines, buckeyes, as well as chestnut, ginkgo, heartnut, buartnut and so on. Climate warming could increase the scope of nut cultivars and geographic area suited to hobby or commercial production. Already, native hazel reaches almost to James Bay; red oak and bur oak almost as far; with butternut not far behind them. Scores of valuable nut and nutwood products have been identified as both feasible and profitable in the world marketplace. A number of complementary management models for nutculture production have emerged, including, as well as the traditional agricultural models, new rural agroforestry and urban nutculture agroforestry models. At least 200 individuals and organizations comprise our dynamic and growing nutculture community in the province.

They continue to encourage their nutculture community and like-minded people to:

1. Promote interest in nut-bearing plants, their products and their nutculture.
2. Promote scientific research in the breeding and nutculture of nut bearing plants suited to Ontario conditions.
3. Encourage planting of improved varieties in gardens and orchards, on farms and public lands.
4. Disseminate information on propagation techniques and nutcultural practices,
5. Provide opportunities for closer association among nut producers and processors.

Over the next few years the stage can be set for the rapid expansion of significant nut farming and home-based nut businesses across lower Ontario, with more modest potential northward. Tree nutculture production and

manufacturing management models are now becoming available. By the end of this decade, starting any new Ontario-nut-based farm or business should become routine.

Some of the special activities being planned include *inter alia*:

- 1) Publishing the second expanded edition of 'Recipes in a Nutshell', which is ready to go to press;
- 2) Publishing a new edition of the 'Eastern Ontario Nut Growers Manual', emphasizing organic and ecological production methods;
- 3) Publishing a new edition of 'Growing Nuts Ontario Style';
- 4) Assisting the private sector development of appropriate technology for Ontario nutculture production needs, such as the prototyping of Cobjon's two innovative red oak acorn oil extractors, namely one a cold press and the other a hot salt water extractor is both in planning, as well as the Thomas Harvester and the Thomas Cracker. Partnering with Mechanical Engineering Technology of Algonquin College in Ottawa is underway;
- 5) Hosting an ongoing series of workshops aimed to advance nutculture for fun and profit and public education events at the public research and demonstration nut groves; and
- 6) Hosting the 98th annual conference of the Northern Nut Growers Association (NNGA 2007) at Carleton University in Ottawa, Canada;
- 7) Establishing an R&D anchor site for Ontario nutculture for its administrative benefits, such as might arise from a successful conclusion to Algonquin College Greenhouse Initiative now underway

The Society of Ontario Nut Growers (SONG) and its eastern Ontario chapter ECSONG will continue to provide advocacy and leadership to Ontario's emerging nutculture community.

The price of traditional energy (e.g. oil) remains volatile and will probably edge upward over time and have an adverse affect on profit margins if prices remain the same. This trend will prompt more interest in evaluating production efficiencies and in the development of alternative energy sources. Biomass from short-rotation woody crops can be grown sustainably as a feedstock for bioenergy and can alleviate our dependence on fossil fuel energy. The cultivation of woody crops enhances biodiversity, protects soil and water resources, could contribute towards a carbon neutral economy and provides many rural development benefits. Any sustainable production system, particularly in southern Ontario, should embrace, if not, amplify these well-accepted global sustainability traits. Short rotation woody crops (e.g. willow), grown close to the 'greenhouse' (within the 70 km economic zone), are a potential solution to this problem. We estimate that there are currently 1,000,000 ha of marginal agricultural land (including degraded riparian areas) that could be devoted to the growing of short-rotation woody crops at high densities (25,000 stems ha⁻¹) in southern Ontario, a great potential yet to be realized.

Programs

In 2005, the final draft of the BMP for Agroforestry was completed by the Consultant, Eastern Ontario Model Forest, and submitted to OMAFRA. It was the consensus of the Task Team for the project that the Agroforestry BMP be packaged in two Volumes, with one volume emphasizing traditional aspects of farm forestry such as managing natural woodlands and the other emphasizing specialized aspects of farm forestry such as windbreaks , shelterbelts and intercropping. In 2006, staff from OMAFRA's Resource Management and Crop Technology Branches have been working on editorial aspects of the books. This includes organizing the materials into two volumes, selecting and incorporating visuals, editing text material and other work. At this time, Volume 1 of the BMP is nearing completion and the emphasis is now shifting to Volume 2. It is expected that Volume 1 will be published by December 31, 2006 and Volume 2 will be published by March 31, 2007.

The OMNR's report outlined the importance of Ontario's Private Woodlands. Ontario has 5.6 million hectares of productive forests under private ownership, 14 percent of the province's inventoried productive forest landbase. Approximately 95 percent (1.9 million hectares) of the productive forest south of the Planning Area is privately owned, while 11.1 percent (3.7 million hectares) of the productive forest in the Planning Area is privately owned.

Private forests account for 13.5 percent of Ontario's growing stock, including almost one-half of the gross total volume of hard maple and "other hardwoods". A detailed report on private woodlands and programs lead by OMNR is included in Appendix A.

Eastern Ontario Model Forest (EOMF)

The Eastern Ontario Model Forest feels strongly that Agroforestry practices represent viable and operationally feasible option for many of Ontario's farmers. To this end, we remain committed to the Committee as well as to the various agencies across the Province who are working to improve the way these practices are delivered and promoted. The Model Forest would like to continue to support the Committee and Agroforestry in Ontario.

However, we feel that there are a number of significant concerns which need to be addressed:

- 1) Changes in budgetary allocations made to UofG's Agroforestry department represent a significant loss to the development of future research projects in Ontario. We feel that operational funding levels should be maintained and that reductions to these levels will ultimately work to reduce the potential benefits (environmental and economic) of agroforestry to the farmers of Ontario.
- 2) There seems to be some disagreement between UofG researchers and extension support activities provided by OMAFRA's Agroforestry Specialist in the southwest. This represents a significant barrier to the advancement of Agroforestry practices across the Province. It is important to address this problem and to find common ground between the various opinions expressed.
- 3) Promotion of Agroforestry Practices

Agroforestry topics are usually categorized somewhere in-between agriculture and forestry by the public, professionals and government agencies alike. Consequently the term agroforestry and the practice of incorporating trees on the agricultural landscape continues to be misunderstood. It is recommended that further efforts to promote agroforestry be made in parallel with the publication of the two associated BMP manuals scheduled for this fiscal year.

Agroforestry Research

In the last 22 years, in the broad field of agroforestry research and development, the UG has graduated more than 30 M.Sc. students and 3 Ph.D. students and more than 30 refereed scientific journal articles have been published. UG also hosted the first North American Agroforestry Conference in 1989, which led to the formation of the Association for Temperate Agroforestry (AFTA) shortly thereafter. (UG has been recently informed by the organizers of the 10th AFTA conference that a plaque recognizing the university's vision and contributions to temperate agroforestry will be presented to UG at the conference in Quebec City in June 2007.) UG agroforestry researchers also recently received a prestigious CIDA Tier 1 grant of \$3 million to bring food security to the resource poor in Ghana, West Africa using internationally-recognized agroforestry technologies.

UG agroforestry researchers are dismayed at the current lack of support for agroforestry, especially at a time when new agroforestry programs are being established in other provinces in both western and eastern Canada and new initiatives in agroforestry are burgeoning at the federal level. OMAFRA in Ontario is investing considerably in agroforestry extension and it is logical that this should be coupled with a moderate program of agroforestry research at UG.

At the sub-committee level, the institutional committee members (GRCA, SONG, OSCIA and maple syrup producers) endorsed a recommendation to the OHCRSC that OMAFRA investigate ways in which to continue to invest in agroforestry research and development (possibly through the OMAFRA-UG agreement).

Progress in 2006

Dave Chapeskie, Agroforestry Specialist, OMAFRA has worked as project lead and co-author on two comprehensive maple industry publications which were released in July 2006. These publications are entitled "A Guide to Improving and Maintaining Sugar Bush Health and Productivity" (English) and "Design, Installation and Maintenance of Plastic Tubing Systems for Sap Collection in Sugar Bushes" (English and French). Various partner organizations assisted with the production of these educational resources including the Ontario Maple Syrup Producers Association, Eastern Ontario Model Forest, Ontario Ministry of Natural Resources, Ontario Woodlot Association, and INFOR Inc. (New Brunswick). There is considerable interest in these publications in both Canada and the United States. It is hoped that a French version of the "A Guide to Improving and Maintaining Sugar Bush Health and Productivity" can be produced so that it is available to francophone maple producers. Efforts are currently underway to promote the availability of these two comprehensive publications.

Over the past several years, Dave Chapeskie has worked with maple industry specialists in the United States on writing a new North American Maple Syrup Council Manual for the Maple Syrup Industry in Canada and the United States. This Manual is a technical guide for producers covering a wide scope of specialized technical information pertinent to the maple syrup industry. It replaces a similar Manual which was published in 1996. Dave Chapeskie was a co-author on three chapters of this Manual (Sap Collection and Storage, Economics and Marketing and was involved in technical review of the Manual. This new publication was published by Ohio State University and is now available.

The EOMF accomplished the following:

Agroforestry Best management Practices manuals Volume 1 and 2

- Continued support for this effort working with OMAFRA staff
- Developed potential Case Study information
- Validated and updated a number of sections
- Reviewed material including illustrations, and various sections

A Guide to Improving and Maintaining Sugar Bush Health and Productivity

- Substantial participation in product development – writing, content development, illustration design development
- Work with desk top publisher through various drafts
- Helped facilitate the printing of 2000 copies

Thanks to funding from Agriculture and Agri-Food Canada's Greencover Technical Assistance Program, several agroforestry research projects are in progress at CAs across the province. These include

- Assessment of the effectiveness of riparian stream buffers (South Nation Conservation, Grand River Conservation Authority)
- Direct seeding of trees (Upper Thames River Conservation Authority)
- Evaluation of existing shelterbelts (Upper Thames River Conservation Authority, in partnership with John Kort, PFRA)

Significant progress was made during 2006 at the University of Guelph in establishing the agroforestry-based bioenergy research. It should be noted here that the University was able to attract more than \$200,000.00 in industry funding over 3 years for this research endeavour. They also received funding for 2 years from the Green Cover Program to verify the effectiveness of riparian buffer strips. Agriculture and Agri-Food Canada is continuing to support a M.Sc. student to evaluate the effectiveness of tree roots to filter nutrients and microbes, especially *E. coli* in a tree-based intercropping system. They have recorded some interesting results and it has been presented under the Environment sub-heading.

Important Research Needs (NOTE: The research needs have NOT been prioritized, therefore they all should be considered as equally important research needs)

- Bioenergy using biomass to heat greenhouses have been utilized with considerable success for many years. However, the lack of a continuous, economic supply of uniform biomass feedstock, in conjunction with some limitations in harvesting, drying and small-scale combustion technology, have seriously hampered the development of bioenergy systems on a large scale. Current high and increasing electricity costs, in conjunction with concerns about greenhouse gas emissions from burning fossil fuels in both the greenhouse industry and society in general, however, are strong precursors favouring the continued development of economically-efficient bioenergy systems. This area needs to be developed fully in southern Ontario, the home of 65% of the national greenhouse industry.
- Investigation of the value of trees to reduce nutrient loading in water courses – Nutrient Management and Source Water Protection (e.g. tree species, production system, density, buffer width) (University of Guelph, GRCA)

- Investigation of the use of trees to filter harmful organisms such as coliform bacteria, including *E. coli*, especially from manure runoff or soil leachates - Source Water Protection (University of Guelph, GRCA)
- Completing a diagnostic which would investigate bio-energy fuels and technologies and assess their potential application in the maple syrup industry. The findings from this study would be used to help guide any future investment in Bio-energy research and demonstration in the maple syrup industry (OMSPA, OMAFRA, Environment Canada, University of Guelph, EOMF)
- To investigate systems to maintain maple sap in a cool condition to maintain sap quality prior to processing (OMSPA, OMAFRA, University of Guelph)
- Project: Investigation of Maple Sap Filters - A Phase 1 Research Investigation was completed in 2005 and a Phase 2 investigation is proposed for 2006. Proponent: Ontario Maple Syrup Producers' Association. Researcher: Dr. Simon Lachance, University of Guelph - Alfred Campus

Shelterbelts for odour control from livestock operations.

- Mechanisms of odour mitigation by shelterbelts include dilution of gas concentrations of odour into the lower atmosphere, dust and aerosol deposition, dust and aerosol interception, and absorption of chemical constituents of odours.
- Do tree species vary in their effectiveness at mitigating odour from livestock barns?
- What species/ combinations of species will provide the shelterbelt porosity required for optimum odour control function?

Shelterbelt establishment on black plastic mulch

- This establishment technique is being widely used in the Prairie Provinces and Quebec, and is now being attempted for the first time in Ontario.
- What are the effects of this establishment technique on tree growth, mortality, and water requirements?
- Irrigation tape can be laid under the plastic mulch during installation. How effective is this technique at improving tree survival and growth?

Achieving and maintaining optimum shelterbelt porosity

- Wind tunnel research has thoroughly documented the impacts of porosity on shelterbelt function. However, the porosity of a shelterbelt changes with time due to growth and mortality. Many shelterbelts become too dense to provide optimum protection.
- Need to study the effect of thinning and pruning practices on shelterbelt porosity.

Weed control on existing shelterbelts

- Many older shelterbelts are being overgrown by wild grape and Virginia creeper. Need recommendations and extension factsheet on appropriate control measures.

Riparian tree buffers

- Riparian tree buffers are established for many reasons, including streambank stabilization, filtering of surface runoff, and shading to the watercourse. Tree establishment in riparian areas can be a challenge due to competition from existing vegetation.
- Need to further investigate effectiveness of weed control techniques in riparian buffer plantings

Need further study on effects on sub-watershed scale buffer plantings on downstream water quality (nutrients, pathogens, benthic invertebrates, fish community)

- Research priority for growing woods ginseng and other herbaceous forest foods under closed plantation canopies and under suited private forests. We need to learn basic cultural techniques. Develop an agreement with CITES to certify farmed woods-ginseng to access export markets.
- Achieve minor use registration of Goal herbicide for field and container conifer crops, for Horticulture and Forestry.

- Engineer and develop a commercial heartnut cracker.
- Research the possibility of a chemical that would loosen the suture of the heartnut so that the shell could fall apart releasing the nut meat without using a cracker.
- Develop equipment and marketing strategies for the various nuts similar to what is being done in Michigan for the chestnut growers there.
- Support the registration of pesticides for nut trees including 'Avaunt', 'Actara', 'Flint', 'Roundup', 'Simazine 80', 'Gramoxone' and 'Devrinol' as a minimum.
- Support the planting of trial or experimental nut orchards across Ontario including the heartnut, hazelnut and sweet chestnut.
- Explore the possibility of creating a black walnut collection and processing industry. Two changes have occurred in recent years that may make the process more practical:
 - a) Better more sophisticated colour sorters have been developed that make the sorting of meats from shell faster and more accurate, eliminating the need for other mechanical sorting equipment and much of the hand work.
 - b) The 'Wizard' walnut harvester makes picking up the nuts a much easier task. These could be rented or sold to collectors.
- Rewrite and expand the Ontario nut growing guide which is now out of date. Include modern nut collecting, processing methods and equipment.
- Develop a protocol to save the native butternut from the devastating butternut canker disease. Genetic engineering has made enormous strides in recent years. Dr. Manard's team at Syracuse University has already transformed the American chestnut to a blight resistant (possibly immune) form, and in a side study they also transformed the American elm to Dutch elm resistant tree. Both studies are in quarantine at the present time awaiting USDA scrutiny.
- Project: Evaluation of a Steam Compression System to Process Maple Sap
 Researcher: Innovative Solutions, Brockville. Proponent: North American Maple Syrup Council
- Project: Evaluation of the Sensory Properties of Consumer Grades of Maple Syrup
 Researcher: Centre Acer, Pleissiville, Quebec. Proponent: International Maple Syrup Institute
- Complete development of Prescription Writing course based on GLSL and Southern guides (OMNR)
- Demonstrate Economic benefit of good forest management - specifically retaining larger trees (OMNR)

Technology Transfer

The University of Guelph published 2 journal paper and 1 more has been accepted for publication in 2006. Researchers also participated in several short-rotation woody crops for biomass production conferences and presented their work. The Ontario Ministry of Agriculture, Food and Rural Affairs continues to employ two full-time Agroforestry Specialists who are involved in the packaging and transfer of technical information to a variety of clients. OMAFRA's Innovation and Competitiveness Division maintains a website for Agroforestry. OMAFRA's Agroforestry Specialists also continue to provide technical support for Conferences, Information Days and other events which have an Agroforestry component. In 2006 OMAFRA working with Partners has provided leadership in the development of a Best Management Practices Manual for Agroforestry which will be published in two volumes in 2006. OMAFRA's Agroforestry Specialists are also providing ongoing review and technical support for a variety of important research projects seen as high priority by client groups. OMAFRA's Agroforestry Specialist, along with a number of Partners have provided input to staff from PFRA regarding existing Agroforestry Programs in Southern and Eastern Ontario .

In 2006, the publication of Volume 1 of the new Best Management Practices Manual for Agroforestry will be finalized. The Eastern Ontario Model Forest (EOMF) was awarded the contract for the writing this document which will be published in Ontario's BMP series of agricultural publications.

Dave Chapeskie, Agroforestry Specialist, OMAFRA has worked as project lead and co-author on two comprehensive maple industry publications which were released in July 2006. These publications are entitled "A Guide to Improving and Maintaining Sugar Bush Health and Productivity" (English) and "Design, Installation and Maintenance of Plastic Tubing Systems for Sap Collection in Sugar Bushes" (English and French). Various partner organizations assisted with the production of these educational resources including the Ontario Maple Syrup Producers Association, Eastern Ontario Model Forest, Ontario Ministry of Natural Resources, Ontario Woodlot Association, and INFOR Inc. (New Brunswick). There is considerable interest in these publications in both Canada and the United States. It is hoped that a French version of the "A Guide to Improving and Maintaining Sugar Bush Health and Productivity" can be produced so that it is available to francophone maple producers. Efforts are currently underway to promote the availability of these two comprehensive publications.

APPENDIX A

Private Woodlands

Prepared for Annual Report on Forest Management 2004/2005

Period: April 1, 2004 – March 31, 2005

Ontario has 5.6 million hectares of productive forests under private ownership, 14 percent of the province's inventoried productive forest landbase. Approximately 95 percent (1.9 million hectares) of the productive forest south of the Planning Area is privately owned, while 11.1 percent (3.7 million hectares) of the productive forest in the Planning Area is privately owned. Private forests account for 13.5 percent of Ontario's growing stock, including almost one-half of the gross total volume of hard maple and "other hardwoods".

In 2004, annual returns from forest resource processing facilities indicate that 8% of the gross total coniferous volume and 27% of the gross total deciduous volume processed in Ontario originates from private land. This equals 14% of the total volume processed. However, this does not fully recognize the contribution of Ontario's private land to provincial wood supply. Smaller facilities (processing less than 1,000 m³/year) are not required to be licensed and do not file annual returns. Wood that leaves the province and wood that is not processed at a facility (e.g., fuelwood) are also not accounted for. The total contribution of private land could be closer to 16%. Table 1 summarizes volume originating from private land in Ontario that is processed at licensed facilities.

Table 1: Wood volume from private land processed at licensed facilities¹

Reporting Category		2000*	2001*	2002*	2003	2004
Hardwood	Volume (m ³)	1,360,598	1,888,843	1,656,919	2,506,999	2,437,828
	Volume (%)	16%	24%	20%	26%	27%
Softwood	Volume (m ³)	1,346,350	1,403,786	1,579,755	1,757,521	1,487,198
	Volume (%)	7%	8%	8%	10%	8%
Combined Hardwood & Softwood	Volume (m ³)	2,706,948	3,292,628	3,236,674	4,264,520	3,925,026
	Volume (%)	9%	13%	11%	15%	14%
Estimated Total from Private Land²	Volume (%)	11%	15%	13%	17%	16%

* yearly data updated from previous annual reports

¹ Source: Facility Annual Returns (not verified); volume of whole tree chips (tonnes) converted to cubic metres (m³) with a 1.1 conversion; volume received from other facilities not included.

² Estimate includes a 2% increment to reflect smaller facilities, wood that leaves the province and wood that is not processed at a facility (e.g., fuelwood).

Private Land Initiatives

In accordance with applicable laws, the ultimate decision of how private land in Ontario will be managed is made by the landowner. The MNR's private woodland initiatives encourage landowners to move towards the standard set by the definition of "good forestry practices" in the *Forestry Act*:

"...the proper implementation of harvest, renewal and maintenance activities known to be appropriate for the forest and environmental conditions under which they are being applied and that minimize detriments to forest values including significant ecosystems, important fish and wildlife habitat, soil and water quality and quantity, forest productivity and health and the aesthetics and recreational opportunities of the landscape..."

MNR encourages stewardship of this resource and provides a framework for sustainability by:

- co-ordinating the programs and efforts of the many agencies and groups interested in promoting stewardship;
- providing education and skill training opportunities for landowners to become more knowledgeable about stewardship;
- providing effective policies as incentive to foster stewardship of woodlands, and
- providing legislative support.

The framework consists of both legislative and incentive components.

The Legislative Component

At the provincial level, the legislative component includes:

- the *Planning Act* and the Provincial Policy Statement;
- municipal tree bylaws passed under the *Municipal Act*, and
- other legislation targeted to protect landscape features and promote good forest management

The provisions of the *Planning Act* and *Municipal Act* provide a basis for municipalities to protect woodlands and their associated values. However, they are discretionary and not mandatory in nature. Monitoring developments in legislation and in the application of the legislation by municipalities may provide insight into how municipalities are addressing local concerns and pressures.

Significant Woodlands in the Provincial Policy Statement

The Provincial Policy Statement (1997), which includes provisions for significant woodlands, was issued under the authority of Section 3 of the *Planning Act*. In accordance with Section 3 of the *Planning Act*, the policies of the Provincial Policy Statement must be reviewed every five years. The purpose of the review is to determine the scope and nature of changes, which are required to effectively protect provincial interests in land use planning. As a result of the review, Section 3 of the *Planning Act* has been amended to require that all decisions affecting land-use planning matters "shall be consistent with" the policy statements issued under the *Planning Act* – this strengthened from the previous wording "have regard for". This amendment came into force on March 1, 2005 and enhances provisions for significant woodlands.

The Provincial Policy Statement indicates that development and site alteration may be permitted in significant woodlands south and east of the Canadian Shield, if it has been demonstrated there will be no negative impact on the natural features or ecological functions for which the area is identified. The MNR may provide expertise and technical support to municipalities in efforts to determine the significance of woodlands in their planning and development decision making. Technical expertise is also provided to the Ministry of Municipal Affairs and Housing for its roles under the *Planning Act*.

Tree Bylaws

Ontario municipalities have traditionally had the authority to regulate the harvest of trees on private land through various statutes. Counties, regional municipalities and a few specific townships in southern Ontario were first able to pass tree bylaws through the *Trees Conservation Act* in 1946, then the *Trees Act* in 1950, and finally the *Forestry Act* (1998 amendments). Under the *Municipal Act* in 1994, all local municipalities with a population of greater than 10,000 could regulate tree cutting. Due to the population limit, bylaw provisions were not accessible to all municipalities.

To simplify the process and authority for tree bylaws, provisions were consolidated into the new *Municipal Act* (2001) which took effect on January 1, 2003. Upper-tier municipalities (counties and regional municipalities), lower tier municipalities (townships) and single tier municipalities now have equal access to tree bylaw powers. Provisions for tree bylaws have been removed from the *Forestry Act*; however by-laws enacted under the *Forestry Act* remain valid until they are repealed. The *Municipal Act* provides enhancements such as the option to charge violations per tree, require permits to cut and impose conditions on the cutting, allow by-law officers to order cutting to stop, as well as providing increased fines of \$10,000 or \$1,000 per tree. Some municipalities now use tickets for minor violations simplifying the enforcement of tree bylaws. Table 2 lists the number of tree-cutting bylaws in Ontario by year and the Act under which they were prepared. To learn more about tree bylaws, visit ontariowoodlot.com

Table 2: Number of municipalities with tree cutting bylaws in Ontario

MNR Region	Legislation	2000	2001	2002	2003	2004
Southern	Forestry Act	23	24	24	19	19
	Municipal Act	15	16	16	22	27
Number of tree cutting bylaws in Ontario		38	40	40	41	46

Targeted Legislation

The provincial interest in privately owned forests is also expressed for the Niagara Escarpment and Oak Ridges Moraine. Through enabling legislation, enhanced protection is provided under the *Niagara Escarpment Planning and Development Act* and the *Oak Ridges Conservation Act* and associated plans.

Additional protection was provided to forestland in the Golden Horseshoe in 2005. The *Greenbelt Act*, 2005 enables the creation of a Greenbelt Plan to protect about 729,000 hectares of environmentally sensitive and agricultural land in the Golden Horseshoe from urban development and sprawl. It includes and builds on about 324,000 hectares of land within the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan. The legislation authorizes the government to designate a Greenbelt Area and establish a Greenbelt Plan. It sets out the main elements and objectives for the Greenbelt, which are addressed in the Plan. It also requires planning decisions to conform to the Greenbelt Plan.

The MNR promotes natural area protection through conservation easements under the *Conservation Land Act*. Easements may be entered into with a qualified organization and landowners can provide limits on land use. Since the easement is registered on title, it binds all owners of the land over the easement's term. The land may be devalued in dollar terms by the easement, which can lower property taxes.

Ontario's regulatory framework also includes the *Professional Foresters Act*. The principal objective of this Act is to regulate the practice of professional forestry and to govern its members in accordance with the Act. While the *Professional Foresters Act* does not restrict a landowner's ability to cut trees on their property, it does affect practitioners of forestry whom they may hire for assistance.

The Incentive Component

To achieve healthy ecosystems, incentives are offered to promote the level of stewardship achieved inside the legislative framework. At the provincial level, the incentive component includes: the Managed Forest Tax Incentive Program (MFTIP) and Ontario Stewardship. Other programs and opportunities complement this framework and are accessible through conservation authorities, environmentally based non-government associations and municipalities.

Managed Forest Tax Incentive Program

The MFTIP was introduced for the 1998 tax year to bring greater fairness to the property tax system by valuing forest land according to its current use. The program is designed to increase landowner awareness about forest stewardship. Participants in the program range from Essex County landowners looking after the fragmented natural landscape, to owners of shoreland in Muskoka, to large forest companies in northern Ontario contributing to the northern economy.

Landowners who apply and qualify for the program have their property classified under the Managed forests property class described in Ontario Regulation 282/98 of the *Assessment Act*. The eligible property is then taxed at 25 per cent of the residential tax rate established by the municipality. The minimum property size for the program is 4 hectares (9.88 acres). Landowners participating in the program are required to prepare a Managed Forest Plan for their property and have it approved by an individual designated by MNR as a Managed Forest Plan Approver.

The area covered by approved Managed Forest Plans indicates the program's success and, to some degree, the amount of private forests being sustainably managed. The goal is to ensure there is no long-term decline in the forest area included in the program. In 2004, there were 10,563 properties and 724,887 hectares of land receiving benefits under the MFTIP (Table 3).

When reviewing MFTIP statistics, it must be acknowledged that in some parts of the province where property taxes are relatively low, the tax savings from the MFTIP are not as great as in areas where property taxes are higher. Also in agricultural portions of the province, many woodlands receive preferential property tax treatment through the Farm Tax Policy. In these areas such as these, landowners may be practicing good stewardship but not entered into the MFTIP.

Table 3: Private forests managed under the Managed Forest Tax Incentive Program, by MNR region

MNR Region	Forest Area Under Management (hectares)					Number of Properties				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Northeast Region	59,218	52,210	137,063	142,254	143,201	887	865	935	962	983
Northwest Region	181,083	180,206	180,430	181,398	182,045	105	115	118	121	135
Southern Region	386,102	379,157	391,364	396,964	399,641	8,364	8,309	8,846	9,302	9,445
Total	626,403	611,575	708,857	720,616	724,887	9,356	9,289	9,899	10,385	10,563

Reporting date – July 31st of the year specified

The Environmental Bill of Rights review of the MFTIP

On September 22, 2003, the Ministry of Natural Resources (MNR) received an application for review from the Environmental Commissioner's Office (ECO) requesting a review of the MFTIP under the Environmental Bill of Rights. The applicants alleged that "...the program policy is no longer achieving its stated objectives. We believe that the failure of this policy will lead to significant environmental harm".

The applicants further stated "The government's principle was that managed forests should be taxed at the same rate and assessed identically to farmlands (i.e., based on land productivity). The assessment of managed forests has now been redefined to be "highest end use" (i.e., a land's potential value for residential and commercial development and not its forest value); therefore, these forests lands are no longer valued on the same basis as farmlands".

On December 30, 2003, MNR informed the applicants that a review would be undertaken. The report was completed June 30, 2004. Recommendation #7 of the report was that the Ministry of Finance and MNR establish a stakeholder committee to implement the report's recommendations. On December 10, 2004, a MFTIP Implementation Committee was established to oversee the implementation of the report's recommendations. The committee included representatives from the Ontario Forestry Association, the Ontario Woodlot Association, Conservation Ontario, the

Association of Municipalities of Ontario and municipalities. Staff from the Municipal Property Assessment Corporation also participated. In addition to implementing the report's recommendations, the committee was directed by the Ministers of Finance and Natural Resources to provide advice in developing a new assessment approach for managed forests. The committee provided recommendations to the government in May, 2005 on a new assessment approach for managed forests that was similar to the approach used for farms to be implemented for the 2006.

Ontario Stewardship

Ontario Stewardship was initiated in 1995 by the MNR to encourage greater landowner involvement in stewardship activities. Ontario Stewardship helps people find information, expertise, and funding to ensure good management occurs on private land. The program's strength lies in its stewardship councils which are volunteer groups of landowners and land interest agencies. Each stewardship council works with a MNR stewardship co-ordinator.

Many stewardship councils have representatives from forest interests and the forest industry. Each council is reflective of the landscape it serves.

The MNR provides funding to each council to be invested in community level projects. This is often combined with funds from other groups, government ministries and foundations. Volunteer hours are tracked and reported to show the total amount invested in private land stewardship. Examples of projects include workshops on woodlot and wetland management, stream restoration projects, endangered species conservation and community tree planting. Commencing 2004/05 and for 2005/06 the Ontario Stewardship opportunity fund was redirected to staffing priorities within the program. Table 4 provides a summary of the program for 2004/05.

Ontario Stewardship Council Focus: The Huron Stewardship Council

Located in south-western Ontario's agricultural heartland, the Huron Stewardship Council has an interest in encouraging responsible management of woodlots on farms. In support of this interest a "Case Studies" project was undertaken to investigate if economic returns from woodlots can compare favourably with those from agriculture. A number of case studies were developed, profiling woodland owners who have not only demonstrated long-term stewardship of their forests, but have also documented financial returns over the years. Returns from these managed forests have been compared to the income from agricultural crops on comparable land over the same period. To view the interesting results from these case studies, follow the "Case Studies" link at www.huronstewardship.on.ca.

The project was initiated by the Huron Stewardship Council, Ontario Ministry of Natural Resources Guelph District and Maitland Watershed Partnerships, with help from The George Morris Centre and many other partners, including the landowners and Ontario Stewardship.

The County Stewardship Council working with partners towards: "A healthy natural landscape that is valued by the Huron County community, managed sustainably by landowners and other partners and utilized in a balanced way for multiple benefits to the Huron community (e.g. economic, human health, recreation, etc.)." For more information, visit <http://www.ontariostewardship.org>.

Table 4: Summary of Ontario Stewardship accomplishments for 2004/05

Reporting Criteria	Measure
Council summary	
Number of stewardship councils	39
Number of council members (12/council)	478
MNR contribution (\$10,000/council)	\$400,000
Opportunity fund (\$)	\$0*
Project summary (primary program area)	
Number of fish and wildlife projects	201
Number of forestry projects	197

Number of “other” projects	127
Total number of projects	525
Partner contributions to	
Number of volunteers	18,557
Number of volunteer hours	236,024
In-kind partner effort (\$)	\$7,666,034
Direct partner contributions (\$)	\$9,153,851
Total partner contributions (direct/indirect \$)	\$16,819,835

* Opportunity fund redirected to staffing priorities within Ontario Stewardship

Other Private Land Initiatives

The MNR supports other initiatives that provide assistance to Ontario’s private land owners including:

- An Extension Note series which provides information in an easy-to-understand format on topics related to land, water, wildlife, trees and property management. The notes are on the Ontario Forests website (<http://ontariosforests.mnr.gov.on.ca>). Other publications, of a more technical nature, are also available to landowners.
- The Eastern Habitat Joint Venture Program, where the MNR and partners actively conserve important wetland and upland habitats for the benefit of waterfowl, other wildlife and the public. Through this program, non-government partners offer technical and financial assistance to landowners for conservation projects.
- The Conservation Land Tax Incentive Program offers a reduction in property taxes to landowners agreeing to protect a natural heritage feature identified by the MNR on their property (e.g., provincially significant woodlands). For 2004, the program had approximately 15,000 properties participating, thereby conserving some of Ontario’s most significant natural heritage features.

APICULTURE AND POLLINATION

Apiculture and Pollination Chair Report

Geoff Wilson

This was another interesting beekeeping year. There were few large problems to deal with, but as always the weather kept everyone on their toes. All sectors, research, industry and government / technology transfer were generally satisfied with the season. As always there are some emerging issues such as the potential introduction of Africanized genes, and problems associated with disease control that need addressed.

In general, the bees started early and came out of winter strong. Good spring honey flows meant lots of honey bees and many swarms. Beekeepers that were able to keep the bees in their colonies reported good honey flows until the end of July when in general the season shut down and little honey was made for the rest of the year. Some beekeepers found very high levels of Varroa mites in September. High Varroa populations in combination with Varroa mite resistance to coumaphos has led to reports of mite damage. This gives a potential for large wintering losses over the 2006 / 2007 winter.

The pollination industry is constantly shifting. There is a trend for continued reduction in the numbers of colonies demanded for apple and other fruit contracts, while cucumber pollination contracts have almost dried up completely. The bright spot for pollination is the rental of colonies for blueberries and cranberries in New Brunswick and Quebec. Every year there are more colonies moving east to fill these pollination contracts.

The research community had a prolific year. Dr. Guzman has settled into his new position in Guelph and is continuing his intensive research schedule including research in both Ontario and Mexico. Many of Dr. Guzman's research projects will be helpful in understanding honey bee genetic and bee reproduction issues that have plagued the industry. The other research scientists have reduced their apiculture and pollination work, but still have some related projects in progress.

The technology transfer group had another busy year trying to keep small problems from becoming larger, while maintaining their hectic work schedule. Some of their major accomplishments included genetic screening for breeding programs, disease scouting, and producing published manuals for beekeepers.

Overall the 2006 season was successful for most people working in apiculture and pollination. This year seemed to have more positive aspects than negative, but as always there is room for improvement.

Apiculture and Pollination State of the Industry

Doug McRory

Ontario experienced an excellent wintering season over the winter of 2005-06. Losses were about half of those that have become normal now with the mites. Early spring weather was ideal for building the population of honey bees in the colonies. Those beekeepers that did not split their colonies had a great deal of swarming. After that it was wet and cool and a lot of the virgin queens produced during the swarming did not get very well mated and were superseded later in the season.

There was a very strong honey flow in July of excellent white honey. Beekeepers indicate that they averaged about 110 pounds per colony from that flow. Most areas dried up in August and very few beekeepers had any late honey from the golden rod and fall aster. Rainy River had their best crop ever from second cut alfalfa that was left by the farmers because it was too short to cut. It bloomed and produced lots of honey.

The season appeared to be ideal for the development of the mites. In the fall the Tech-Transfer Team were doing "Mite-Scouting" with several of the commercial beekeepers and the mite levels were quite high.

The honey market for bulk honey remained down with beekeepers reporting a return of .95 per pound in 2005 with no change in 2006. The volume of honey sold by Ontario beekeepers as retail pack stayed constant in 2005 with 2004 but because the total production was up in 2005 from 2004 the percentage of honey sold retail dropped by about 10%. The retail price reported for 2005 was \$2.07 per pound. This is the incentive to pack and sell as much of your production as possible.

The number of beekeepers is down about 200 to 2400.

The number of colonies went up by 700 to 76,700.

Beekeepers are looking for alternative income from their honey bees as the bulk price is below what beekeepers feel is the cost of production. 37 semi loads (13500 colonies) of bees were rented to blueberry and cranberry growers in Quebec and New Brunswick in 2006. This worked better than previous seasons as the bees were returned faster this season and therefore came back in better shape. The bees were also back in time to get some of the July honey flow.

Cucumber pollination has dropped right off as the contractors apparently have moved production to United States.

Orchard pollination continues at about the same pace as before but slowly many orchards are being removed.

Pumpkins and other vine crops appear to be increasing with added rentals of bees for pollination.

Over all Ontario Beekeepers appear to be happy with beekeeping. The beekeepers that depend on the bulk market are having problems. Most beekeepers are having reasonable success with controlling the mites. No major disasters occurred with any wide spread problem

University of Guelph Honey Bee Research Projects

Dr. Ernesto Guzman

Dr. Ernesto Guzman has been involved in several projects. A brief description of each one follows:

- a) **Varroa mite control using organic pesticides applied with different delivery methods.** After analyzing the results of last year's experiments we found the following: Thymol and oxalic acid were applied with three different delivery methods for the control of Varroa mites in field colonies, between late September and early October. The products were applied alone or in combination and the results were correlated with climatic variables (temperature and humidity). The miticides were applied as dust, diluted in sugar syrup, trickled onto the bees and dissolved in ethanol embedded in vermiculite (florist) blocks. The best results were those of thymol applied in dust (>83 %) and in vermiculite (>76 %). The lowest efficacies were those of the oxalic acid treatments (<40%). The efficacy of combined miticides was not higher than that of single-product treatments. Additionally, a high number of mites were killed during the first three days of miticide applications, but there was no difference between the number of mites that fell after three days of miticide applications in treated colonies with that of control colonies. A positive correlation was found between temperature and mite mortality for the thymol in dust and for the thymol in vermiculite methods ($r = 0.63$ and $r = 0.59$, respectively). Conversely, a negative correlation was found between humidity and mite mortality for thymol applied in dust or in vermiculite ($r = -0.60$ in both cases). Oxalic acid did not show the efficacy expected, probably due to the presence of brood in the experimental colonies when they were treated. These results suggest that thymol in dust and in vermiculite provide an acceptable level of varroa mite control in honeybee colonies during early fall. The application of these treatments during warm and dry days might improve the efficacy of mite control. However, more methods of delivery need to be studied to increase the time of release and the efficacy of natural miticides against varroa mites.

This year the project was assigned to Hanan Gashout, a graduate student at my lab. During 2006, we tested more than 20 materials as carriers of natural miticides, with the objective of increasing the products' time of

release as well as their efficacy. The carriers that allowed a longer time of miticide release were a food-grade gel, meat pads and homosote (fiber wood) coated with wax. We also found that miticides applied as dust or liquid or mixed with mineral oil showed an extended period of evaporation. Two of the experimental carriers were selected to test them with three natural miticides in field colonies. The natural miticides were selected after screening 22 organic components in the lab; varroa mites were exposed to these products and the three compounds that caused more mite mortality were chosen for the field experiments. These products were thymol, origanum oil and clove oil. We are still conducting the field trails and expect to have results by next spring. Additionally, experiments on toxicity of natural miticides to adult bees and brood will be conducted in 2007.

- b) **Effect of diluents and cryoprotectants on the viability of frozen honeybee spermatozoa.** Honeybee queens can be instrumentally inseminated, but the procedure is limited to the season when drones are available. At the present time, there are no techniques that allow the preservation of highly viable drone semen for a year or more. Semen preservation techniques would facilitate the improvement and maintenance of bee stock and would allow researchers and breeders to tailor to commercial and scientific needs any time of the year. The technique would also be invaluable in the control of Africanized honeybees if they ever become a problem in Canada. This project is under the responsibility of Megan Taylor, another graduate student in my lab. The study will determine some factors that affect the overall quality of frozen honeybee semen. We will try to find out what diluent components and what cryoprotectants (substances that prevent the rupture of spermatozoa membranes when freezing procedures are used) increase or decrease spermatozoa viability. We will also test various diluent:semen ratios to find out which one provides the highest spermatozoa viability. We expect to be able to develop optimal diluents and diluent:semen ratios, as well as to select an optimal cryoprotectant by the end of the study. This summer, Miss Taylor gained experience on the different techniques needed to conduct the study. She learnt how to collect semen, how to prepare diluents and how to determine its viability in the lab; she also practiced deep-freezing techniques used to preserve semen of farm animals. We are working in collaboration with Dr. Mary Buhr, a very experienced researcher in semen preservation working for the Department of Animal Science at the University of Guelph. Preliminary results suggest that diluents containing antioxidant components increase the viability of preserved honeybee semen.
- c) **Genetic effects of four behavioural traits of evolutionary and economic importance in honeybees.** This study, conducted by Peter Unger (a graduate student), is expected to generate information that will help in the breeding of varroa-resistant, productive and gentle honeybees. Moreover, the study has implications about the evolution of social behaviour in insect societies. We will determine if there are genetic correlations among four honeybee behaviours (hygienic, grooming, foraging and defensive behaviours). Additionally, we will test for dominance effects of these behaviours, using four different strains of honeybees that are currently reared in Ontario. The four behaviours will be studied in parental and hybrid colonies in field and observation hives. Some data has been collected this year, but we still do not have results to report.
- d) **Use of miniature mating nucs to rear queens.** This is a small project lead by Paul Kelly for a second year. Miniature baby nucs require less bees and food to rear queens, and thus could be more economical to use than larger units. Keeping a small population of bees inside them is very difficult to achieve (bees abscond) and this is the main inconvenience of using them. Trials with baby nucs were conducted using pheromone baits to keep the bees in the nuc. Preliminary results are encouraging.
- e) **Heritability and genetic effects of mechanisms of resistance against varroa mites in honeybee colonies.** This is a project that is being conducted in Mexico under my advisory by Laura Espinoza (graduate student). The objective is to determine which behavioural mechanisms of worker bees confer more resistance to honeybees against the varroa mite and how heritable they are. Results suggest that hygienic and grooming behaviour explain most of the resistance found in bee colonies.
- f) **Dominance and parental effects in hybrid European-Africanized honeybee colonies.** This project is also being conducted in Mexico under my advisory (by Felipe Becerra, another graduate student). We are studying how different characteristics of economic and evolutionary importance are inherited in hybrids colonies of European and African descent. The results of this project will help us to better understand the genetic architecture underlying important traits of honeybees.

- g) **Genetic basis of honeybee defensive behaviour.** This is an international project that involves the collaboration of several institutions: the National University of Mexico, Purdue University (USA), the University of Illinois (USA) and the University of Guelph. The main objective of the project is to study the defensive behaviour of honeybees at the colony and individual levels, using stocks of bees that differ for this characteristic (European and Africanized bees). We study the guarding, pursuing and stinging tasks of honeybees and we perform different crosses to collect samples of bees performing the behaviour in order to study their genome with DNA techniques. We look for expression in candidate genes that may be associated to the above tasks.

Ontario Beekeepers Association Technology Transfer Report

Alison Skinner, Janet Tam and Rachel Bannister

A. Breeding and Maintaining Parasitic Mite Resistant Honey Bee Stocks:

1. Maintenance of Tracheal Mite Resistant Honey Bee Stocks

Seven bee breeders participated in the tracheal mite resistance testing. One assay was completed in early September, evaluating 72 colonies for the resistance trait. Bee breeders are advised to use the top 25% of their resistant stock in their breeding programs.

2. Maintenance of the Hygienic Trait in Ontario Bee Stocks

In July and August, 12 bee breeders participated in the testing of potential breeder colonies for hygienic behavior. 304 colonies were tested using the liquid nitrogen freeze kill method. Colonies which ranked in Group 1 (>75% of killed brood cells removed) and Group 2 (50-75% of killed brood cells removed) are recommended for use as breeders for varroa mite and brood disease resistance. Hygienic colonies were included in the 2006 tracheal mite resistance testing.

3. Survey of the Quality of Honey Bee Queens from Ontario Breeders

Queens were submitted by five Ontario bee breeders for evaluation. Twenty-seven queens and their attendants were evaluated for the presence of tracheal mites and nosema spores. The queens were also examined for physical damage and the number of sperm in the spermatheca were estimated. Monitoring the queen health will ensure the quality queens produced in Ontario.

4. Health Status of Colonies Tested in the Breeding Program

Bee samples were taken from 145 potential breeder colonies from six bee breeders and stored in ethanol. Additional sample delivery is expected in November. Varroa and tracheal mite infestation levels and the presence of nosema spores will be determined. The results of this survey will indicate the health of the colonies and will highlight problem areas that can be corrected. Monitoring the health of breeder colonies will ensure the quality of the bee stock produced in Ontario.

B. Integrated Pest Management (IPM) Program to Control Honey Bee Parasitic Mites:

1. Spring Oxalic Acid / Mite-AwayII™ Treatment Comparison

In March, 106 colonies in two locations were divided into four treatment groups: a single trickled oxalic acid application (n=43), two trickled oxalic acid applications, ten days apart (n=43), a Mite-AwayII™ (formic acid) treatment (n=10) and no treatment (control)(n=10). Varroa mite infestation was determined using the alcohol wash method pre-treatment, ten days after treatment and 24 days after treatment.

2. Spring Oxalic Acid / Mite-Wipe™ Treatment Comparison

In March, 113 colonies in a single location were divided into five treatment groups: a single trickled oxalic acid application (n=23), two trickled oxalic acid applications, 11 days apart (n=22), a single Mite-Wipe™ (formic acid) application (n=23), two Mite-Wipe™ applications, three days apart (n=23) and no treatment (control)(n=22). Varroa mite infestation was determined using the alcohol wash method pre-treatment, 11 days after treatment and 25 days after treatment.

3. Honey Bee Mite Scouting

Mite scouting is a service whereby adult bees are sampled from colonies, disease levels are determined and results are reported back to the beekeeper. In the spring, eight beekeepers participated in the conclusion of a trial mite scouting program supported by the Agricultural Adaptation Council. During March, April and May, 574 colonies located in 45 yards were scouted. In the fall, a pay per service honey bee mite scouting program was launched. 286 colonies were scouted in 31 yards. Samples of adult bees were collected in ethanol and analyzed for varroa mites, tracheal mites and nosema disease. Results were promptly provided to each beekeeper.

4. Resistance Testing

The Pettis test was used to determine the presence of varroa mites resistant to conventional miticides such as Apistan® (fluvalinate) and CheckMite+™ (coumaphos). At times, Bayvarol® (flumethrin) an unregistered treatment, was tested to determine its efficacy in Ontario. In the spring, resistance testing was conducted near Kingston, Ontario, in three bee yards belonging to two beekeepers. In the fall, resistance testing was conducted in 15 bee yards belonging to six beekeepers.

5. Organic Honey Bee Colony Management

The Tech-transfer team and the University of Guelph established an organic beekeeping project in 2003. A combination of soft chemical treatments, cultural management techniques and effective monitoring are used to maintain a bee yard organically. No synthetic chemicals nor antibiotics are used. In the spring and summer of 2006, 24 hour sticky boards and frequent visual examinations were used to monitor for mites and diseases. Organic acids were used to control varroa and tracheal mites. An early fall treatment of Mite-AwayII™ was applied in September. Mite fall was monitored using sticky boards. A late fall treatment of trickled oxalic acid will be applied in November and subsequently monitored.

6. Fall Formic Acid Treatment Comparison

Mite-AwayII™, 3 applications of Mite-Wipe™, 6 applications of Mite-Wipe™ and no treatment (control) were applied to 24 colonies in October (n=6). Three weeks after treatment, Bayvarol® was applied as a finisher treatment for an additional three weeks. Varroa mite fall was monitored during the three weeks of treatment and three weeks of finisher treatment using sticky boards.

7. Two Season Treatment Comparison

This trial was conducted to determine the effects of different combinations of fall and spring treatments on varroa mite levels. Forty-two colonies in a single location were divided into 6 treatment groups (n=7): fall trickled oxalic acid and no spring treatment, fall and spring trickled oxalic acid, fall Mite-AwayII™ and no spring treatment, fall and spring Mite-AwayII™, fall CheckMite™ and no spring treatment and finally, no treatment (control). Mite fall was monitored for three weeks following fall treatments using sticky boards. Colonies will be assessed in the spring of 2007 for strength and mite levels before spring treatment applications. Mite levels, colony strength and honey production will be monitored throughout the summer.

8. Small Hive Beetle

A project has been initiated to prepare for the invasion of the small hive beetle into Ontario. Control methods used in the US will be studied in New York to determine their suitability in Ontario. To date, a background review on the beetle and control methods is underway.

C. Maintaining Food Safety in the Honey Bee Industry:

1. Environmental Contaminants

Research is being conducted on potential environmental sources of honey contamination. Veterinary drugs (primarily sulfonamides) and areas where they may be residual in the environment, thus accessible to foraging bees, are being identified. In the spring of 2006, brood chamber honey samples were taken from colonies which showed positive test results in the fall of 2005. Additional honey samples will be collected from bee colonies in areas at risk. Agricultural practices will also be surveyed in these areas.

2. Sulfonamide Residue Trial

Two single brood chamber colonies were fed sulfa treated sugar syrup in the fall. Honey produced by these two colonies in 2007 will be analyzed for residues.

D. Progressive Training and Information Program for Beekeepers:

1. Beekeeping and Queen Rearing Workshops

Four “Introductory Beekeeping with an Emphasis on IPM” workshops were held in Frankford (May), Guelph (June), Oro Station (June) and in Casselman (July). Another workshop, “Introductory Queen Rearing” was conducted twice, in Frankford (May) and Guelph (June). The workshops consisted of classroom presentations accompanied by hands-on sessions in the bee yard.

2. Business Skills for Beekeepers

Beekeepers need access to business management training to augment their beekeeping skills. In most bee operations, management decisions are being made without the proper background information. The proposed training sessions would provide the hands-on learning which would teach beekeepers to keep proper financial records and make educated management decisions. The two-day workshop will take place early in the winter of 2007

Apiculture and Pollination Emerging Issues

1. The arrival of Coumaphos and Fluvalinate resistance, and the possibility of resistance to organic compounds in Varroa mites, is seen as the greatest risk to Ontario beekeeping in the future.

Possible solutions:

- Through extension, have beekeepers adopt Integrated Pest Management (IPM) mite control programs as developed by the OBA Tech-Transfer Program. This includes changing their stock over to the HBTM resistant hygienic stocks that are available from Ontario bee breeders, hard and soft chemical treatments and cultural management techniques.
- Register Bayvarol®
- Develop Thymol.
- Register Formic Acid using the Mite-Wipe Pads.
- Develop and evaluate biocontrol methods for Varroa control (i.e. fungi and bacteria).
- Develop resistance testing methodology for organic mite treatment compounds.

2. Potential chemical residues in hive products from environmental sources may be a risk to the beekeeping industry in Ontario.

Possible solutions:

- Environmental assessment in areas of hive product contamination.

3. The risk of introducing African genes to Ontario honey bees due to allowing imports of queen bees into Ontario under Federal permit.

Possible solutions:

- To obtain and establish the laboratory infrastructure to identify African genes in the population of bees that are imported into Ontario.
- Continue to test bees that come into Ontario from mainland United States.

4. The quality of bee colonies returning from pollination is variable and affects production.

Possible solutions:

- Develop best management practices.

- 5. Resistance of American Foulbrood (AFB) to the only registered chemical – Oxytetracycline. This has not happened yet in Ontario but the samples being tested for r-Oxytetracycline are showing “moderate” susceptibility to Oxytetracycline. Eventually, Ontario will have resistance to deal with.**

Possible solutions:

- Register both Tylosin and Lincomycin in Canada.
- Continue to monitor the susceptibility to Oxytetracycline of colonies that breakdown with AFB and destroy them by fire or irradiate the equipment.
- Continue to develop hygienic stocks of bees with the Ontario Bee Breeders.
- Promote cultural controls and better management to minimize the effects of AFB on the health of honey bee colonies.
- Promote the testing of new products to control AFB.

- 6. Small Hive Beetles are across the border from Ontario and have been found in Alberta and Manitoba due to imports of Australian packages infested with Small Hive Beetles. .**

Possible solutions:

- Continue to do surveys near high-risk areas.
- Register Check-Mite+™.
- Register GuardStar®.
- Research the possibility of using nematodes to control.
- Research basic biology and behavior of Small Hive beetles to develop better control strategies.

- 7. Ontario Queen and Nuc Producers cannot ship queen cells to the United States.**

Possible solutions:

- Negotiate with the USA the inclusion of queen cells in their Import Protocol.

- 8. Ontario Queen and Nuc Producers would like to import new genetic material from Buckfast Bees in Denmark and possible from Siberia in Russia.**

Possible solutions:

- Work on the Import Protocols for both imports through CFIA.

- 7. Ontario Beekeepers are interested in taking Ontario honey bee stock to Chile to have it reproduced and returned to Canada as production queen bees in time to produce early splits in Ontario.**

Possible solutions:

- Work through Canadian Honey Council to have Canadian Association of Professional Apiculturists to work with CFIA to develop an Import Protocol for queen bees from Chile.
- Work with Chilean authorities to determine requirements to export honey bee germplasm to Chile.

Apiculture and Pollination Research Priorities

A. Apiculture Research Priorities

Research Priority 1: Further development of an effective IPM and food safety program for controlling parasitic mites, small hive beetles and infectious diseases of honey bees. Example: Biocontrols or organic compounds.

Research Priority 2: Development of Varroa mite resistant bee stocks using different selection approaches and integrating resistance into Ontario hygienic tracheal mite resistant existing bee stocks.

Research Priority 3: Environmental assessment for possible contamination of hive products.

Research Priority 4: Develop resistance testing methodologies for organic mite treatment compounds.

Research Priority 5: Study resistance of honey bee pests and pathogens to chemical treatments.

Research Priority 6: Research on nutraceutical properties of Ontario honey and other hive products.

Research Priority 7: Develop viable requeening systems for Ontario utilizing Ontario stock

Research Priority 8: Develop methods of overwintering large number of queens.

Research Priority 9: To identify and develop alternative control strategies for pests that has minimal impacts on beneficial insects. Example: Corn borer, wax moth control.

Research Priority 10: Projects to develop nutritional supplements for bees.

B. Pollination Research Priorities

Research Priority 1: Determine best management practices for colonies moved for pollination.

Research Priority 2: Pollination requirements and management of orchards and berry crops.

Research Priority 3: Management strategy for cucumbers and other vine crops.

Research Priority 4: Management strategy for pollination of field crops.

Research Priority 5: The importance of actively encouraging education and research on declining alternative pollinators.

Apiculture and Pollination Service Priorities

Service Priority 1: Surveying for Varroa mite and AFB resistance to Coumaphos, Fluvalinate, Oxytetracycline and organic compounds.

Service Priority 2: Maintenance and enhancement of the Ontario bee inspection program and the apicultural laboratory services.

Service Priority 3: Registration of Bayvarol®.

Service Priority 4: Providing DNA and morphometric analysis of honey bees in Ontario.

Service Priority 5: Provide mite and disease scouting service.

Service Priority 6: Registration of Tylosin and Lincomycin.

Service Priority 7: Apply for a grant to bring Buckfast bees from Denmark to Ontario.

Service Priority 8: Ontario Beekeepers' Association (OBA) takes a resolution to the Canadian Honey Council (CHC) to ask Canadian Association of Professional Apiculturists (CAPA) to work with CFIA Animal Import Section to work out an Import Protocol for queen bees from Chile.

Service Priority 9: The OBA takes a resolution to CHC to ask CFIA to negotiate with USDA Animal and Plant Health inspection Service to include queen bee cells for import into United States.

Service Priority 10: Enhanced yard mapping using GPS.

Apiculture and Pollination Tech Transfer Priorities

Priority 1: Maintenance of Ontario government apicultural regulatory and technology transfer programs.

- Monitor the susceptibility to Oxytetracycline for colonies that breakdown with AFB and have them destroyed by fire or irradiate them. Monitor for Apistan®, Check-Mite+™ and Bayoral® resistance using the “Pettis Test” or “Vial Test”.

Priority 2: Maintenance and enhancement of the OBA Tech Transfer program.

Priority 3: Improve techniques for monitoring mite levels.

Priority 4: Monitor the quality of hive products to meet consumer expectations.

Priority 5: OBA Tech-Transfer Team apply for a grant to develop Good Management Practices for “Honey Production in Ontario” and “Alternate Hive Products in Ontario”.

APPLE

State of the Industry (Nov 2005)

- Adrian Huisman, Harold Schooley, Ontario Apple Growers

REPORT TO THE POME FRUIT RESEARCH & SERVICES COMMITTEE

The 2005 crop results are now in and are attached to this report. It has been a difficult and time consuming process to obtain this data but I think we have been able to develop a new mechanism of gathering the information so that it is more meaningful and representative of what growers really harvested and received for their apples. This new procedure includes collecting information from packers as well as grower cooperators. I thank all those involved. The bad news is that grower returns remained dismal. Despite a large crop, grower returns actually declined by \$10 million from 2004. I believe most of this is due to the fact that 2004 returns were overstated. Regardless, returns in both 2004 and 2005 were very depressed as a result of overproduction and declining exchange rates.

The 2006 crop is expected to be down sharply from 2005. The July estimate called for a 15% reduction. The actual crop was down more than 15%. We are now in the process of gathering this information.

The OAG in cooperation with Agricorp has GPS/GIS surveyed all commercial apple growers in Ontario. The results of this survey are attached. It is interesting to note that the number of grower members (those with 10 acres or more) has declined while the overall acreage has remained relatively steady at about 17,400 acres. The goal of the OAG is to update this information on an annual basis in order to provide our marketers with the best possible information on production trends. If it were not for the improvements made in collecting industry data, we very likely would not have known that the production of Honeycrisp was set to increase sharply in 2006. Thankfully we did in time to introduce improvements in our marketing strategies. Again we thank all our growers for their cooperation.

Adrian Huisman
Manager

November 6, 2006

Report of Action Taken on 2005 Recommendations

Recommendation # 1

2005-1 Continuation of Postharvest Research Program

To: University of Guelph, Attention: Dr. Alan Wildeman (VP Research) and Chair, Department of Plant Agriculture

Recommendation: The University of Guelph needs to develop a productive, relevant, state-of-the-art postharvest research program in the Dept of Plant Agriculture. A long-term strategy needs to be developed to ensure that the necessary staffing, space, and facilities are assembled in order to have a viable postharvest research program, which addresses needs of the fresh market produce industry in Ontario.

Response

The Department of Plant Agriculture agrees with the sub-committee that there is an acute need to rejuvenate and rebuild the postharvest research and teaching capacity within the department. To this end the Department has been making some progress recently. In August of 2006 Dr. Peter Toivonen arrived in our department on secondment from AAFC Summerland (BC) to continue his postharvest research here. Peter is settling into the department and we have initiated a request for continuance of his secondment (the initial term was only 6 months). A new postharvest research storage facility has been built in the Bovey complex and Peter has been working along with Jennifer DeEll, Dennis Murr and Gordon Hoover (the technician in Plant Agriculture allocated to the post harvest

area) to get the facility running to spec. The facility is running (albeit not perfectly) and we are dedicated to making it a highly functional facility. This year also, the department was given the opportunity to search for a junior Canada Research Chair (CRC tier II) in postharvest. However, the timelines and strictures for this search were far too tight and before the opportunity was lost we traded the CRC to another department in exchange for a 3-year contractually limited faculty (CLF) position in postharvest. I am in the process of working to convert this 3-year CLF into a full-time tenure tracked assistant professor position by finding a bridge to a future retirement in another area. When we are successful in creating this new full-time faculty position we will be able to bring in a young keen new researcher into the area of postharvest here at Guelph, and this new person will work along with Peter Toivonen and Jennifer DeEll, and use the new facility to re-grow the capacity for postharvest research and teaching in Plant Agriculture at the University of Guelph.

Sincerely
Dr. Rene Van Acker
Professor and Chair
Dept. of Plant Agriculture

Recommendation #2

2005-2 Increasing Demand for Ontario Produce

To: OMAF, AAFC

Recommendation: The Provincial government should become actively involved in developing a brand that identifies Ontario produced fruits and vegetables with functional health benefits.

Response

In response to industry's requests and interest, OMAFRA developed a research-based approach to examine the broad opportunities for the Branding and Marketing of Ontario foods. This research, conducted during the summer of 2006, looked at Ontario consumers' attitudes and behaviour with regards to their selection and purchase of food products in both retail and restaurant settings. Preliminary research findings were then reviewed with industry representatives and strategy options are currently under development.

There was no response from AAFC.

Recommendation #3

2004-3 Promotion of Benefits to Eating Ontario Apples

To: OMAF, AAFC

Recommendation: Considering the substantial benefits that Ontario apples contribute to the Ontario and Canadian economy with little or no chance for cost recovery, it is recommended that the Federal and Provincial Ministers of Agriculture and Health and the Premier take an active role in promoting the benefits of consuming Ontario apples. Furthermore, it is recommended that both levels of government take steps to reduce onerous regulation and taxation that provides barriers to Ontario producers' ability to compete, maintain quality, or add value to their product.

Response from OMAFRA

Recommendation #4

2005-4 IPM Delivery Systems

To: OMAFRA

Recommendation: It is recommended that OMAFRA review and evaluate the existing IPM programs in other provinces. OMAFRA should then work toward adopting a program, that will provide financial support to growers, thereby encouraging them to continue to use IPM.

Response

This item was raised as an issue for OMAFRA and Hugh Berges took it to the Expert Committee on IPM (ECIPM) as an item they might be interested in pursuing on a national basis. It was decided that the ECIPM (through its members) would provide information to the secretary on how IPM is delivered in each province. However, in the meantime, CARC is no longer supported by AAFC and its sub-committees (including ECIPM) are all dead. The committee formally known as the ECIPM has been focusing on revitalization, but has not done anything further on this review.

As a result, the OMAFRA Apple IPM specialist will be contacting other provinces to collect information on IPM programs and funding, and preparing a summary to be distributed to the Ontario Apple Research and Services sub-committee by February 2007.

Hugh Berges and John Finlay
OMAFRA

Emerging Issues (not ranked)

1. Postharvest Research

There needs to be long-term commitment to postharvest research by the University of Guelph. The old hort storage building was demolished this past summer and the new renovations within the Bovey building at the University of Guelph will not accommodate the scale of research that could be conducted previously. In addition, the two full-time professors in the field of postharvest physiology have recently retired and there is no solid plan to fill these positions in the near future. Therefore, there is considerable angst about the future of postharvest research in Ontario.

2. Attaining and Maintaining Optimum Fruit Quality for Consumers

Produce buyers are becoming more demanding with excess supply to choose from and quality problems such as bruising, internal browning, low sugars, and poor fruit color are substantially reducing pack-outs and thus producer returns. These low pack-outs are a millstone around the necks of producers that severely affect profitability. Further costs are added to retailers if reduced shelf-life is associated with this fruit. Fruit prices are not expected to rise in the near future. The only avenue producers have to increase their returns is to send a higher percentage of fresh apples to market. This can be done in two ways. Work to attain higher quality parameters at the production end of the cycle and then work to maintain that quality in the storage, packaging and marketing end. Scientific data is needed to attain and maintain optimum consumer quality at both ends of the system.

3. Reduced Risk Pesticides

Apple growers strive to incorporate reduced risk pesticides into their pest management programs. Reduced risk pesticides are more environmentally friendly and are considered to be short lived, and target specific. Many of these products only suppress direct pest populations, not control them. In some cases, reduced risk pesticides are not effective in managing secondary pests (leafhoppers, wooly apple aphid, rosy apple aphid, scale), and as a result

these pests are becoming a problem. Thresholds and timing for application of these new products can also differ significantly from traditional products. Resources are needed to evaluate the efficacy of reduced risk products, in the management of direct pests and their impact on secondary pests, and the thresholds and timing of application of these materials.

4. Increase in OBLR in Orchards

Obliquebanded leafroller is becoming an increasing pest of apples in many areas of Ontario. While products are available to manage this pest effectively, growers need workshops to educate them on the biology and behaviour of this pest, as well as the timing and use of available products. OMAFRA needs to organize grower workshops in January and February 2007 to provide growers with information on monitoring and managing Obliquebanded leafroller. These workshops should be held in Leamington, London, Simcoe, Waterdown, Meaford and Brighton/or Newcastle. Information on the timing and location of these workshops can be distributed through OAG.

5. Lack of Control over Germplasm and New Apple Varieties

The days of having a good apple cultivar drop into the lap of the average grower appear to be finished. We are now dealing with a system in which grower clubs or individuals intimately connected with a breeding program or some other institution will have first dibs on anything that is worthy of planting. Ontario has never had a full-time apple breeder or a highly active breeding program, and therefore, has traditionally relied on outside sources for any new and worthy cultivars. Fortunately we have not yet been shut out of materials coming from B.C. or Quebec, as these selections and cultivars are from public or semi-public breeding programs. At this point in time, Ontario is probably ok for cultivars, but it is likely that growers will eventually have fewer and fewer choices of apples available to plant. It is conceivable that there may not be anything worthwhile to plant at some point.

2006 Recommendations

Recommendation #1

2006-1 Construction of a Postharvest Research Program

To: University of Guelph, Attention: Dr. Alan Wildeman (VP Research) and Dr. Rene Van Acker (Chair, Department of Plant Agriculture)

Recommendation: The University of Guelph needs to build a productive, relevant, state-of-the-art postharvest research program in the Dept of Plant Agriculture. A long-term strategy should be developed to ensure that the necessary staffing, space, and facilities are assembled in order to have a viable postharvest research program, which addresses needs of the fresh market produce industry in Ontario.

There needs to be a bonafide long-term commitment to postharvest research by the University of Guelph. Previous facilities housed in the Cold Storage building were demolished in the summer of 2006 and the limited space renovations completed in August 2006 within the Bovey building in Guelph allow only limited research capability. Although this was an admirable stop-gap measure, further space and staffing are required to meet the industry needs in postharvest research. The capacity of the lab and storage space is simply insufficient, as it can not accommodate the scale of research that was conducted previously. In fact, the cold storage and controlled atmosphere capability was reduced to less than half, necessitating the apple industry to construct at their own cost sufficient cold storage and CA facilities to accommodate research.

In addition, the two permanent full-time professors in postharvest physiology who retired in the fall of 2005 have not been replaced. Currently there is the opportunity to fill only one vacant full-time faculty position, but on a contractually-limited basis and there is no guarantee that this position will become permanent. There needs to be researchers filling these positions in postharvest biology and technology with the experience and knowledge to move this discipline forward and build a reputation in keeping with the University's ranking in Canada. Furthermore, industry should have input into such choices.

There should be a partnership established between the University of Guelph, provincial and federal governments, and industry to provide funding, establish priorities, and ensure that the postharvest program gets built and becomes productive once again.

Postharvest research continues to be a high priority in the apple industry. This industry needs to have research facilities available to test new products and processes under small-scale commercial-like facilities, to help maximize returns for those who are adopting the use of new products (i.e. 1-MCP), processes (i.e. value-added), and/or cultivars (i.e. Honeycrisp, Ambrosia). Research needs to be conducted in a facility that models current and emerging state-of-the-art commercial facilities, so that industry can improve their ability to compete by reducing product losses during storage and by learning how to further reduce the costs of operation. Such research is too expensive to conduct on a full commercial scale, where an abundance of variables make results of trial and error difficult to interpret.

2006-2 Increasing Demand for Ontario Produce

To: OMAFRA, AAFC

Recommendation: The Provincial government should become actively involved in developing a brand that identifies Ontario produced fruits and vegetables with functional health benefits.

The Foodland Ontario marketing program has done an excellent job of establishing a brand for fresh Ontario produce. Foodland Ontario currently provides advertising for Ontario produce, creates brand awareness with consumers, makes consumers aware of what is available in fresh produce and where they can buy it, and provides incentives to retailers to provide Ontario produce. The government should maintain support for this effective tool and maintain the focus on fresh Ontario produce.

Foodland Ontario has been most effective in rural Ontario stores, but less effective in the large urban centres. Therefore, market research and fine-tuning needs to be done in order to increase its impact in urban centres.

In addition, the government should investigate how to use this program to promote the health benefits of fresh produce. Foodland Ontario could easily incorporate a branding campaign to identify Ontario produce with health attributes. For example, use the recognized Foodland Ontario symbol in a different color and promote the health benefits of fruits and vegetables (backed-up with scientific research studies), as well as other attributes that consumers value, such as locally grown and produced using environment-friendly practices, food safety protocols, with worker safety and welfare considerations.

Recommendation #3

2006-3 Maintain AAFC Entomology Position in Vineland

To: AAFC, Attention: Drs. Gary Whitfield, Wayne Lindwall, and Marc Fortin

Recommendation: AAFC should maintain the position of entomology toxicologist. The position should remain at Vineland to ensure that the researcher continues to work to address the research priorities of the Ontario fruit industry.

It is encouraging that “AAFC has staffed a new toxicologist position in Entomology at the Southern Crop Protection Research Centre which includes the facilities located at London, Delhi and Vineland. The successful candidate, Dr. Ian Scott is currently completing post-doctoral studies at Cornell University and is expected to join AAFC in early March of 2007. Dr. Scott’s responsibilities will be to conduct research into toxicology that will serve the horticulture and field crop sector in Ontario and across Canada.”

However, ONE position to address both horticulture and field crop sector is not adequate. In tree fruit and grapes in Ontario, there are more than enough emerging issues in pest management to fill a work plan. These issues are unique to Ontario because of the region’s unique pest complex (see list below). Ontario’s tree fruit and grape industry need

an effective and efficient approach to focus the research efforts to the tree fruit and grape sectors and to station this position in Vineland. Vineland is central to the tree fruit and grape area and has the facilities, insect and mite colonies and trained technical staff.

Apples - Apple maggot, Codling moth, *Plum curculio, Oriental fruit moth, Apple clear wing moth. Also major issues with pesticide resistance management involving Oblique banded leafroller, *Oriental fruit moth and potentially Codling moth and Apple scab. Apple clear wing moth is new to the area.

* Note - These pests are not present in British Columbia but are major problems in Ontario. However, more emphasis has been placed on maintaining expertise in British Columbia regarding tree fruit pest control. The pest complex and population levels are more pronounced in Ontario.

We cannot rely on other jurisdictions such as New York or British Columbia to provide solutions and strategies for the Ontario pest complex. Ontario is the major production area for tree fruit and grapes in Canada.

Recommendation #4

2006-4 IPM Delivery Systems

To: OMAFRA

Recommendation: It is recommended that OMAFRA review and evaluate the existing apple IPM delivery systems in other provinces. OMAFRA should then work with grower organizations and the federal government toward adopting a program, which will provide financial support to growers and thereby encourage them to continue using IPM.

An IPM program for apples has been in use in Ontario for more than 20 years. Ontario apple growers continue to use IPM to minimize their impact on the environment while maintaining economic sustainability. Growers recognize the benefits of using IPM to manage pest resistance, extend the life of pest control products, and provide consumers with a high quality, safe, environmentally friendly product. Unfortunately the costs of implementing an IPM program has increased dramatically, with growers spending more money to receive agri-phones, hire crop scouts, purchase new reduced-risk products (including pesticides and mating disruption technology), and pay for IPM certification. These extra costs associated with adopting IPM programs have not been offset by increased prices in the market. As a result, Ontario apple growers are bearing the cost of IPM implementation and certification, while society reaps the environmental and food safety benefits of IPM. Other provinces (Quebec, Nova Scotia and British Columbia) have devised programs to help reduce the costs incurred by growers following an IPM program. These programs have helped encourage growers to continue to use IPM. Studying the delivery of apple IPM programs in other provinces may help the Ontario government work with other government agencies to develop methods of encouraging growers to adopt IPM practices.

APPLE RESEARCH AND SERVICES PRIORITIES - November 2006

Allocation	Priority	Sustainable IPM Systems
R & D	1	Efficacy testing, pesticide timing and evaluation of biological controls for managing European apple sawfly and pear Psylla.
R & D	1	Strategies for management of fireblight on pome fruit including growth regulators, cultural methods, biocontrols and non-chemical alternatives.
R	1***	Storage rots and postharvest disorders of pome fruit. Efficacy of current and potential new low risk materials and strategies.
D	1	Development of an integrated approach for control of black rot, mildew and OBLR.
R	1	Efficacy testing of reduced risk products and their fit into IPM programs.
R & D	1	Survey resistance in codling moth and apple scab.
D	2	Field validation of predictive models developed for insect and disease under Ontario conditions.
R & D	2	Development of sustainable IPM practices and resistance management for internal Lepidoptera pests (including OFM and CM) and the development of mating disruption strategies for apple insect pests such as codling moth and dogwood borer.

		Postharvest Strategies for Quality and Safety Assurance
R & D	1 *	Storage Technology: - 1-MCP /SmartFresh - Cultivar Recommendations
R & D	1	Fresh-Cut Quality Factors - Postharvest treatments of whole fruit - Preharvest treatments of whole fruit
R & D	1 ***	Control of Storage Disease and Disorders - Fungicide Resistance - Thermofogging - Lenticel Breakdown
R	1	Antioxidants, Bioflavonoid and other functional components
D	2	Field validation of predictive models (i.e. predicting scald & internal breakdown)

		Crop Cultural Management
R & D	1	Cultural Practices for Optimum Fruit Storability to ensure maximum return (listed in order of priority): 1. Fruit Firmness and Brix Levels 2. Micronutrients 3. Harvest Dates 4. Fruit Finish 5. Colour Development 6. Crop Load 7. Light Interception
R	1**	New Cultivar recommendations (i.e. thinning, crop growth regulators)
R	2	Rootstocks

* Currently being dealt with and funding in place.

** Ongoing on farm trials but research needed on variety specific attributes - storage life, etc.

*** Ongoing but may require further funding.

R - Needs Research

D - Development and Delivery

Note: 1. Each of the three section itemized above has been ranked in order of importance
2. Each of the three sections is equally important

Additional Service Comments

Communications

- IPM Manual is out of date
- Orchard Network Newsletter – valuable tool but needs to be more timely
- Publication 360
 - needs to be split out
 - presented in binders
 - chemical recommendations should be available at the Hort Crops Conference in February

Tech Transfer

- Hold more meetings on specific grower issues (i.e. OBLR)
- High Speed Internet Services – there was talk of a plan to provide rural communities with this service – where is that at?
- Growers are unaware of what diagnostic services are available to them
- OMAFRA staff need to keep abreast of crop protection materials and in turn keep growers informed
- OMAFRA sponsored conference calls with consultants is an excellent service that should be kept
- Scouting Service workshop held each April is also very valuable. Would like to make sure that all growers are invited each year.

2004-2007

Chair: Dr. Jennifer DeEll (OMAFRA)

Vice-Chair: Mr. Harold Schooley (Ontario Apple Growers)

Minor Use Liaison: Ms. Kathryn Carter (OMAFRA)

BERRY CROPS

Executive summary:

A mild winter and good spring weather resulted in above average yields for most berry crops. Total strawberry acreage continues to decrease, but there are marginal increases in the acreage of day neutral strawberries

Over the last four years, there has been a rapid and progressive loss of wholesale markets to the year-round flood of imported fresh berries. This is of serious concern to the industry and will need a major realignment within the industry. Also, there has been a reduction in sustainable agriculture research efforts, dumping of California strawberries and the lack of good varieties for the early markets and day neutrals in general.

Research and service priorities are now aligned to a value-chain approach with the goal to maintain and increase domestic market share of Ontario Berry Crops in 5 years using sustainable production systems, which are profitable to the grower, to provide Ontario consumers with healthy fruit.

The OBCRSSC has two recommendations: 1) that the OHCRSC coordinate the development of a business case for Ontario to support a nematologist in AAFC in Ontario, and 2) that communication channels between food, marketing, production, environmental and medical groups be improved and facilitated, that an effective replacement be found for ICAR, and that new technologies be developed to enable efficient tracking of current research project titles and progress.

1. Industry Scan:

- Current state of industry

The relatively mild winter of 2005/06 and good spring weather resulted in above average yields of strawberries, raspberries and blueberries for most of the province. Late spring frosts in south central Ontario, where many of the larger wholesale producers are located, reduced the strawberry crop in that region by up to ½. Retail prices at the farm gate were reported to be strong for all crops and pick-your-own operations reported good sales of all small fruit crops. Wet weather during harvest was a nuisance, especially for the fall bearing raspberry crop, but overall the season was good.

The wholesale strawberry market continues to face increased and continuing pressure from imported fresh strawberries, mainly from California. Many grocery stores featured fresh imported strawberries during our peak production period. Requests for fresh fruit from Ontario wholesale growers did not start until the end of our production season. Prices in this sector were below average.

Strawberry acreage is presently declining; total acreage in the province has dropped approximately 25% since 2002 (OMAFRA statistics). Strawberry propagators also report reduced sales of plants across the north eastern US and Canada over the past 3-5 years. While some growers are planting fewer acres, some are leaving the industry entirely. Pick your own acreage is also declining; it was noted that customers are picking smaller quantities for immediate consumption rather than large quantities for home processing.

The dayneutral strawberry acreage is increasing slightly as more growers tried dayneutrals for the first time. Production is increasing slowly for fresh market, but declining for the wholesale market. This juvenile sector of the industry is expected to expand, but there are several limiting factors that need to be overcome including tarnished plant bug, powdery mildew, a need for heat tolerant varieties and markets.

There is a concern about the 2007 raspberry crop because of the wet 2006 season and development of root rots and cane diseases later in the season.

Blueberries from B.C. come arrive on the Ontario market in early August, but are only significant for a 10-15 day period. Generally, prices for the 2006 blueberry crop were good.

It is estimated that there are 75 acres of Saskatoons in the province; while production is good, markets are difficult to find. Currant acreage is estimated at 25 acres; growers of this crop are working hard to develop markets. Several new elderberry plants have been recently established for fresh markets, locally sold preserves, and processing for industrial purposes.

2. Emerging Issues

- **Reduction of wholesale markets**

In strawberries, raspberries and blueberries, wholesale growers now face a flood of imported berries, mainly from California into Ontario during our traditional market season at prices that could be considered to be below our costs of production. Over the last 20 years, the supermarket chains have consolidated into three major chains. These pressures are now apparent in the market place and over the last four years growers have seen margins and markets disappear. The problem continues to grow, especially for fresh strawberries. China is now exporting large quantities of frozen strawberries as well.

- **Reduction in sustainable agriculture research efforts.**

With continued erosion in the value of the OMAFRA/Univ. of Guelph enhanced partnership, and the retreat from production horticulture research, the infrastructure for horticultural research is being noticeably reduced. The loss of scientists and technicians with the expertise to do this research is now such that in a few years we will be unable to find the expertise to do the needed research. For example, the University of Guelph has now lost its post-harvest research faculty.

- **Dumping of California strawberries.**

Large quantities of California strawberries were dumped into the Ontario market in spring and fall. For example, in October large quantities of California strawberries were retailing for \$1.99 /lb. This as \$5 per crate FOB California, which is considerably below the \$7-8 costs of production. This was particularly damaging as Ontario producers, are attempting to compete in this market.

- **Lack of new varieties.**

Growers are now noticing that there have been no new strawberry and raspberry varieties for the early market released in the last 10-15 years. Other immediate needs are strawberry varieties to bridge the gap between the end of the June bearing production and the beginning of day neutral production, and firmer raspberry varieties suitable for shipping. The continued erosion of breeding support now leaves the industry vulnerable in this sector of their markets. A new early strawberry variety is due to be released from the reduced University of Guelph strawberry program in 2007, but no new raspberries are on the horizon.

2.2.5 Pests

Powdery mildew continues to be a problem in strawberries. Many growers do not recognize the early signs of powdery mildew on strawberry leaves, and confuse it with leaf scorch. Powdery mildew affects the fruit and bloom of the day-neutral variety, Seascape, which is the most widely grown day neutral. Powdery mildew is a common foliar disease in the fall on June bearing varieties, especially on the variety Jewel. It is unknown what impact it has on the crop the following year. Nova is a good management tool, but there is a high potential for resistance to this product. Pristine was registered in 2006, allowing growers to alternate fungicide families, but more products are needed.

White grubs remain an issue for blueberry growers. In addition to the several species of white grub larvae which feed on plant roots, Japanese beetle adults are expanding their range and becoming a more common direct pest. The adults feed on fruit and foliage and larvae feed on roots. Skunk activity in blueberry plantings has been high; this is a good indicator of a white grub problem.

Tomato ringspot virus is showing up in raspberry, especially in eastern Ontario. This pest vectored by dagger nematode, which is commonly found in old orchard sites.

3. Report of Action taken:

Responses to 2005 recommendations; the following responses were received from Annette Anderson:

- Nematology research in Ontario

All pest management priorities identified through Ontario Hort. Crops Research and Services Committee are forwarded to the Ontario Pest Management Research and Services Committee. Hugh Berges, chair of OPMRSC did follow up with Dr. Gary Whitfield regarding the development of a business plan for the nematode position. However, at that time, AAFC was undertaking a reorganization of research programming and Hugh Berges was advised that it would be best to defer development of this rationale. If nematode research continues to be a concern for berry crops, it is important for the committee to identify the type of research (specific nematode problems) that needs to be done and the impact of not having nematode expertise (eg. Potential quarantine issues, economic impact, crop losses) available to the industry)

You may be interested to know, that there is some work on nematode identification that is going on related to the DNA Barcoding project at the University of Guelph. Dr. Robin Floyd in Department of Integrative Biology, U of G is involved in this work.

- Develop/enhance a mechanism for crop production, food science, marketing, environmental and medical research communication

Enhancing knowledge management and communications related to research is something that the ministry in conjunction with the ARIO is looking at developing more specific strategies and goals. Given that the focus of the 2006 meetings is on service priorities, the subcommittee would be encouraged to further develop ideas on identifying linkages for communicating research. The OHCRSC chair would be happy to discuss this more broadly in terms of horticultural research at the December 2006 OHCRSC meeting.

As of end of September, 2006, Agriculture and Agri-Food Canada announced that funding for the Canadian Ag. Research Council was terminated. This is the body that maintains the Inventory of Canadian Agri-Food Research. It is my understanding that the funding for ICAR is in place for one additional year. It is not clear on what plans are for the database beyond that.

4. Issues:

- Research and service priorities.

The committee realigned their research and service priorities onto a value-chain model in 2004. This was to bring our priorities in line with the AAFC and OMAF pillars for research and to give the research scientists involved in the University of Guelph/ OMAF contract guidance for the forthcoming program proposals.

This year the subcommittee revised the goal and all other priorities remained the same, with the addition of an Education/Extension section.

The Ontario Berry Crops Research and Services Sub-committee's goal is:

“to maintain and increase domestic market share of Ontario Berry Crops in 5 years using sustainable production systems, which are profitable to the grower, to provide Ontario consumers with healthy fruit”.

The six areas are not in order of priority.

Time-frame considerations. We have set five years as the time-frame as this is what is considered long-term in a political framework. However, we consider that 10 years would be a more realistic time-frame for projects such as breeding.

Measurement of success. Success will be measured as a comparison of the Ontario farm-gate value as reported by OMAF against the Statistics Canada value of berry crop imports.

Crops considered berry crops.

The major crops are strawberries, raspberries and blueberries.

Other berry crops which are known to be commercially grown in Ontario are cranberries, currants and gooseberries, saskatoons, elderberries, lingonberries.

Other crops with potential include blackberries(or brambles) and sea buckthorn.

Unless otherwise stated, the research priorities apply to all these crops.

A. Marketing

Over the last ten years, imported berries are being consumed in larger quantities throughout the year. To counter, this marketing research is needed to enable Ontario growers to recapture market-share in the following areas:

- coordinated marketing
- develop new markets
- e.g. school snack programs
- fruit quality
- quality control
- define varieties for specific markets
- develop new products
- expand the range of berry crops grown
- e.g. wild strawberries
- develop improved packaging and shelf-life

B. Food Quality

- food safety
- develop an industry-wide food safety plan
- define quality assurance parameters
- develop traceability systems
- nutraceuticals
- survey nutraceutical research programs which exist in Canada and U.S. to assist with marketing
- -survey nutrients in locally grown varieties to set the baseline standard, to assist in marketing

While the committee felt that nutraceutical research was of value, the preferred method to deal with the issue was a) to define the basic levels of nutrients in berry crops and market these benefits and then b) give thought to developing higher levels of the different constituents. We felt nutraceutical research would be very expensive and this should be considered to be a second level priority which does not divert resources away from the main goal.

- shelf-life and packaging
- develop systems to improve shelf-life of fresh berries destined for the
- wholesale market
- develop improved modified-atmosphere packaging and films

C. Production

Increased imports and continued pressure on prices require innovative new production technologies. We now have techniques that can extend the season which need to be evaluated with Ontario varieties and tested for their economic viability. With these new production techniques the pest spectrum will change and present new challenges.

Strawberries

- Season extension

- investigate high tunnels on dayneutral varieties
- explore row covers and other systems as a service priority
- develop pest control methodologies for
 1. Tarnished plant bug
 2. Mildew
 3. Anthracnose
 4. Mites
- investigate fertigation technologies
- develop planting time recommendations for seed (F1 hybrid)- and vegetatively-propagated varieties
- include economic justification in the results of season extension research

The committee felt that much of the season extension research could be done on farms with cooperation between the growers and the researchers.

- Weed and pest control
- develop innovative approaches, including organic production systems
- pursue minor use registrations for new products on an on-going basis

Raspberries

- Season extension
- develop tunnel (high priority) and greenhouse production systems

Immediate short-term needs include fertility recommendations and investigation of water relations

- Weed and pest control
- develop innovative approaches
- To include monitoring systems for insects
- pursue minor use registrations for new products on an on-going basis, especially for Botrytis, cane diseases and insects
- develop education program on disease and pest control which includes resources for scouts
- Nutrition
- develop N and P recommendations for fall-bearing varieties
- develop fertigation recommendations and compare these to broadcast recommendations

Other Berry crops

- Weed and pest control
- pursue minor use registrations for new products
- survey blueberry scorch, stunt, and ringspot infection in highbush blueberries in order to establish the extent of the problem
- Production systems

D. Breeding

Develop strawberries and raspberries that are adapted to Ontario

Strawberries

- June-bearing varieties – Trait priorities: 1) quality, 2) yield, 3) season extension, 4) pest and disease management
- Dayneutral varieties – Trait priorities: 1) propagation ability, 2) tarnished plant bug resistance, 3) quality, 4) yield, 5) pest and disease management.
- F1 Hybrids – Double haploid inbred lines through anther culture

- Seed-propagated F1 hybrid varieties of strawberries exist. Two inbred lines are cross-pollinated and the seed is genetically uniform. With conventional methodologies this breeding takes twice as long as the conventional breeding systems

Raspberries

- Summer-bearing varieties – good quality, firmness for shipping, winter hardy. One possible site with suitable winters would be New Liskeard.
- Fall-bearing varieties – good quality, low chill, prolonged productivity for greenhouse production
- Identify varieties from other breeding programs that are of high quality and adapted to Ontario
- identify varieties from BC, NS, NY and MD breeding programs, that have virus-tested negative propagation material

Highbush blueberries

- identify varieties from MI and USDA programs

Other berry crops

identify varieties as these crops develop

E. Propagation

- Continue to develop and support the Ontario strawberry, raspberry and *Ribes* plant propagation program and maintain its location in New Liskeard
- develop propagation methodologies for F1 hybrid dayneutral strawberry varieties
- develop a list of viruses and mycoplasmas known to infect other berry crops of interest, except highbush blueberries.
- develop a reliable and ongoing DNA testing program for the plant propagation program

F. Extension/Education

Effective education programs need to be developed to advance alternate production methods for strawberry and raspberry. Suggestions include a focus group approach where growers share experiences and challenges. Alternate production methods include high tunnel production, day neutral production, organic systems.

5. Recommendations

- 5.1 Recommendation number: 1.
- 5.1.1 Issue: nematology research in Ontario
- 5.1.2 OASCC linkages
- 5.1.3 Target Agency: Ontario Horticultural Crops Research and Services Committee
- 5.1.4 Title: that the Ontario Horticultural Crops Research and Services Committee coordinate the development of a business case for Ontario to support a nematologist in AAFC in Ontario.
- 5.1.5 Background: For the previous two years the OBCRSSC has brought a recommendation to the OHCRSC to support a nematologist at Vineland. In 2003, several other committees, i.e. Root, bulb and leafy vegetable, Crucifer crops, also indicated a similar need.

At the 2003 meeting, Dr Gary Whitfield indicated the need for a business case approach. The OBCRSSC feels that it is the role of the OHCRSC to coordinate the recommendations from the subcommittees into a single business case to be forwarded to AAFC.

Direct crop losses due to nematodes, viruses and other pests vectored by nematodes, and quarantine issues on propagation material due to nematodes are of concern to the OBCRSS. The development of new products and/or methods to manage nematodes, as well as determining if the present threshold levels before treatment with new products are accurate is needed. Potential crop losses due to nematode infestation on

perennial crops can be substantial. The committee recognizes that the Uof G has a turf grass nematologist who could put some effort to other crops but a nematologist dedicated to horticultural is necessary. Nematodes of particular concern are root knot, lesion and dagger nematodes. The potential infestation of stunt and golden nematode cannot be ignored.

5.2 Recommendation number: 2.

5.2.1 Issue: Agricultural research communication

5.2.2 OASCC linkages: OPMRRSC

5.2.3 Target Agency: OMAF, MNR, MOE, University of Guelph, AAFC

5.2.4 Title: that communication channels between food, marketing, production, environmental and medical groups be improved and facilitated, that a replacement be developed for ICAR, and that new technologies be developed to enable efficient tracking of current research project titles and progress.

5.2.5 Background:

Research and technology is progressing rapidly on a number of fronts, and is increasingly specialized within disciplines. A progressive berry industry, in a true value chain, must make use of information and resources from many research programs, including production, food science, marketing, environmental and medical. Effective communication, or at least awareness of, initiatives relating to the berry value chain will help to avoid duplication of effort, and in optimize the knowledge base that currently exists. With the demise of the Inventory of Canadian Agri-Food Research, another method of communicating research initiatives must be established.

OMAFRA, the University of Guelph, and Agriculture and Agri-Food Canada are three examples of institutions where research relevant to the berry industry takes place. Traditionally, the Ontario Berry Research and Services Committee and the ICAR were two vehicles for communicating research initiatives and informal results. However, many other groups are now involved in research indirectly related but still relative to the berry industry. In addition, many of these groups do not report projects through ICAR, and the inventory is incomplete. The *Compendium of OMAF Funded Food*

Safety<http://www.gov.on.ca/OMAFRA/english/research/food/foodsafety/compendium.htm> is a good example of communication that we hope will be facilitated in other disciplines.

The Pest Management Research Reports published by the Expert Committee of Integrated Pest Management is also an important resource, that we hope continues.

Communication channels for reporting research initiatives must be developed or improved between branches and divisions within OMAFRA, between departments at the University of Guelph, and among the various AAFC research teams, Ontario universities, and Provincial ministries where research relative to the berry crop value chain exists.

CRUCIFER CROPS

Executive Summary

Jennifer Bush is now the Vice Chair for the OCCRSC.

Emerging Issues:

1. There is still a concern about the move away from Integrated Pest Management specific research under the new OMAFRA – U of G program. Funding constraints along with the loss of technicians make field scale research difficult.
2. Emerging pests and diagnostic services – growers and consultants need access to accurate and economical pest identification services.

Research Priorities:

Research priorities were discussed and ranked as given below. The overwhelming need in this sector is still for pest management research, and as such all pest management research (insects, diseases and weeds) has been grouped together as the top priority.

1. Pest Management Systems
 - a) Management of insect, disease and weed pests, including development of thresholds and monitoring practices
 - b) Reduced risk products
 - c) New and emerging pests
 - d) Established pests
2. Minor Use Registrations – crop groupings
3. Nutrient Management Practices and Nutrient Uptake of Crucifer Crops with Respect to the Source Water Protection Act:
4. Post Harvest Handling
5. Variety Evaluation

Service Priorities:

Service priorities were discussed and ranked as given below. The overwhelming need in this sector is for continued technology transfer and as such has been given the top priority.

1. Efficient Technology Transfer – OMAFRA (scout training, Hort. Matters)
2. Swede midge Pheromone Trapping, Degree Day Model and Alerts – required by industry and growers to better time insecticide applications until thresholds can be developed
3. Value Added Products and Marketing – product marketing should be explored to maintain competitive edge in global marketplace

RECOMMENDATIONS TO OHCRSC AND OPMRSC

There are six recommendations, ranked in decreasing priority, in 2006.

1. Limited research dollars for IPM research in the new OMAFRA-U of G Research Program structure
2. Lack of delivery, implementation and diagnostic capabilities of IPM programs in Ontario
3. Crop loss of rutabaga industry due to cabbage maggot
4. Horticultural crop nutrient management information and research as it pertains to the Clean Water Act.
5. Nematode Research capabilities
6. Clarification and information regarding responsibility and traceability for food contamination issues

Details of each recommendation are provided below.

Recommendation 1:

Issue: Limited availability of research dollars specifically for integrated pest management research in Ontario.

Background: With the new restructuring in the OMAFRA–U of G Research Program there has been a shift away from Pest Management specific research to an integrated and interdisciplinary approach to significant industry issues. Under the new program, funding is limited for direct integrated pest management research. This subsequent lack of provincial funding increases the financial strain on grower groups that need to support IPM research for sustainability. This, in conjunction with increased overhead costs, technician layoffs and static research dollars will have a significant impact on research for the vegetable industry in Ontario.

Recommendation: The OCCRSC recommends that the OMAFRA–U of G Research Program Administration re-evaluate the funding limitations associated with direct IPM research within the new Sustainable Production Systems Program. Possibly linking IPM research to other research areas such as Green Belt protection may help to address these concerns

Target Agencies:

- Rob McLaughlin, Associate Vice President (Research) Agri-Food & Partnerships
- John O’Sullivan, Research Program Director, Plant Program
- Ken Hough, OMAFRA Research Support
- Sandi Christopher, OMAFRA Research Programs Administrator
- Michael Dixon, Chair, Environmental Biology, U of G
- **Dr. Rene Van Acker** Chair, Plant Agriculture, U of G

OASCC Linkages: OHCRSC and OPMRSC

Recommendation 2:

Issue: Lack of delivery, implementation and diagnostic capabilities of IPM programs in Ontario

Background: OMAFRA withdrew from providing IPM services to growers a number of years ago. Since then attempts to establish province-wide crop monitoring, scouting and diagnostic services that are independent of seed, fertilizer and pesticide suppliers have failed (e.g. AIMS). Crop consulting services will likely be more successful on a regional basis, but will need to service a wide range of crops within their area.

Integrated Pest Management (IPM) programs, which include resistance management strategies, help to prolong the effective life of pest control products and have been developed for many high value crops but have not been fully adopted or available to growers and processors due to:

- 1) lack of availability of training opportunities and trained IPM consultants and scouts in some regions, include web-based training modules;
- 2) lack of economic viability for privately delivered IPM consulting, scouting and diagnostic services;
- 3) lack of affordability of such services and materials for growers.

Increased need for IPM services is expected as new reduced risk pesticide products often need more intensive monitoring and understanding of the pest complex and the activity of the product in order to be used successfully. In addition, IPM is an integral part of agricultural risk management.

Recommendation: OMAFRA should make a commitment to effectively address the barriers to IPM implementation and delivery in Ontario, including those identified above. At a minimum, OMAFRA should ensure that scout training and support is offered in all vegetable-growing regions of Ontario. Support could come in the form of incentives such as tax breaks or central bulk supply purchasing to help alleviate IPM program costs. Additionally, it is imperative that improved diagnostic services be available to Canadian growers. With the growing number of independent field scouts, growers and consultants require access to accurate diagnostic testing with quick turn around times.

Target Agency:

- OMAFRA
- CFIA (Charles Brisco / Rob Favrin) and U of G (Marc Saborin)

OASCC Linkages: OHCRSC and OPMRSC

Recommendation 3:

Issue: The rutabaga industry continues to face the prospect of major crop losses due to lack of registered pest control products and resistant cultivars for cabbage maggot. Currently there is reliance upon only one control option and there are few if any available alternatives.

Background: Rutabaga growers in Canada have lost access to cabbage maggot control options in the past several years leading to reliance upon only one group of insecticides, the organophosphates: Lorsban is one of these materials under review by the Pest Management Regulatory Agency and may be lost or restricted for this use. In addition, the use of one group of organophosphates repeatedly will lead to insecticide resistance and loss of control.

The OCCRSC wishes to emphasize the urgency of the situation to PMRA of Health Canada, AAFC Research Branch and the University of Guelph. Until suitable alternatives can be developed and registered in Canada, it is vital that the PMRA maintain registration of currently labeled pest control options which are presently the minimum required.

Recommendation: In light of the urgent need for the rutabaga industry to address an increasing problem with cabbage maggot control options, the OCCRSC recommends to Agriculture and Agri-Food Canada Research Branch, London and to University of Guelph's Ridgetown College and Plant Agriculture Department, Guelph that there be continued emphasis on a research program which identifies and evaluates effective alternatives to currently labeled insecticides and resistant varieties.

In addition the OCCRSC wishes to strongly remind the Pest Management Regulatory Agency of Health Canada that they must consider carefully any reviews of pest control products for rutabagas as there are presently no alternatives to currently labeled materials.

Target Agencies:

- **Ken Campbell, Pest Management Center**
- **Dr. Rene Van Acker** Chair, Plant Agriculture, U of G
- **Dr. Gary Ablett, Campus Director, Ridgetown College, University of Guelph**
- **Richard Aucoin, Health Canada, Pest Management Regulatory Agency**

OASCC Linkages: OPMRSC and OHCRSC

Recommendation 4:

Issue: The OCCRSC recognizes that horticultural crop requirements for Nutrient Management Strategies and Plans are not currently underway, however information and research is still needed as it pertains to the Clean Water Act.

Background: OMAFRA is currently supporting work that is characterizing the nutrient quality of on-farm fruit and vegetable wash waters, and surveying leachate, soils and ponds from greenhouse and container nurseries. OMAFRA is also exploring options to increase the amount of resources available for research to support nutrient management standards.

Research is currently being undertaken by OMAFRA on 17 horticultural crops. Current research is focusing on 3-year trials to verify current management guidelines and includes soil sampling (particularly available nitrogen, organic matter, texture) and surveys on management practices.

Growers are concerned about the impact of nutrient management plans and legislation on production of crucifer crops. Of particular concern is the applicability and accuracy of current nutrient parameters in assessing nutrient input/output of cole crop production practices.

OCCRSC is pleased to see these issues being addressed by OMAFRA as noted above. However, with new legislation on the way for the Clean Water Act it is necessary to establish/edit current recommendations, detailed rate response studies must be conducted.

Recommendation: The Ontario Crucifer Crops Research & Services Committee requests that OMAFRA ensure that horticultural Nutrient Management research pertaining to the Clean Water Act is initiated. Additionally, when studies are completed, information must be readily available to growers and industry.

Target Agency: OMAFRA

OASCC Linkages: OHCRSC and OPMRSC

Recommendation 5:

Issue: Loss of Nematode Research Capabilities in Ontario

Background: Previously, at AAFC-Vineland there were 4 nematologists active in research. In 2002, the last nematologist in Ontario retired. In the past, this committee was given assurances by previous directors of AAFC Southern Crop and Food Protection Research Centre that the capacity for conducting nematode research and addressing nematode concerns in this province would be maintained. AAFC now requires a business case to justify the creation of any position, including nematology. The presence, introduction, and outbreaks of nematodes in Ontario vegetable crops have the potential to result in serious quarantine and trade issues, and as such it is essential that a significant nematode research program is available to support the Ontario root, bulb and leafy vegetable sector.

There are currently nine nematodes regulated by the CFIA that have the potential to become established and threaten the production of horticultural crops in Ontario. The lack of an 'in house' nematode taxonomist at AAFC will force Ontario producers to use US resources for identification which may lead to quarantine and trade issues on exported crops.

Although there is one nematologist at AAFC - Horticulture Crops Research & Development Centre (St-Jean-sur-Richelieu), that research program focuses on nematodes of potato, corn and turf and does not address vegetable crops.

Very few nematologists are left at any AAFC locations throughout the country. Correct identification of all taxa of crop pest pests and the maintenance of a research effort is crucial for the adequate protection of root, bulb and leafy

vegetables and the stability and competitiveness of the industry. It is noted however that AAFC-ECORC in Ottawa has hired a nematode taxonomist that Ontario growers will have access to.

Recommendation: Given the range of crops under the purview of OHCRSC that are concerned by the lack of nematology expertise of relevance to the vegetable and horticultural crop sectors in Ontario, the OCCRSC recommends that OHCRSC & OPMRSC coordinate and develop a business case to support the hiring of a nematologist by AAFC. Currently, the OCCRSC recognizes the Golden cyst, root knot and root lesion nematodes as major pest concerns.

Target Agencies:

- Annette Anderson, OHCRSC
- Hugh Berges, OPMRSC

OASCC Linkages: OHCRSC and OPMRSC

Recommendation 6:

Issue: Clarification and information is needed to help define where responsibility and traceability lie if there are food contamination issues.

Background: Currently, the OCCRSC recognises that there is not a satisfactory system in place to support or differentiate locally grown produce in the event of any food contamination scares; nationally or internationally. For example, in the event of a food safety issue concerning US produce, Canadian consumers should be made aware of the availability of locally grown produce. In the past, US food scares have dramatically affected sales of Canadian/Ontario grown fresh produce.

Additionally, many products (ie bagged salads) that are labelled “Product of USA” actually contain a mix of Canadian and American produce. This leads to confusion among consumers.

Recommendation: The Ontario Crucifer Crops Research & Services Committee requests that OMAFRA set up a system to help clarify and define where responsibility and traceability lie if there are food contamination issues. Additionally, this system would help to update consumers during the process so that they are made aware of alternative local sources. This would involve both testing and a public relations response during food safety scares.

Target Agencies:

- Annette Anderson, OHCRSC
- Hugh Berges, OPMRSC

GINSENG

Executive Summary:

Since 2002 the Ontario ginseng industry has been challenged by the impact of adverse weather. 2002 began with a spring freeze that affected 60% of the planted acreage, and was followed rapidly by widespread disease infestation. The industry has continued to face weather-related issues. Rapidly spreading foliar disease outbreaks, drought, mild winters that increased the risk of root disease and recently unprecedented rainfall have left the industry with reduced yields and quality. This changing climate has affected root quality across North America. As a result of earlier industry decisions in Ontario, that focused on production issues through research at Agriculture and AgriFood Canada and the University of Guelph, and through the support of OMAFRA with the establishment of a ginseng specialist position in Simcoe and assistance with export marketing and trade missions, the Ontario industry is better positioned than anywhere else in North America to address these challenges. Continued support from OMAFRA in these areas is essential. The federal response through the National Minor Use Priority Setting Workshops has moved the industry forward to better disease control solutions. Continued access to new and better products will maintain Ontario's position in global trade. This previous focus on production issues and the resulting solutions has allowed the industry to use more of its current resources for market development.

Public acceptance and widespread use of herbal cold medicine containing a ginseng extract has provided a market for root parts that might otherwise have been discarded. Evidence continues to mount supporting the use of ginseng to stabilize blood sugar levels in the fight against Type II diabetes. Emerging markets that show a promise of building trade directly with the People's Republic of China have generated a slow but positive trend in the upward movement of root prices. The ability of the industry to comply with Good Agricultural Practices and food safety standards has assisted greatly in accessing these new markets.

While the industry is progressing and adapting to changing markets, there is concern that increased acreage at this time would exert a downward pressure on prices. Competition from production of *Panax quinquefolius* in China has impacted the market there but market promotion and product branding efforts are developing a profile for Ontario root that is keeping it in demand.

The forum provided by the ginseng subcommittee has generated an exchange of perspectives and ideas that has worked, and continues to work, well. The overall industry perspective gained regarding issues and needs has allowed the industry to identify gaps and challenges and this has provided a first step in developing solutions. Many challenges remain for this industry to overcome. The cohesiveness of growers under a forward-thinking Provincial organization will provide a basis to continue to move forward.

STATE OF THE INDUSTRY:

Crop Size:

Ontario acreage: 6,500 acres (includes all ages of gardens)

2006 harvest: 3.5 million lbs, down 500,000 due to adverse weather

2006 plantings: ~ 1,200 acres; down about 40%

2007 harvest: will reflect a major increase in acreage from plantings 3-4 years ago but the impact of adverse weather may reduce this potential.

Wisconsin: 200,000 – 400,000 lbs, down from 600,000 and continuing to decline

British Columbia: There are currently 400 acres of ginseng in BC. It is estimated that this will decline to 120 acres in 2-3 years. This year's production is ~ 800,000 lbs. It is estimated that production will drop to 150,000 in 2 years. There are only 8-10 ginseng producers left. The price of BC ginseng sold to HK brokers was around \$7 per pound in 2005. BC root prices are traditionally lower than prices for Ontario grown root.

Peoples Republic of China – 1-1.5 million lbs and increasing

Crop Prices:

Currently ranging from:	\$15- \$18/lb, up 20% from 2005.
Overall crop value (includes all ages @ current prices):	\$350,000,000.00 (est.)
Value of 2006 harvest:	\$63,000,000.00 (est.)

Movement of product:

Most of this product moves into the Asian market before the Chinese New Year, which this year will be Feb 18, 2007. Movement after that is reduced.

Traditional movement into Asia has represented 80-90% of the North American crop.

United States production is largely for domestic sales. Import opportunities are developing for the export of fresh Ontario root to the U.S.

Alleged use of 10,000 lbs of fibre/mo for processing into herbal cold medicine has the potential to open up a significant market for fibres. Source of root for this is not clear.

Approximately 1 million lbs. of dried root, about 30% of the Ontario crop, moves through Hong Kong, into the Peoples Republic of China for processing, back into Hong Kong and then back to North American markets. Traceability is becoming increasingly important in such markets. Product branding in this market is also important.

Emerging Issues:

The ability to move root directly into the Peoples Republic of China (PRC): Consumer confidence in China is a major factor in the marketing of ginseng roots and processed products. Development of a branding program for Ontario root is essential and is being undertaken by the OGGA. Earlier establishment of a Wisconsin identity currently overshadows the Ontario presence in this market. Movement directly into this market is dependent upon meeting food safety and residue requirements set by the PRC government. Some of these requirements have the potential to become a trade barrier. The PRC has developed a Good Agricultural Practices (GAP) standard and some buyers have indicated willingness to work with the Ontario industry to use the GAP established in Canada for herbs, spices and natural health products. There is an increasing need for Provincial or Federal government personnel to intervene on behalf of growers and negotiate import requirements

Accessing the US market: The emerging potential for the sale of fresh root into the US offers both an opportunity and a challenge. MRL's established in the US would need to be met. If MRL's play a role in access, then government to government discussions will need to take place. There is no tolerance level for residues of products not registered for use on ginseng in the US, and registrations are on a state by state basis. Ontario producers will need harmonization with pest control products available to and registered for U.S ginseng producers. Co-operation with IR4 through joint registration of new products will be critical. This co-operation is being jeopardized by PMRA demands for efficacy and residue trials in BC. Declining acreage and yield in BC is estimated to result in BC production being 10% or less of Ontario production. The Ontario industry will be hampered in accessing this market if data collection becomes dependent on BC trials. Ontario needs Federal recognition as the sole significant production area for *P. quinquefolius* in Canada. If this market develops it will be necessary to determine postharvest practices that prolong the life and quality of fresh root and to examine packaging options.

Importation of seed from PRC: The development of a viable *Panax quinquefolius* industry in the PRC may lead to the potential to import seed to Ontario when domestic seed is in limited supply. It is imperative that no seed be imported into Canada from the PRC. *P. quinquefolius* in the PRC is grown in close proximity to *Panax ginseng* (Asian ginseng). These plants, while closely related taxonomically, are medicinally distinct and are used for distinctly separate purposes. These plants can hybridize. Unintentional introduction of hybridized seed into Canada would threaten native populations of *P. quinquefolius* as well as commercial plantings. It is imperative that CFIA

continue its moratorium on the import of ginseng seed from China. Continued communication among CFIA, OGGA, OMAFRA and AAFC should be encouraged.

Product branding in Chinatowns: Given that about 30% of the ginseng root sold to China will re-enter North America it is imperative that this root be traceable and that Ontario root be branded, even when it re-enters the country. There is currently no apparent branding of Ontario root in the local Chinatowns nor is there an awareness of Ontario production.

Abiotic rust: The theory has emerged across the native range of ginseng in North America that climate change is exerting an effect on root quality. Increasing levels of rust are being noticed across the range of both wild and cultivated populations. This rust may or may not be associated with pathogens and it is becoming evident that abiotic rust plays a role in downgrading root quality. While Korean research has shown that there are various nutritional triggers that generate a rust response, the significance of these triggers in North America is largely unknown. There is a developing awareness that this rust response is linked to increased temperature. This linkage is possible genetic and associated with increased temperature tolerance in fertilization and seed set. Production practices that mitigate this response need to be examined and implemented.

Widespread use of cloth fabric: There has been a gradual shift in the ginseng industry from wood lath shade to fabric shade. Currently approximately 70% of ginseng gardens in Ontario are grown under cloth shade, primarily low structures. It has been recognized for some time that cloth fabric, particularly in low shade structures, alters the humidity and temperature regime of cultivated gardens. Growers have mitigated this to some extent by raising the side shade and by venting panels to release heated air. In recent years it has become evident that cloth shade also presents a risk to garden health. Because of the weave of the fabric, water will pool on the shade and drip onto strips in the gardens. These strips receive significantly more moisture and plants in those areas are showing increased disease. There are alternative weaves available to the industry and these need to be evaluated for their ability to mitigate this factor.

Inability to move on joint IR4 projects: This is becoming increasingly evident as the BC industry declines. With the BC industry comprising about 6% of Canadian production and declining, it is difficult to conduct residue and efficacy trials in the 2 provinces. It is important to recognize that Ontario is the major producer of *P. quinquefolius* to the extent that Ontario data should be sufficient to satisfy PMRA requirements for product registration. Recently PMRA noted at an IR4 planning meeting that pyrimethanil (Scala) was upgraded to an “A” and PMRA decided not to participate due to the lack of plot availability in B.C. This is unacceptable. A Province supplying 94% of this product should not have to forego joint registration opportunities because a Province supplying 6% of the product cannot conduct trials. An emerging market for fresh root in the US is developing and it is critical that Canadian producers be harmonized with products used in the US to avoid product seizure under the zero tolerance policy.

Potential loss of fumigant registrations: Re-evaluation of 1,3-dichloropropene and the inability to apply fumigant to land over sensitive aquifers will have a major impact on the ability of growers to produce ginseng in the Norfolk area. It was indicated that Environment Canada plans to conduct water studies in 2007 to collect more information on 1,3-dichloropropene residues in sensitive areas however there has been no confirmation of this. Without adequate control products, root disease will reduce ginseng yield and quality and impair access to emerging markets both in the US and in PRC where similar ground water regulations are not in place. Yet again, the burden of environmental protection has been placed on the shoulders of agricultural producers without recourse to markets where competitors are not required to meet these standards and these costs can be recovered.

INDUSTRY RESEARCH PRIORITIES

- o Prolonging the life and quality of fresh ginseng roots
- o “Banking” ginseng seed for use in later years
- o Identifying triggers for abiotic rust
- o Evaluating and mitigating water pooling in different weaves of shade fabric.

SERVICE NEEDS

- o The GAP process needs to be “meshed” with the Chinese process.
- o Development of a seed certification process for ginseng.
- o An industry-wide meeting to communicate information from the ginseng fertigation trial
- o Annual garden walker workshops to update growers and staff on emerging garden health issues
- o Continuation of the ginseng crop report
- o Maintenance of the ginseng specialist position in Simcoe

GAPS IN SERVICES

- o There is lack of research personnel at both AAFC and the University of Guelph who are prepared to address ginseng issues.
- o Establishing a processing industry in Ontario where value-added ginseng products can be manufactured under Good Manufacturing Practices in accordance with the regulations of the Natural Health Products Directorate.
- o There is a need for the establishment of a seed certification program and certified ginseng seed dealers who can clean and sort seed, treat for disease and test for viability.

Recommendations:

2006 RECOMMENDATIONS

2006-1 Evaluate the potential for value-added ginseng enterprises in Ontario

To: Clarence Haverson, OMAFRA ,
Manager, Business and Organization Management, 1 Stone Rd, Guelph

Recommendation: That OMAFRA evaluate the needs and challenges for value-added processing of ginseng in Ontario. This market niche needs to be identified as to wholesale and retail potential in Ontario Chinatowns. Barriers associated with Federal regulations, language barriers involving information packaging, and branding and labelling issues need to be clarified and solutions explored.

Approximately 30% of the Ontario crop re-enters this Province as value-added products. This processing has taken place primarily in Asia. Can these products be replaced with products manufactured in Ontario? What is the target market for these products? What products are most sought after in Ontario Chinatowns? What is the best way for the Ontario industry to approach this – as a manufacturing co-operative? – as individual value-added enterprises? - as a single desk marketing venture? Are there regional or environmental barriers to the development of these initiatives? What role does consumer confidence play in product credibility, quality and safety? These questions must be answered if the Ontario industry is to expand its potential. The OMAFRA Business and Organization Management Team is uniquely placed to undertake this initiative.

2006-2 That the Federal Government, through PMRA, Provide funding for efficacy/screening trials that are part of joint IR4 proposals.

To: Doug Rothwell, PMRA Minor Use Coordinator
cc. Richard Aucoin, Chief Registrar, PMRA

Recommendation: That PMRA and/or the PMC provide funding for the collection of efficacy trial data for joint IR4 projects.

The collection of efficacy data has become a limiting factor in the accessibility of Ontario ginseng producers to registration of minor use pest control products. While the PMC funds residue trial studies, the collection of efficacy data has remained the burden of the various horticulture sectors. This places a burden on the industry that is unrecoverable in the marketplace.

The ginseng industry recognizes the need for efficacy data and also that it is neither possible, nor appropriate, for the federal government to fund trials for every product on the market. It does, however, request that those projects that

have the potential to be joint IR4 registrations be funded federally. Export opportunities are emerging in the US for the importation of fresh ginseng roots. This new market will be jeopardized by the inability of the industry to access products registered in the US. Not all pest control products registered in Canada for ginseng are registered in the US and their 'zero tolerance' rule will prevent root from moving into the US if these products are detected. Joint registration of products will alleviate this pressure but this must be done in a timely manner and places an unfair burden on the Ontario industry when US registration requires crop tolerance but not efficacy data. If data requirements in Canada cannot be harmonized with the US data requirements then the federal government should supply funding to support necessary additional trials.

2006-3 Develop a Business Case for the hiring of an applied Nematologist and an applied Pathologist by AAFC in Ontario

To: Clarence Haverson, OMAFRA ,
Manager, Business and Organization Management, 1 Stone Rd, Guelph

***Recommendation:* That OMAFRA Business and Organization Management Team prepare a business case for the hiring of an applied nematologist and an applied pathologist by AAFC in Ontario. Particular emphasis should be placed on these disciplines as they relate to the horticulture industry.**

It has become apparent over the past several years that Agriculture and AgriFood Canada is retreating from support of the horticulture sector in the areas of nematology and plant pathology. At the same time, the horticulture industry, including the ginseng industry, has experienced threats associated with invasive and introduced pests such as the golden nematode, for example. In an atmosphere of global trade and global movement of produce, including ginseng, there is a heightened risk of the introduction of new pests into our production areas. The responsibility to mitigate these risks should fall on the shoulders of Federal departments such as AAFC.

In addition to threats resulting from global trade and product movement, there are increasing threats from the impact of climate change on pests and diseases of horticultural crops. Recent mild winters and changing patterns of precipitation are indicating that nematodes and pathogens can take advantage of environments that are more conducive to their survival. Failure of various herb crops, reduced yield and quality in ginseng, and other instances beyond the scope of this subcommittee, have driven home the need for access to cross-commodity nematology and pathology expertise. We need to do much more than identify these nematodes and pathogens, we need to mitigate their impact on our crops. Past research outlining the life cycles and host ranges of these pests, and potential controls, may no longer be appropriate under these changing conditions. We can no longer make assumptions based on historical information. Under changing climate conditions pest dynamics are changing. Where it was once sufficient to address pest control with product screening and general production practices, it is now obvious that new factors exist. This particularly applies to the need in the ginseng industry to re-evaluate the use of fabric shade material from the perspective of disease management.

Many of these situations exist as a direct result of global trade arising from Federal trade policies and agreements. Failure of AAFC to address this issue has led to a misalignment of federal resources with industry priorities. To remain competitive globally, Ontario producers must have the most up to date information on the understanding and management of these pests. This requires new research initiatives and extends beyond the scope of Provincial experts.

University support in these fields falls short of overall industry needs and tends to be directed toward specific research projects dependent on the relative wealth of various industry segments.

The Provincial Business and Organization Management unit can draw on the expertise of team members to develop this business case.

2006-4 Collection of efficacy data for ginseng for Ontario only

To: Doug Rothwell, PMRA Minor Use Coordinator
cc. Richard Aucoin, Chief Registrar, PMRA

Recommendation: That the collection of pest control registration data for ginseng from Ontario sites be recognized as sufficient for evaluation by PMRA.

The demographics of the ginseng industry in Canada is changing dramatically. Several years ago the British Columbia industry represented roughly 30% of the root produced in Canada. Acreage there is declining rapidly with the move to Ontario of Canadian Imperial Ginseng and Chai Na Ta Ginseng.

According to Agriculture and AgriFood Canada, there are currently 400 acres of ginseng in BC and this will drop to 120 acres 2008. This year's production is around 800,000 lbs. It is estimated that production will decline to 150,000 lbs. in two years. This is approximately 6% of Ontario production and between 4-6% of Canadian production.

It is therefore recommended that PMRA and the Pest Management Centre recognize that, in the case of ginseng, data from Ontario does in fact represent sufficient information to register pest control products and to proceed with joint registration through IR4

GRAPE AND WINE

INTRODUCTION

This report was prepared by the “Grape and Wine Research and Services Sub-Committee of the Ontario Horticultural Crops Research and Services Committee”. It summarizes the work of the subcommittee over the past year, especially the discussions at the Sub-Committee Meeting organized by Kevin Ker, chairperson (KCMS Inc/CCOVI Brock University) and Neil Carter (OMAFRA) held on November 14, 2006 at Rittenhouse Hall, OMAFRA Vineland, Vineland Station Ontario. This report is a summary of the accomplishments of the grape and wine industry, issues, research and service priorities, pest management issues, minor use priorities and recommendations affecting the industry.

The entire 2006 report is available in electronic format with complete listing of research and service activities by individual and agency/institution. Contact Kevin Ker at kker@brocku.ca to request an electronic version

STATE OF THE INDUSTRY – Wine and Juice Grapes

Grape Prices: As part of the short crop Memorandum of Understanding, as it relates to the three year wine grape price agreement, 2006 wine grape prices increased by 3% across all varieties over 2005. Juice grape prices were set through negotiations which took place in August. Juice grape growers continue to receive low market prices for their grapes.

Replant Program: The GGO continues to lobby both the Federal and Provincial levels of government for the implementation of a Replant Program. The GGO has completed an economic impact study on the Replant Program.

Education and Research Underway is a three year wind machine and plant hardiness research project with industry stakeholders such as GGO, OMAFRA, Wine Council of Ontario, Brock University, KCMS Applied Research and Consulting Inc. and our growers. The project addresses the issue of how to reduce the risk of spring and fall frosts as well as winter injury to grape vines. It is intended to help growers determine when to operate wind machines for maximum effectiveness. Part of the project involves looking specifically at the survival of cultivars. A communication strategy about wind machine use is completed and will be implemented in order to educate the public.

In 2006, Phase II of the GIS/GPS vine management system (VITIS) project began towards the development of a computerized weigh bill system and the incorporation of a food safety and traceability component. In 2006, the GGO partnered with CFIA, KCMS Applied Research and Consulting, vine import brokers and growers to implement a three year vine monitoring program for phytoplasmas. Innovative vineyard practices will continue into 2007 and partnership with the Ontario Weather Network to enhance our weather stations and the type of data growers receive from them.

Ontario Fresh Grape Growers' Marketing Board - Fresh Grape Industry Update

The 2006 Sovereign Coronation crop was up sharply from 2005 to approximately 1920 tons (1340 – 2005). Quality was excellent with more uniform ripening and full bunches. Based on new plantings coming on stream, the volume will continue to climb over the next several years.

The overall sales of fresh grapes were up 16% to 2,420 tons. The Fredonia volume was about the same at 2005 at 500 tons. Unfortunately, not all the Fredonia crop was marketed for fresh and no Concord grapes were sold for fresh this year. As more Sovereigns come on stream, the industry will have a challenge to market the entire Fredonia crop in the future.

Weather and the 2006 Grape Crop

For three years consecutively (2003, 2004 and 2005) the grape growers of Ontario had poor crops due to vine damage sustained by cold winters, but 2006 has produced a more stabilized crop. Revitalizing and replanting of vineyards continued in 2006. Wet conditions in August and September caused powdery mildew in the vineyards and some breakdown of grapes.

Crop Summary

Most of the grape areas of the province experienced a very mild winter. There was potential for crop losses in early December when temperatures fell below -11.1° C. The use of wind machines in that area also helped reduce crop losses for most part. Buds were healthy coming out of the winter. Cold temperatures during the last 5 days of April almost resulted in damage to buds but fortunately, only high risk, low lying areas experienced any damage. Wind machines were used extensively during this period to help reduce the damage from spring frost. There was considerable vine damage carried over from the winter of 2005. Growers had to replace several vines in their vineyards.

Heavy rains and warm temperatures created an ideal environment for diseases (powdery and downy). Growers struggled with high disease pressures which resulted in some crop losses. Grape Berry moth pressure also remained high throughout the growing season in many areas. Growers faced one of the most difficult harvest seasons in many years with above average rainfall and lower than normal temperatures. There were 14 days in September with recorded rainfall and 13 days in October. Heavy rains made it difficult to get into the fields to harvest the crop and contributed to crop losses due to fruit breakdown.

Heat units were the lowest recorded in several years. Growers and wineries had difficult harvest decisions to make during the fall - whether to wait for more heat units versus harvesting before the fruit broke down. Final harvest continued into a drier November with the last of the Bordeaux reds. Generally, yields are up considerably from 2005 and higher than spring estimates due to the good bud survival and plenty of moisture.

Emerging Issues Grapes, 2006

The following emerging issues were identified by the Sub-committee as being important for the future of grape and wine production in Ontario. No recommendations are attached to these issues.

Multicoloured Asian Lady Beetle (*Harmonia axyridis*)

Research is underway on several fronts including population ecology and predictive modeling (Dr. Mark Sears, University of Guelph) and vineyard monitoring (KCMS Inc.). A multi-year NSERC strategic grant covering many aspects of the required research has also been spearheaded by Dr. Gary Pickering, CCOVI/ Brock University. The sub-committee emphasizes that MALB is still an extremely important issue in the grape and wine industries but that no recommendation is required on this insect this year.

Premature Grape Breakdown

As harvest approached, significant breakdown was observed across Ontario in several varieties, especially Pinot Noir, Riesling and Chardonnay. The cause of this breakdown was undetermined but likely due to multiple items: physiological breakdown due to heavy rains experienced during the pre-harvest interval, bunch rot due to infections by *Botrytis cinerea*, sour rot due to the activity of *Acetobacter* (as well as other fungal organisms), fruit fly and yellow jacket activity. The breakdown also resulted in elevated levels of volatile acids, which at some locations, attracted multi-coloured Asian lady beetle. Many crops were harvested well before normal maturity to avoid complete loss of the crop.

Land Use – Greenbelt

An extensive summary of greenbelt issues was included in the 2004 OGWRSSC report. However, the government has now established a Greenbelt which includes the unique tender fruit and grape lands in the Niagara Peninsula. The Greenbelt places a freeze on these lands for agricultural purposes only and limits the rights of farmers. The industry is monitoring the effects this legislation has on the value of farm land. In addition, there are serious concerns over attempts to classify drainage ditches as fish habitat and farm woodlots as wildlife habitats.

Salt Damage

The province and local municipalities continue to use salt on roads adjacent to farm land. This has resulted in damage to grapevines caused by salt spray. Alternatives to salt need to be tested in order to mitigate the damage and the resulting financial losses being sustained by producers.

Vertebrate Damage

Grower complaints from deer browsing, avian damage and loss of crop are occurring with more frequency, especially along the Beamsville Bench area. There are local bylaw restrictions in several municipalities in the Niagara Region which prohibit the discharge of firearms, so the only control is by bow. There are also Ministry of Natural Resources limits on the hunting season and number of deer which can be killed.

Juice Grape Production and Profitability

Juice grape producers continue to suffer from poor demand, oversupply, and low prices for their crop. The announced closure of the only Ontario processing facility for juice grapes has placed many growers in an economically non viable position.

Herbicide drift causing damage on grapes

This issue was submitted last year as an issue with recommendations. Several of the targeted agencies responded and are contributing to finding solutions to this problem (see “Responses in 2005 to Recommendations from 2004”, page 19). The sub-committee removed the recommendation this year but wanted to include it in the “issues” section to highlight the fact that it is an ongoing problem.

Great Lakes Charter

The charter is under review and based on first drafts, there will likely be restrictions on how much water can be taken from the Great Lakes system for agricultural irrigation use. This could have serious implications on the availability of water for irrigation. Further, the GGO and OTFPMB in cooperation with Regional Niagara has commissioned a study on the feasibility of diverting water from above the escarpment to areas below the escarpment for irrigation purposes. This would also be contrary to requirements in the current draft.

Wind Machines

There are now over 400 wind machines in the Niagara Peninsula used to mix air from different levels at different temperatures to “warm the micro-climate around the vine”. Wind machines are used primarily near the end of harvest to reduce the risk of a fall frost, in mid-winter to reduce the risk of winter injury, and in the spring to reduce the risk of spring frost damage to buds. Because of the machines’ proximity to homes in the rural and urban areas, the noise they produce may be disturbing to some residents. The machines often run through the late evening and early morning when people are trying to sleep. The industry will need to show the positive effect from the use of wind machines as non-farming residents may challenge the use of wind machines as a normal farm practice.

SERVICE ACTIVITIES

Eight OMAFRA staff provided reports of their activities in technology transfer related to grapes for this past year. The number of OMAFRA staff reporting technology transfer (extension) activities in grapes varies from year to year and staff with direct responsibilities in the grape sector naturally has longer reports. Other OMAFRA staff not included in this compilation also provide assistance to the grape and wine industry through activities such as policy, planning, publishing, and the important area of minor use registration. OMAFRA Program Leads (Hannah Fraser, Entomology; Mike Celetti, Pathology; Leslie Huffman, Weed Management; Denise Beaton, Crop Protection) and other OMAFRA specialists work with grape specialists to provide recommendations and technology transfer through various avenues throughout the year.

Some examples of Services to the industry by OMAFRA staff include:

Projects with Growers, Marketing Boards, U. of Guelph, Brock University, AAFC, etc.

- CanAdapt Sovereign Coronation Maturity Project
- CanAdvance/CRESTech Wind Machine Project
- Revised “Establishment and Costs of Production for Grapes in Ontario”, formerly OMAFRA pub 813 – distributed 150, available on OMAFRA website
- Niagara Irrigation Study
- Sustainable Practices – Wine Council of Ontario
- Grape Rootstock trial
- set up an IPM scouting program for Grape growers in Prince Edward County region

Industry Committees – **active participation on industry committees and policy groups**

Regulatory agencies -

- PMRA, MoE, etc
- Land Use Issues – Town of NOTL and St. Catharines and Niagara District Airport – impact of raising land elevations and the effect on adjacent grape growers
- Consultation to OMAFRA policy staff – on-going
- Communications Plan Committee for wind machines in NOTL.

Presentations to growers and industry – OFVC and other conferences

Environmental Farm Plan

Publications, Fact sheets, Info-sheets, Newsletter Articles

For example, Tender Fruit Grape Vine (TFGV), 6 issues per year, 600 copies per issue, OMAFRA INFOsheets, Local Media articles, technical papers at conferences

Out of Province Travel – investigative research in other grape producing regions

Other Activities - Regular “extension” day to day activities – diagnostics for growers, phone calls, emails, technical information for business, growers, consultants, other government agencies

Examples of Private Sector Service Activities

Diagnostics: Diseases, insects, nutritional, physiological, pesticide damage
Collect samples and either identify in lab or submit to Lab Services, U of G

Pesticide Recommendations: Resistance management strategies, Fungicide timing, Weaknesses in individual spray programs, Post-infection treatments, Cultural controls to improve disease control

Sprayer Assessments: Evaluate sprayer coverage, Assist with sprayer calibration, Liaise between researchers elsewhere and grower community

Grape Information Sessions: Organize and find sponsors for annual grape research tour as a means of disseminating information

OFVGA Annual Meeting: Participate as speaker and session chair

Pesticide Efficacy Trials: On contract basis from agri-chemical industry and also AAFC minor use program, Assist with development of spray programs using new products

Grape Crop Monitoring Activities 2006

Under contract with GGO and OTFPMB, KCMS Applied Research and Consulting monitors approximately 3,000 acres are monitored once each week, comprising of 263 blocks at 41 farm locations across the entire Niagara

peninsula. Labrusca cultivars (juice and fresh market) along with hybrids and vinifera cultivars (for wine) were monitored for pest activity, crop phenology, crop load estimations and plant health issues on weekly basis from 01 May to 01 September for routine evaluations. A comprehensive crop report (including information covering all aspects of grapevine production and pest information) was developed and recorded each week based on the data from the monitored sites. Messages were available to all grape growers via local or toll free telephone access. The Grape Crop Report messages were updated each week. These messages were developed including consultation and information from Dr. Wendy McFadden Smith (Grape Pathologist), local government agencies (OMAF AAFC), research colleagues from Brock University, University of Guelph and research/extension from nearby US faculties. For the 2006 growing season, the Niagara crop report had 3,873 (vs. 3,946 in 2005) calls and South-western Ontario grape crop report 142 (vs. 231 in 2005) calls.

2007 Services by KCMS

1. Continuation of development and delivery of self funded regional Pest Monitoring Service for vineyards in Niagara. Service available to all grape growers in Niagara. GPS monitoring will be available for the 2007 growing season
2. Development and delivery of region wide Grape Crop and Pest report for Niagara and South-western Ontario available to all growers and funded by Ontario Growers Marketing Board (prepared in conjunction with Dr. Wendy McFadden-Smith)
3. Continuation of Independent Professional Tissue and Soil Sampling service for vineyards. Professional interpretation of results included and are available for all grape producers
4. Crop estimation and dormant season bud sampling services
5. Site specific weather monitoring with the ability to record temperatures at various intervals all months of the year. This system is capable of expansion to record daily rainfall, wind speed/direction and relative humidity.
6. Region wide monitoring for the presence of MALB prior to and throughout the harvest season to assist growers with control options
7. Co-ordination of a rapid response unit in order to evaluate MALB populations in vineyards to reduce impact at the processing level (Supported by the WCO and the GGO)
8. Continuation of specific vineyard monitoring for potential vectors of phytoplasmas associated with the complex of grapevine yellows (Funded by the GGO and supported by the CFIA and OMAFRA 2006-2008)
9. Assessing the effects of wind machines on a variety of grape cultivars at different periods throughout the dormant season (as research partner of Can Advance research project 2005-2007)
10. Investigation of equipment and techniques to assess hardiness of Niagara region grape cultivars (buds, xylem and phloem) by means of cold exotherm analysis (in conjunction with Brock University and Can Advance project above)
11. Expanded 3- dimensional GPS vineyard mapping and site evaluations for grape production. This expanded mapping program will enable growers to identify on site production potentials, problems and employ recommendations for planting, cultivar selection, site adjustment, wind machine placement and other production practices. This service will use not only mapping technology but analytical services for grower use

2006 SERVICE PRIORITIES (not ranked)

1. Delivery of support IPM services and training if IPM personnel
2. "Tender Fruit Grapevine", "Hort Matters" newsletters and web based information
3. Vine Importation monitoring and Hot water treatment evaluation
4. Support services for precision viticulture (3D mapping, GIS, software information/validation)
5. Test and evaluate new cultivars and selections
6. Water Quality/Irrigation
7. Sound, Objective Financial Information for Growers
8. Water use, quality and conservation. Provision of services to ensure a reliable and high-quality water source is available.

Summary of Issues with Recommendations for 2006(not prioritized)

1. **Lack of pest control product availability:** The OGWRSSC has submitted recommendations to the PMRA for many years concerning the issue of pest control product availability. Lack of “harmonization” remains a critical issue.
2. **Staffing at Vineland etc.:** The OGWRSSC and other Sub-committees within the OASCC system have made repeated recommendations for many years to AAFC (and others) outlining the need for replacement or enhancement of the staffing in research capacity especially at Vineland AAFC (SCPFRC). No real action has been taken to fill vacant positions and more gaps are occurring over time.
3. **More water management research needed:** Water management is becoming an extremely important issue for grape growers but there is currently not enough information specific to Ontario’s grape growing conditions to guide their irrigation and soil water management decisions. The Environmental Farm Plan provides general direction on sustainable farming practices, but not sector specific guidance related to best practices in grape growing.
4. **Import restrictions on *Vitis* plant material:** The danger of introducing grapevine diseases on vines and/or rootstock imported from Europe into Ontario has caused the Canadian Food Inspection Agency (CFIA) to impose new regulations on the treatment of vines entering Canada.
5. **Winter injury research needed:** Although late spring and early autumn frosts can cause considerable damage to grapes and tender fruits, winter cold injury has been a more serious problem in recent years.

The **Vineland Renaissance Advisory Panel** needs continued support from all organizations to rebuild the Vineland Research Station.

GREENHOUSE FLORICULTURE

EXECUTIVE SUMMARY

The OGFRSSC meeting held on Nov 7th 2006 at Rittenhouse, Vineland , was attended by 19 people, of whom 10 were industry representatives, including 7 growers from the Niagara area.

This was a critical transition year for numerous floriculture related issues.

During 2005-6 growers remained concerned about pressure on the industry resulting from:

- The increasing number of imports threatening domestic production and reducing export sales to the US
- The strength of the Canadian dollar
- Frequent cross border delays as a result of increased security and quarantine issues
- The lack of harmonization of rapid pest and disease diagnostics for ornamental crops
- The continued high cost of fuel and energy
- The growing trend among retail outlets to hold local growers financially responsible for produce quality right to the point of purchase by the consumer even though they had little control over post-harvest care in the retail outlets
- The lack of effective methods for promotion of the floriculture industry with the public and different levels of government
- The pressures on water usage with several growers stressing the concern of previous years that the viability of the grower had to be considered as well as that of the farm operation with the further growth of the urban population
- The need for sustained support for research and development to keep the industry competitive to be combined through combined government and industry partnerships
- The need for more data on management of greenhouse environments including strategies for long term recycling of nutrient solutions
- The stringent rules regarding work place safety in controlled environments and the lack of adequate agrichemical tools to implement effective IPM programs

In an attempt to deal with these issues and changes especially in the service and research areas grower organizations primarily Flowers Canada Ontario (FCO) increased their efforts during 2005- 2007, hiring new staff and helping fund more marketing, service oriented and research projects as well as attempting to harmonize their efforts with other agricultural industries such as the vegetable greenhouse growers.

March 2006 marked the end of direct funding for floriculture research projects through the OMAFRA/Guelph contract although the university OMAFRA contract was extended for one year. To replace the OMAFRA research operating grants a new program of competitive grants was made available in 2005. Researchers and extension experts interested in floriculture were *free* to apply. In the 2005-6 competition in the new Sustainable Production program of OMAFRA one research application relating to greenhouse production was submitted and funded. This four-year project deals with cross commodity issues of the ornamental and vegetable greenhouse industries in Ontario. The researchers who initiated this project were also successful in obtaining matching operating grants from FCO, OGVG and other government agencies such as NSERC and the Ontario Centres of Excellence (OCE). AAFC will support elements of this new project albeit on greenhouse vegetables. The Canadian Foundation of Innovation (CFI) separately is funding new infrastructure at the University of Guelph to study temperature and CO₂ enrichment of plants. The new research enabled by these new facilities are important in understanding both the effects of global climate change on plants and the effects of tightly controlled greenhouse environments on crop production systems. Unfortunately this nationally funded, competitive program is terminating and alternative programs will be difficult to access for some years on behalf of floriculture related programs.

In summary, the floricultural industry through the efforts of FCO took a greater role in harmonizing promotion, marketing, service and research in floriculture in Ontario with the view to integrating all levels of potential government support. The subcommittee recognised this new role for FCO in its recommendation for 2006-7. As specific “research” recommendations were **not** to be submitted to OMAFRA this year, three recommendations emerged from the Nov 7th meeting of this subcommittee.

1. The industry through FCO and TOGA needs to continue to promote floriculture within the domestic market and improve the lines of communication within the industry and various levels of government and emphasizing the value to Ontario economy.
2. OMAFRA, AAFC and FCO need to continue efforts to harmonize minor use registration programs and integrate the services of laboratory diagnostic groups in Guelph for assessing diseases and pests of greenhouse ornamentals that also impact issues such as trade,
3. Educational programs both in the form of special short-term grower courses and continuing education at the college level need to be encouraged.

STATE OF THE INDUSTRY AND MAJOR EMERGING ISSUES

Markets: Statistics Canada continues to report that Ontario represents over 55% of the total greenhouse floriculture production in Canada. Ontario's industry still has a value over \$700 million, but in the last 24 months many factors have continued to plague the greenhouse floriculture sector. Briefly these are, 1) the rapid rising gas and energy costs, 2) the rise in the value of Canadian dollars, and, 3) strong competition in the cut flower and potted plants from imports, primarily from South America but increasingly imports from around the world. As more growers export less competition for domestic markets increases. Growers in almost all commodities have experienced lower returns for their investment compared to past years because more produce was on the market.

Cut Flowers: This sector continues its decline as foreign competition remains aggressive. A few growers who have been able to consolidate and switch to growing alternate crops for niche market are still doing well but profit margins have been down domestically and there still are many border issues that cause delays in the shipment of exports. Flowers Canada, OMAFRA AAFC are working closely with CFIA and USDA to resolve the problems that arise from time to time but the cumulative impact of reduced margins, boarder problems and competition from abroad has resulted in a severe reduction in cut roses, alstroemeria, chrysanthemums and more recently snapdragons that up to last year remained a stable export commodity. Still the high quality of Canadian produce such as gerbera has helped maintain some local growers. There is a demand for niche crops such as bulbs but it is unclear whether current markets can be sustained in the face of foreign competition and aggressive marketing internationally.

Potted Flowering Plants: As in recent years growers of potted crops continue to be under pressure from low margins. Some in the industry feel that poor handling of the product by retail outlets remains a key reason for declining profits. Poinsettia production, the single largest holiday crop grown in Ontario, is down by over 33% comparing to 2003-4 figures. Other commodities such as geranium are down but a few staples such as chrysanthemum and Easter lilies maintain their profit margins.

Bedding and Spring crops: Bedding plants and spring flowering hanging baskets continued to drive the industry in both Ontario and the U.S. in terms of growth and return on investment however profits were down because more product was on the market.

Pests/diseases: The significance of pests and diseases to the industry is closely tied to the availability of effective pest control products. This was again emphasised by priorities identified over the last few years to the AAFC Minor Use Priority Meeting in Ottawa. Graeme Murphy and Jim Chaput both OMAFRA experts reviewed the current strategies and chemicals that were available and that might become available for dealing with what the subcommittee agreed were the five major pests (i.e., issues) Thrips, Whiteflies, Leaf Miner, Mites and Mealy bugs. The major diseases threatening different sectors of the floriculture industry remain powdery mildew, *Fusarium*, *Pythium*, *Phytophthora*, downy mildew and leaf spots due to a number of viral and bacterial agents. It was pointed out by several growers and the experts that all diseases require treatment and the issue remains registration and testing. The subcommittee was guided by the expert committee and let them determine the best course of action for registration based on recommendations from other sub-committees and the cold reality that in Ottawa at the annual meetings of PMRA when final recommendations are considered it is rare to receive approval for more than a single new chemical. Co-ordination with other sectors such as greenhouse vegetables was also suggested as both horticultural industry groups share a common problem of meeting requirements of work place safety.

Reports that were presented to the OGRSS subcommittee on Nov 7th 2006 outlining recent activities associated with

A) Industry Initiatives,

B) Service and Extension Activities at Vineland and

C) Research at AAFC, Harrow and the University of Guelph.

A) INDUSTRY INITIATIVES:

a) From Jamie Aalbers, (FLOWERS CANADA ONTARIO, Guelph)

At the 2005 meeting the following research priorities were identified for the sector. Under each priority are the titles of research projects the FCO Research Committee has committed industry cash to in the past year. Most projects are on-going.

- **Hiring a new pathologist or identifying an expert at the University of Guelph who could devote time to floriculture crops**
- Remediation of Root Diseases in Floriculture Crops (John Sutton)
- Developing a Quick Immunoassay for *Erwinia carotovora* (Chris Hall, Theo Blom)

- **Development and implementation of IPM programs**
- Control strategies for leafminer (Lisa Conroy) – see attached report
- Development of an IPM program for thrips (trap plants and *S.feltiaea*) (Rose Buitenhuis and Les Shipp) Harrow
- DNA Barcode of Life (Rob Hanner)

- **Optimisation of the greenhouse environment and efficient energy use**
- High intensity pulse lighting (Theo Blom)
- Reducing energy costs in ornamental production (Bernie Grodzinski)

- **Integration of nutrient, water and disease management strategies from an environmental perspective**
- Oxygenation of nutrient solutions (Youbin Zheng, Mike Dixon)
- Development of ozonation and chlorination systems for greenhouse irrigation (Youbin Zheng, Mike Dixon)
- Ion specific nutrient management (Glenn Roberts, Mike Dixon)

- **Post-harvest handling and production issues**
- Novel post harvest techniques (Hexanal as an alternative to 1-MCP) (Gopi Paliyath)
- Height Control of Potted Plants (Theo Blom)

- **Development of improved and new floricultural crops**
- UofG Bedding Plant Trials (Rodger Tschanz)
- Development of new and improved floriculture crops (Al Sullivan)

- **Training of a skilled labour force for the industry**
- TOGA Ergonomic Study

- **Promoting, marketing of Canadian products domestically and for export**
- Economic Impact Study of the Ontario Greenhouse Industry (TOGA)
- Development of a Marketing Strategy for Ontario Flowers (AdFarm)
- In the 2005 meeting 5 issues (with recommendations) were identified as well. Flowers Canada has had input on these issue in 2005/2006 as noted below each point.

- **The need for pathology expertise in greenhouse ornamentals**

On a broader scale FCO (through TOGA) has a representative on the Vineland Renaissance Advisory

- Panel. This panel has been tasked with presenting a plan for the future of the Vineland Research Station. James Farrar is sitting on the panel and ensuring that the needs of greenhouse floriculture and greenhouse vegetables are included in any future plans for the station.
- **The need for harmonization of new pesticides for the industry through the minor use registration program**
- This issue is one we work on continuously. Early in 2006 FCO hired a full-time Minor Use Pesticide Technician (Cary Gates). Garry Watson has been retained as a consultant on this issue since 2004.
- **The need to become more energy efficient and environmentally friendly management of greenhouse environment**
- The Research Committee has funded a project by AgEnergy _ Demand side Management (investigating greenhouses for energy conserving practices). TOGA has funded AgEnergy on this project as well and has approved 3 other projects from AgEnergy:
 - Natural Gas Storage Optimization Program
 - Emissions Credit Study
 - Combined Heat and Power Potential through Cogeneration
- **The need for educational programs both at the college level, and as a component of continuing education**
- Flowers Canada (ON) Night School Course in fall of 2006 at Vineland
- **The need for the industry to continue to promote itself within the domestic market and continue to improve better lines of communication within the industry and various levels of government and emphasizing the value to Ontario economy**
- A marketing strategy for Ontario grown flowers has been developed through a project funded by FCO. The Board of Directors is now considering the recommendations and looking for funding to move forward on the marketing plan.
- The Economic Impact Study has been completed indicating that the Ontario greenhouse industry has one of the highest multipliers in the economy and contributed just under \$4 billion to the Ontario economy in 2005. This document has been presented to government (federal and provincial) and is being presented to municipal councils in Essex County and Niagara.
- Communication to the industry through newsletters, websites, research symposium and industry summits.
- In September and October a risk assessment of the ornamental horticulture sector was conducted across Canada. The results will be available in January, but the assessment itself was an excellent tool to meet with growers across the country and work on strengthening our national network.

b) Garry R. Watson and Cary Gates of Flowers Canada Ontario (Guelph)

-Flowers Canada's Minor Use Pesticide Registration Project:

While not traditional academic research, this project falls under the Research Committee of Flowers Canada Growers because increased access to newer and more pest management solutions ranks among the top three priorities of all growers surveyed. The project had been underfunded and understaffed for many years but a three-year federal/Ontario grant has allowed additional staff resources to be allocated.

Our goal is to select pest management products and plant growth regulators that are reduced or low risk, possibly biological, compatible with IPM programs, new chemistry or modes of action, more targeted and environmentally friendly etc. and do whatever is necessary to facilitate Canadian floriculture registrations. This may include conducting data mining and possibly arranging and managing efficacy and crop tolerance research to make applications expanding the label of products from other sectors, working with registrants of new active ingredients to ensure applicable products to floriculture have labels that meet the needs of our growers, working with international registrants to facilitate getting their new products registered in Canada and liaising with government departments on behalf of registrants who are having problems with the Canadian regulatory process. We have increased the available number of product options available to our growers by 10% over the last year.

We have been successful for the last three years in competing for 1 or 2 of the 36 projects selected from over 800 entries from all of horticulture for research to be undertaken by the new Pest Management Centre of Agriculture and Agri-Food Canada on priority pest problems and solutions that we proposed that require substantial applied research and data development to satisfy the PMRA requirements for registration.

We have supported this endeavour by writing seven comprehensive profiles describing the floriculture industry, its crops and production methodology along with its current pest management practices and future needs. These will be used to guide reduced risk pesticide initiatives to fill gaps in our existing arsenal of products and develop educational programs to assist growers. We also consulted extensively on a comprehensive review of the PMRA compared to the regulatory processes of six other countries to make recommendations to the horticulture government/industry Value Chain Round Table on ways the PMRA could be more effective in increasing our competitiveness by providing better access to more registered minor use pesticides and PGRs. Several of these recommendations have already been implemented.

B) Service and Extension at Vineland:

a) from Graeme Murphy, OMAFRA

DNA Barcoding: A researcher at the University of Guelph (Prof. Paul Hebert) identified a gene that is common to all animals, but sufficiently different in each species to be used as a means of identification. Before this can be done however, a database of DNA profiles (matched with correct identification by traditional taxonomic means) has to be developed. An OMAFRA project funded by a number of industry groups (including the greenhouse industry) is involved in building a database for major Ontario agricultural pests that will speed up their identification. This has particular relevance to the greenhouse industry where exports play a vital role. The presence of common pests in product crossing the US border can lead to delays while insects are sent for identification. This concern has resulted in a second project proposal with funding from the greenhouse ornamental and vegetable industries. Dr Bob Hanner at the U. of Guelph is planning to conduct a feasibility study on the development of a prototype portable DNA sequencer that would allow on-site identification of pests, speeding up their identification and removing costly border delays.

Publication 370: The latest revision of Pub 370, *Production Recommendations for Greenhouse Floriculture*, was completed during the summer of 2006 with the new copies arriving from the printers at the end of September.

Biocontrol of Whitefly in Poinsettia: Following preliminary trials at 3 poinsettia growers in 2005, a demonstration trial with greater scope was planned for 2006. Initially, in collaboration with a major propagator of poinsettia cuttings, a biocontrol project was implemented in poinsettia stock production between Feb and June 2006. The level of control achieved was very successful and the propagator sent out letters with its shipments of cuttings advising growers of how the cuttings had been treated, with the suggestion that biocontrol in the finished crop would be easier given that the cuttings had no pesticide residues. Additionally, at a meeting of poinsettia growers in June to discuss biocontrol options, 12 growers agreed to be part of a trial to use biocontrol based on standard rates and frequencies of introduction of parasitic wasps. Of these 12, eight growers also agreed to take part in a trial to look at the use of trap plants (eggplants) as a monitoring tool, a release point for the biocontrol agents, and potentially as a banker plant to enhance the populations of biocontrol agents. The trial has been successful with 9 out of 12 growers not needing to spray at all for whitefly. Two growers are conducting clean up sprays during the first half of November, and one pulled out of the program in mid October.

Other Activities included:

- attending the Ottawa minor use meeting in March and working with the industry to develop its minor use priorities. An “A” priority at that meeting was granted for the miticide Pylon
- Ongoing advice to growers
- Consultation with industry, agribusiness and consultants on issues of importance to the greenhouse industry

b) from Wayne Brown, Greenhouse Floriculture Specialist, OMAFRA

Study of Soil Solutions from Ontario Floriculture Greenhouses Using Open, Top Irrigated Production Systems:

A two year study was undertaken to monitor nutrient trends particularly of nitrate and ammonium-nitrogen and phosphorous present in soil solution at the 30 and 90 cm depth using soil solution lysimeters. Eight greenhouse floriculture operations growing cut flower and potted plants utilising open, top watered irrigation systems were intensively monitored based on the following criteria; clay versus sand soil texture; high versus low volume irrigation systems; and high versus low nutrient-requiring crops.

The results vary with the crop being grown, irrigation technology, time of year and soil type. As well, the results reflect the diversity of non-closed loop production systems in Ontario greenhouse floriculture. Results of samples captured from tile drain outlets suggest that the tiles effectively capture excess irrigation solution and that discharge into irrigation ponds dilute the discharge from tile drains. Relative changes in nutrient concentrations were less for both cut flowers and potted crops when grown with low volume irrigation and when crops were being grown on or in clay soils. Nitrate-nitrogen concentrations were higher when crops with high fertility requirements were being grown. Phosphorous levels were generally < 0.5 ppm, the minimum detectable concentration by the analytical laboratory.

The information from this study should encourage additional applied research, assist in the development of practical nutrient management strategies and Best Management Practices for Ontario greenhouse floriculture operations. Funding for sample analysis was provided by the OMAFRA Nutrient Management Research Program and Flowers Canada Ontario.

2005 Poinsettia Cultivar Trial Evaluation: In 2005, 109 poinsettia cultivars were grown in the Dep’t of Plant Agriculture Greenhouse Complex at Vineland. Last year was the first year that both Dummen USA and Selecta First Class participated in a significant way, with each company contributing two dozen cultivars each with most of them unknown to most Ontario growers. In 2005, we experienced difficulty getting the Ecke cuttings cleared through customs resulting in less than desirable rooted cuttings. A grower Open House was held on December 2nd with 80-90 growers and industry representatives in attendance. The trial provides an opportunity to observe and compare all the varieties (new and old alike) grown under the same environmental conditions and in a semi-commercial scale. As a result of the trials last year, many of the cultivars from Dummen and Selecta First Class are being tested by growers. A few of the key cultivars or series now being tested by growers this year include “the Enduring Series” from Ecke, “the Premium Series” from Dummen, Olympus and Red Dragon from Fischer, “the Christmas Time Series” and White Christmas Evol from Selecta First Class.

Special thanks to Sungro Horticulture for providing the growing media and JVK for providing the 15 cm pots.

Influence of Temperature and Shade on Bud Abortion Prior to Visible Bud:

Growers often feel compelled during the first three weeks of January to maintain warm greenhouse temperatures to insure that the lily crop remains on schedule. However, the plants begin flower initiation shortly after emergence in early January when light levels are extremely low. A group of lilies were given 3 weeks of 24 C from January 9 – 30 and were compared with those grown at 17 C during the same time period. Plants grown at 24 C during January initiated a similar number of buds to the 17C grown lilies but had an average of 2.1 buds aborted compared with 0 aborted with the control plants.

OMAFRA Publication 370: Production Recommendations for Greenhouse Floriculture was revised during the spring of 2006 and was available for the 2006 Canadian Greenhouse Conference

2006 Canadian Greenhouse Conference: The 28th Annual conference was held October 3,4,5 of October. The flower bus tour in Niagara was quite well received because it focussed solely on retail oriented operations. The speaker programmes particularly the energy, marketing and perennial sessions were very well attended

2006 IPM Workshop: In January, Graeme Murphy and I held our annual daylong workshop with approximately 25 in attendance.
Greenhouse Grower Night School – Fall 2006 .Organised by Theo Blom, Albert Grim and myself and sponsored by Flowers Canada Ontario, 18 persons are participating in night school titled Math 101 for Greenhouse Growers.

Energy Issues: Co-operated with Ron McDonald of AgViro in selecting Niagara greenhouses as suitable locations for energy audits.
Assisted Shalin Khosla in organising bio-energy workshop for the Niagara region.

C) Research:

a) OMAFRA CHANGES: The following information was provided by Stuart Budd and Annette Anderson OMAFRA :

1. OMAFRA – University of Guelph Agreement Research Programs

The current five year agreement (2002-2007) was extended for one year and will end on March 31, 2008. The five research programs under the OMAFRA-University Agreement are: Food, Environment, Sustainable Rural Communities, Bioproducts, Sustainable Production Systems.

Research projects under the former Plant Program concluded on April 1, 2006. Production related research continues under the Sustainable Production Systems Program however there are also opportunities for plant related research in other programs such as Bioproducts, Food and Environment.

The new **Sustainable Production Systems Program** is based on priorities and criteria provided by OMAFRA and established through input from OASCC and the Agricultural Research Institute of Ontario (ARIO). Proposals are invited that demonstrate an *integrated and interdisciplinary approach to significant industry issues, provide a beneficial impact for the Ontario agri-food sector, contain a clear communication and tech transfer strategy and show leverage of cash and in-kind contributions from other partners.*

An initial Call for Proposals was issued last fall and “one” new projects began in April 2006 pertaining to greenhouse issues.

A second Call for Proposals was issued this fall and initial submissions (Letters of Intent) are currently being reviewed by the University.

No further Calls for Proposals are anticipated for next year so there was no need for further input on research priorities this year. As directed by OHCRSC chair, Annette Anderson, the subcommittee focussed on industry and service priorities this year.

2. OMAFRA Competitive Research Programs was discussed and it was noted that the Announcement of future Calls for Proposals will be posted on the Ministry website and promoted broadly to Canadian research institutions.

3. Transfer of Research Stations and Colleges to ARIO

The Ontario government agreed to transfer ownership of 14 Research Stations and 3 agricultural colleges from the Ontario Realty Corporation to the Agricultural Research Institute of Ontario (ARIO). Legal transfer of the properties is nearing completion. The University of Guelph is now managing the properties for ARIO.

b) AGRICULTURE AND AGRI-FOOD CANADA from Les Shipp For Floriculture Subcommittee (OHCRSC)

Researcher Names: Les Shipp, Rosemarije Buitenhuis (NSERC Postdoctoral Fellow), Graeme Murphy and Bruce Broadbent

Project Title: Use of trap plants as a risk reduction control option for thrips on ornamentals

Project Objectives:

- Conduct multiple choice cage trials to determine the attractiveness of different plant species as a trap plant for western flower thrips (WFT).
- Evaluation the effectiveness of trap plants treated with and without a pesticide for WFT
- Evaluate the effectiveness of trap plants under commercial potted chrysanthemum production conditions.
- Conduct a survey with potted flower growers to determine pesticide and biological control usage.
- Determination the optimal trap plant placement in a crop – Perimeter vs Intercropping

Major Accomplishments:

- 1) Multiple choice trials were conducted to determine the attractiveness of different plant species (eggplant, flowering chrysanthemum and flowering gerbera) as a trap plant species for WFT. Flowering chrysanthemums collected the greatest number of WFT, both for feeding and oviposition. One reason for this preference is the large number of flowers on the plant.
- 2) The effectiveness of flowering chrysanthemum trap plants treated with and without Spinosad for WFT control was tested at different spatial scales and for different time periods at GPCRC:
 - In the small cage 1-week study, where the trap plant was directly adjacent to only four crop plants, the trap plant attracted the adult WFT away from the crop. The presence of a trap plant also decreased oviposition on the crop
 - On a larger scale, in the 4-week big cage experiment under high thrips pressure (500/week), significant differences in number of adult WFT between the control and the trap plant treatments generally started to occur after 3 weeks. The number of WFT larvae on the crop did not seem to be influenced by the trap plants in these trials.
 - The addition of Spinosad to the trap plants was expected to improve the efficacy of trap plants. However, no significant differences were found between treatments with treated and untreated trap plants with the number of WFT on the crop. Removing the trap plants from the greenhouse after one week was equally effective as treating the trap plants with Spinosad.
- 3) A commercial trial was conducted at a potted chrysanthemum greenhouse in the Niagara area. The trial was only conducted for 4 weeks due to a thrips outbreak in the crop. Results from this trial showed similar findings to the 4-week big cage experiment in Harrow.
- 4) A survey was initiated with potted ornamental growers (chrysanthemum, poinsettia and cyclamen) to determine their pesticide and biological control usage throughout the year. The results of the survey are presently being compiled.
- 5) Greenhouse trials are being conducted at GPCRC to determine the optimal trap plant placement in a crop (perimeter vs intercropping). The crop is the vegetative stage of potted chrysanthemum. Flowering chrysanthemum plants (var. Chesapeake) are used as the trap plants. The trials are conducted for 4 weeks to compare the results with previous cage trials.

c) UNIVERSITY OF GUELPH:

i) Summary of Floriculture Research, By Youbin Zheng and Mike Dixon

1. Improving Productivity and Pathogen Resistance of Ornamental Crops by Nutrient Solution

Oxygenation—Mike Dixon, Youbin Zheng, Linping Wang & Sally Taylor (Funded by CORD through FCO, Also funded by Ontario Centres of Excellence, OMAFRA)

To investigating the potential positive and negative effects of nutrient solution or plant root zone oxygen supersaturation on crop growth, production and health, several experiments were conducted in the past year.

Experiment 1

Miniature roses were grown in solution culture with different dissolved oxygen (DO) concentrations (8, 20, 30 and 40 ppm). Results showed that that DO ranging from 9 to 40 mg·L⁻¹ did not have any effect on leaf photosynthetic rate, stomatal conductance, and chlorophyll content or chlorophyll fluorescence parameters. However, the respiration rate of roots increased linearly with the increase of DO levels in the nutrient solutions. In terms of plant growth, there were no differences between treatment 20 ppm and the control (9 ppm) in any of the measured parameters. When DO increased to 30 mg·L⁻¹, the total fresh weight, root dry and fresh weights, number of branches were significantly decreased compared to the control. When DO increased to 40 mg·L⁻¹ all the measured growth parameters significantly decreased compared to the control. When inoculated with *Pythium*, it showed that roots in the control and 40 ppm DO solutions were more susceptible to *Pythium* infection.

Experiment 2

Potted miniature roses (grown in Promix) were subirrigated with different nutrient solution with different DO concentrations (8, 20, 30 and 40 ppm). The responses of plant physiology and growth to root zone oxygenation were measured. Responses of roots under different DO treatments to *Pythium* infection also investigated. Data are under processing.

Experiment 3

Two varieties of cut rose have been grown in pots and watered with nutrient solution with different DO concentrations (8, 20, 30 and 40 ppm) for more than a year. Cut rose production data are under processing and will be reported to our funding organisation and growers in the near future.

2. Using aqueous ozone in diseases control – Mike Dixon, Tom Graham, Ping Zhang and Youbin Zheng (Funded by Ontario Centres of Excellence, OMAFRA, FCO and PRTI)

The ozonation research is progressing well, with several commercial trials underway. We started a trial at a Rieger Begonia production facility earlier this year. The early system development taught us a lot about system requirements and the challenges that are associated with a production system. As a result of the initial work, the grower has decided to revamp his fertigation system, thereby allowing for a more integrated ozone system to be installed. The grower expects to resume production in early 2007, at which time we will resume the trial.

The research group has also initiated a commercial trial at a Niagara region cut rose facility. This trial will see ozone applications applied throughout the production facility to not only control pathogens in the irrigation water, but to improve post harvest shelf life as well. To date, we have completed an engineering and pathogen survey of the facility and are in the process of designing the various systems that will be installed.

We are investigating the efficacy and developing the protocols in applying aqueous ozone in controlling leaf diseases (e.g. powdery mildew) and root diseases (*Pythium*) for greenhouse production of ornamental crops (e.g. miniature roses, African violets), and in sterilizing plant tissues in commercial tissue culture process.

3. Ion Specific Nutrient Management —Mike Dixon, Tom Graham, Jamie Lawson, Glenn Roberts & Youbin Zheng (Funded by CORD through FCO, Also funded by Ontario Centres of Excellence, OMAFRA)

There have been several delays on this project, due in part to a change in management at PRIVA, our industrial partner. This aside, the growth system is in place and we are proceeding with the development of the new ion specific control method.

Currently, we are focusing on integrating the 'in-line' HPLC platform that has replaced the ion specific electrodes in this project. Furthermore, we are refining our control algorithms to take advantage of the higher precision of the HPLC system.

Note: It was found that the ion specific sensors (Ion Selective Field Effect Transistors) that had been under development by PRIVA were not robust enough to be used in a solution as chemically complex as a hydroponic nutrient solution.

4. The Application of Ozonation and Chlorination Technologies for Control of *Pythium* and *Phytophthora* in Greenhouse and Nursery Irrigation Systems —Mike Dixon, Youbin Zheng, Calvin Chong, Jen Llewellyn, Tom Graham, Diane Cayanan, Ping Zhang & Weizhong Liu (Funded by CORD through FCO and Landscape Ontario)

The objective of this project is to develop protocols for using aqueous ozone and chlorine to control common diseases (e.g. *Phytophthora infestans*, *Phytophthora cactorum*, *Pythium aphanidermatum*, *Fusarium oxysporum*, *Rhizoctonia solani*) in Ontario greenhouse and nursery productions. Currently, we are investigating the critical concentration and contact time for using ozone and chlorine in controlling the aforementioned five diseases in the laboratory conditions. Concurrently, we are also investigating the thresholds of ozone and chlorine on five ornamental crops *Spiraea japonica* "goldmound", *Hydrangea paniculata grandiflora*, *Physocarpus opulus* "Summer Wine", *Weigela florida* "Alexandra", *Salix integra* "Hakura Nishiki". Armed with the above information, commercial trials will be conducted in commercial greenhouses and nurseries in the coming year.

ii) Ornamental Breeding Project - Progress Report Nov. 2006 from Al Sullivan and Praveen Saxena - Plant Agriculture

The objective of the breeding program is to develop new cultivars for the greenhouse and landscape industries. Native and indigenous Canadian species are the primary subjects of the research and new species are constantly being evaluated as potential candidates for research. The candidate species are being screened for their ability to grow in low input environments characterized by low water, nutrients and light. Promising candidates are entered into the breeding program and the most appropriate breeding scheme is determined. A large experiment is underway to evaluate *Aquilegia* species for adaptability to low input environments. The *Aquilegia* genotypes are from both native and non-native species. Twenty-one genotypes are being compared under three watering regimes (ie high, moderate and drought levels) in the greenhouse. The evaluation of vegetative growth has been completed and several genotypes have shown good levels of drought tolerance. The evaluation of flowering characteristics will begin after the plants have received a cold treatment. Some of the species that are included in the breeding program are *Liatis* sp, *Malva* sp, *Aster* sp, *Echinacea* sp and *Heliopsis* sp. *Echinacea* sp are being evaluated for both ornamental and nutraceutical qualities (below). Research on tissue culture techniques for the selection of elite

individuals, multiplication, and greenhouse transplant for overall assessment will begin with *Trillium sp* as a model and progress to other important species.

iii) From Praven Saxana (PAg): Progress Report on Echinacea (November, 2006)

Overall Objective: The ultimate objective of the Echinacea project is the creation of unique genetic lines of medicinal and ornamental value and an entirely new controlled environment production prototype. Environmental and nutritional factors will also be manipulated for optimized biomass and chemical production from selected, elite germplasm lines. The project represents the first model system for living crop plants as a ‘factory’ for production of specific chemicals. In this context, yield is defined as chemical harvest rather than strictly biomass accumulation.

1. Selection of Echinacea lines as new phyto-medicinal crops

- The production of new varieties and higher quality products from Echinacea spp. requires a greater understanding of the regulation of plant growth and the production of specific phytometabolites. The objectives of this study was to compare the responses of seed explants from different individual seedlings in different culture systems, to regenerate clonally propagated germplasm lines derived from the individual seeds and to compare the chemodiversity of the regenerated plants under standardized conditions.
- A method has been developed to screen genetic diversity of plants from different seed populations collected from several North American sources based on regeneration efficiency and chemical profile. Clonal propagation of seedling-derived regenerants and screening for antioxidant potential and concentrations of metabolites such as caftaric acid, chlorogenic acid, cichoric acid, cynarin, and echinacoside has identified 58 unique germplasm lines. These lines are being further evaluated to select breeding stock of elite, highly regenerative, chemically superior, clonally propagated varieties.

2. Assessment of the potential of greenhouse production of Echinacea species.

The methods have developed and are being evaluated to assess the role of $\text{NO}_3^-:\text{NH}_4^+$ ratio on biomass and phytochemical production of *Echinacea purpurea* and *E. angustifolia* in the greenhouse

From Theo Blom, PAg/ UoG. 2006-7 (converted from Adobe /BG)

NAME	Prof	Tech	PROJECT TITLE
Blom, T.	.10	.10	NUTRITION - P-nutrition for potted chrysanthemums (Grodzinski et al.)
Blom, T.	.20	.10	HEIGHT CONTROL - The effect of high night and day temperature, photoperiod and the use of PGR's on flowering of chrysanthemums. - End-of-Night light quality on height of potted mums (J. Bjerregaard, PhD, Denmark) and poinsettias. - Aeration systems on stem length of hydroponic tulips. - Sumagic bulb dip on Easter lily (W.Brown, OMAFRA).
Blom, T.	.10	.10	PHYSIOLOGY - The effect of watering regime on root morphology of bedding plant plugs (Dr. Nabil Albatal, Syria). -The effect of light pulsing on plant growth-year 2 (Youbin Zheng, UoG).

Blom, T.	.20	.20	CONTRACT PROJECTS
			- IBA and light quality on rooting of chrysanthemums (Hussain Ahmad, MSc, UoG).
			- BTM on biomass and root development.
			- Quantification of <i>Erwinia carotovora</i> in nutrient solution (M.Bassoriello, Msc student; J.C.Hall co-supervisor).
			- Effect of PGR's and supplemental lighting on potted carnations.
			-PHCA on efficiency of nutrient uptake
Total:	0.60	0.5	

¹ Note: Technical person is David Kerec. His technical support has been reduced from 1.0 to 0.5

An Overview of the new project funded under the Sustainable Plants Program of OMAFRA in 2006 from Bernie Grodzinski (UoG, PAG and EVB)

As indicated above regarding the changes in the OMAFRA/UoG contract "An initial Call for Proposals was issued last fall and new projects began in April 2006." To my knowledge within the "Sustainable Production Systems Program" our project relating to greenhouse research was the only one submitted to and funded by OMAFRA. My project is entitled "Energy efficient cycling of C and N for year-round production of high-value fresh produce and nutraceuticals in controlled-environment-systems (CES)". As the Principle Investigator I am responsible for this project which is now in its first year. Briefly: Our new OMAFRA project reflects cross-commodity issues dealing with the greenhouse research in an integrated manner. The technical support from the Department of Plant Agriculture accounts for 3.65 technical FTEs (i.e., Nana .95, D.Kerec .50, VanderKooi .05, G.Hoover .65, Alm .55, BNichols .45 and R Tschanz .50). That from Environmental Biology accounts for 1.4 technical FTEs (JLawson 0.9 and CSopher 0.4)].

My researcher team is unique consisting of a core of 18 OAC faculty, (12 PAG and 6 EVB). In addition 4 researchers from AG Can/OMAFRA and UWO are part of the team. The level of NSERC and peer reviewed funding (over \$1.4m/y) as well as the level of funding from major industry especially those associated with ornamentals and greenhouse vegetables (over \$ 600K/y) reflect the ability of the team to compete for matching funding from several sources.

For brevity it suffice here to outline that currently the major ornamental greenhouse industries through Flowers Canada Ontario supports **Blom** (floriculture- greenhouse systems), **Dixon** (CES, hydroponics sensor technology), **Grodzinski*** (CES, gas exchange, biochemistry, pathology, remote sensing), **Hall*** (chemistry, allelochemicals), **Paliyath** (post-harvest), **Sullivan** (breeding/ native species), **Sutton*** (pathology/hydroponic recycling), and **Zheng** (physiology/ sensor technology). These scientists are collaborating currently on several projects that will be reported on at the annual meeting of FCO in January 2007. The OGVG supports collaborative projects of **Micallef*** (vegetable genetics and physiology, greenhouse vegetables, CES) **Grodzinski***, **Sutton*** (Fusarium), **Papadopolous** (greenhouse vegetables/hydroponics) and **Koshla** (OMAFRA extension specialist). **Powell** (food safety and government policy) has received support from this group as well. The vegetable growers have provided support to **MacDonald** (vegetable production), **Doran** (nutraceuticals, biochemistry and physiology) and Grodzinski for work on Alliums. Doran is the new Walmsley Fellow of the OCE. The nursery industries support studies of **Chong** (nursery and landscape) and **Hsiang** (pathology/crop plants). **Saxena*** is currently working on ornamentals and phytomedicinals with **Dixon**, **Zheng** and will be collaborating further with **Sullivan** and **Grodzinski**. **Rinker**'s studies with mushroom CES will be linked to the studies of the **Dixon**'s group relating to off-gassing from animal farm operations. Collaborators such as **Goodwin*** (pathology), **Shelp*** (biochemistry), **Rothstein*** (molecular genetics) **Hüner*** (Western) and **Toivenon** (AAFC /post-harvest) all have strong basic programs and have important roles in integrating their area of expertise. There is already a considerable exchange of

students among departments and institutions. In addition to the new operating funds I have been able to compete for new equipment and infrastructure. This does not come from OMAFRA funds.

New Infrastructure grants reported by B Grodzinski. My group is part of a network that is building new laboratory and CES infrastructure at the main campus at Guelph and Western (including greenhouses, growth chambers, CESRF/Biotron (\$9 M), new Biotron facility, \$28.6 M). Our new analytical systems at Guelph will allow fine control at low temperatures, high light and elevated CO₂ levels. The whole-plant- and canopy-gas-exchange equipment are unique allowing detailed photoperiod investigations and estimates of best energy balance required for optimising crop growth. We are also developing and testing new remote imaging equipment to monitor plant development and facilitate early detection of stress such as that induced by diseases in crops.

INDUSTRY AND SERVICES ISSUES/RECOMMENDATIONS

As indicated above the industry had two very difficult years in a row. Nevertheless, it remains strong. Research priorities are basically the same as in the 2005 report.

Because of the changes in OMAFRA funding structure in 2005-6 the emphasis in 2006 for the subcommittee was to highlighted issues and recommendations reflecting the industry status and service priorities. As specific “research” recommendations were *not* to be submitted to OMAFRA this year, three recommendations emerged from the Nov 7th meeting of this subcommittee.

1. The industry through FCO and TOGA needs to continue to promote floriculture within the domestic market and improve the lines of communication within the industry and various levels of government and emphasizing the value to Ontario economy.
2. OMAFRA, AAFC and FCO need to continue efforts to harmonize minor use registration programs and integrate the services of laboratory diagnostic groups in Guelph for assessing diseases and pests of greenhouse ornamentals that also impact issues such as cross-border trade,
3. Educational programs both in the form of special short-term grower courses and continuing education at the college level need to be encouraged.

Issue #1: Promotion, Marketing and Advancing the Floriculture Industry in Ontario

The Issue

Although the greenhouse ornamentals industry experienced dramatic expansion in last 15 years largely due to export to the USA, this trend has stopped. Current pressures on export to the US include higher \$CD, quarantine issues, and border delays due to increased security. There is an urgent need to expand domestic markets, so that the industry has a buffer to protect itself against fluctuations in the foreign market and pressures from imports.

Current Market Research/Extension Activities

Flower growers and handlers remain fiercely independent entrepreneurs and are beginning through the efforts of FCO and other groups such as TOGA to work collaboratively to promote the greenhouse industries. The industry is examining voluntary check off systems to enhance funding opportunities for researchers and consulting groups. There remains a need for trained economists to work with all sectors of the government, university and industry to develop business strategies. The trend in this industry and the need for self promotion and closer ties with all levels of government are currently priorities with FCO. New staff has been hired.

Gaps/Barriers/Deficiencies

One of the greatest strengths of the floriculture industry is that there are a wide range of growers and retailers of a wide variety of crops. Many growers remain independent and in spite of efforts to pull in the same direction the process has been slow. Something fairly simple that works among the vegetable greenhouse growers is a check off system to generate working capital to invest in market research and research in horticultural and greenhouse sciences. To date the floriculture industry has not adopted such a system of generating adequate working revenue. It seems unlikely that royalties from new inventions (cultivars lines) will come on stream fast enough to make the industry self-sufficient and confident. The industry needs to continue to work with both the province and Ottawa to develop marketing strategies for its diverse membership. The industry (FCO) has recently hired new staff and

consultants, and is developing better economic information on its various sectors (i.e. bedding plants, potted plants and cut flowers). A thorough economic analysis of the industry by sector is providing the foundation upon which future domestic and export marketing and promotional strategies can be based by all.

Recommendation:

Flowers Canada (Ontario) continue with its comprehensive review of its communication needs to determine if they can be met by existing systems and experts, or whether they need to develop a new communication package and network tailored to the specific needs of the ornamental industry of Ontario. Efforts should include OMAFRA staff.

Target Agencies:

Flowers Canada (Ontario), Flowers Canada Growers, OMAFRA.

Issue #2: Harmonize minor use registration programs and integrate diagnostic services for rapidly assessing diseases and pests of greenhouse ornamentals

The Issue

Pest and disease control is an ongoing concern and an immediate production issue. The year-round nature of the industry in an environment highly conducive to the development of pests and diseases, means that pest management is always a priority. Pests of ongoing concern to the industry include: Thrips, Whiteflies, Leaf Miner, Mites and Mealy bugs etc. Diseases are similarly important and their spread is frequently linked to the pest that might transfer them. In addition new irrigation technologies have been rapidly adopted by the industry over the last ten years. As a result, there have been increasing concerns over a number of pathogens including *Pythium*, *Phytophthora*, *Rhizoctonia*, *Fusarium* and *Erwinia*. Foliar diseases such Botrytis and powdery mildew are both aerial pathogens that can cause serious damage and losses in a number of different ornamental crops. Powdery mildew in particular is widespread and found on many different crops. In the last 5-10 years, there have been a number of crops in which powdery mildew has been diagnosed for the first time. A lack of effective fungicides has made growers' battles with this disease difficult. Downy mildew is another foliar disease becoming more prevalent. To compound the difficulties with this disease, there are no registered fungicides for its control. From a more crop-specific perspective, bacterial diseases of geranium are causing widespread losses to the industry, not only through direct damage, but also through quarantine action. There are no effective pesticides for control of many of the bacterial diseases that are occurring.

The industry is currently increasing the use of biocontrol systems to control insects and diseases. Many growers are using biological control successfully and many others have tried it without success. A major reason for failure is the lack of biocontrol friendly pesticides, many of which are already registered in the US. Additionally, biological control agents for diseases are treated as pesticides by PMRA, and suffer from the same bottleneck in registration.

Gaps/Barriers/Deficiencies

Continued support of research and extension activities that focus on the management of pests and diseases is required to maintain the competitiveness of the industry in the global marketplace. Specifically, work is needed on the control of thrips and fungus gnats to continue the work carried out at AAFC Vineland in recent years. Disease management research into the epidemiology and control of major pathogens is also needed as a result of the increased use of new irrigation technologies. The work at Vineland, Harrow and Guelph should be continued into these aspects of disease management. New pesticides compatible with biocontrol are desperately needed if the use of natural enemies in floriculture is to reach its potential. The registration of microbial fungicides for biocontrol of diseases is also an important issue for the industry.

There is an immediate need for pathology expertise in greenhouse ornamentals. The greenhouse ornamental industry is the largest horticultural sector by farm gate sales in Ontario and Canada with 2005 sales of \$766 million and almost \$1.42 billion respectively. As an industry of great economic importance provincially and nationally, it is

important that governments and universities support it with appropriate research. From a pathology point of view in particular, there is an immediate concern. A major priority for the industry in recent years has been the responsible use of irrigation water through the use of recycling technologies. Recycling of nutrient solution increases problems of root diseases spread. The retirement of our resident pathologist Dr. John Sutton jeopardises continuity of research on ornamentals after 2004. Disease management issues can become a barrier to even wider adoption of recirculating technology. If the industry is to fulfil its environmental obligations under new nutrient management legislation, it is important that associated disease issues be resolved by more team activities.

Recommendation:

FCO and the diagnostic services of OMAFRA at Guelph can in the short term help by integrating more closely the ongoing activities of extension experts and researchers to conduct and improve efficacy studies for utilizing new micro-array analyses and bar coding procedures. In addition efforts should be made by researchers and extension experts to work more closely with the new diagnostic facilities to help identify the most effective research to obtaining more data that will assist in registration programs and alleviation of cross border identification problems.

Target Agencies

Flowers Canada (Ontario), Flowers Canada Growers, OMAFRA diagnostics service, University of Guelph (EVB).

Issue #3: Training of a skilled labour force for the industry

The Issue

The greenhouse floriculture industry is the third largest agricultural industry sector in the province. Dairy and hogs are the only sectors with a larger farmgate. There are many excellent career opportunities for skilled work force. Individuals with training in basic computer science who also have horticultural training, specifically in greenhouse crop production are rare. Employees currently working in the industry need the opportunity to upgrade their knowledge and skills.

Current Activities

The Ontario Greenhouse Alliance (TOGA) HR committee has been working with Flowers Canada (Ontario) Inc. and the Ontario Ministry of Training, Colleges and Universities (MTCU) to address this need for the industry. TOGA undertook a HR survey to identify needs. MTCU has committed to instituting an apprenticeship program for the greenhouse industry, but as yet efforts have not been finalised.

Gaps/Barriers/Deficiencies

There is a shortage of skilled labour trained in Canada in this industry. Educational programs designed for greenhouse production are needed to provide new graduates with the necessary skills for a career in greenhouse floriculture. Additionally, a campaign at schools is needed in order inform young people of the opportunities that exist in the industry. For growers and employees already in this industry, more continuing education opportunities are required.

Workshops and night courses put on by OMAFRA and the University of Guelph are very well received. The Ontario Greenhouse Alliance (TOGA) HR committee need to work more vigorously with Flowers Canada (Ontario) Inc. and the Ontario Ministry of Training, Colleges and Universities (MTCU) to address the need for this industry and the greenhouse vegetable industry.

Recommendation: The committee supports the initiative of TOGA and Flowers Canada (Ontario) in establishing its education program and recommends it continue to work with educational institutions in achieving its objectives. It is also important that these industries address the need for continuing education as part of their mandate.

Target Agencies

Flowers Canada (Ontario), TOGA and University of Guelph

Issue #2: Harmonize minor use registration programs and integrate diagnostic services for rapidly assessing diseases and pests of greenhouse ornamentals

The Issue

Pest and disease control is an ongoing concern and an immediate production issue. The year-round nature of the industry in an environment highly conducive to the development of pests and diseases, means that pest management is always a priority. Pests of ongoing concern to the industry include: Thrips, Whiteflies, Leaf Miner, Mites and Mealy bugs etc. Diseases are similarly important and their spread is frequently linked to the pest that might transfer them. In addition new irrigation technologies have been rapidly adopted by the industry over the last ten years. As a result, there have been increasing concerns over a number of pathogens including *Pythium*, *Phytophthora*, *Rhizoctonia*, *Fusarium* and *Erwinia*. Foliar diseases such Botrytis and powdery mildew are both aerial pathogens that can cause serious damage and losses in a number of different ornamental crops. Powdery mildew in particular is widespread and found on many different crops. In the last 5-10 years, there have been a number of crops in which powdery mildew has been diagnosed for the first time. A lack of effective fungicides has made growers' battles with this disease difficult. Downy mildew is another foliar disease becoming more prevalent. To compound the difficulties with this disease, there are no registered fungicides for its control. From a more crop-specific perspective, bacterial diseases of geranium are causing widespread losses to the industry, not only through direct damage, but also through quarantine action. There are no effective pesticides for control of many of the bacterial diseases that are occurring.

The industry is currently increasing the use of biocontrol systems to control insects and diseases. Many growers are using biological control successfully and many others have tried it without success. A major reason for failure is the lack of biocontrol friendly pesticides, many of which are already registered in the US. Additionally, biological control agents for diseases are treated as pesticides by PMRA, and suffer from the same bottleneck in registration.

Gaps/Barriers/Deficiencies

Continued support of research and extension activities that focus on the management of pests and diseases is required to maintain the competitiveness of the industry in the global marketplace. Specifically, work is needed on the control of thrips and fungus gnats to continue the work carried out at AAFC Vineland in recent years. Disease management research into the epidemiology and control of major pathogens is also needed as a result of the increased use of new irrigation technologies. The work at Vineland, Harrow and Guelph should be continued into these aspects of disease management. New pesticides compatible with biocontrol are desperately needed if the use of natural enemies in floriculture is to reach its potential. The registration of microbial fungicides for biocontrol of diseases is also an important issue for the industry.

There is an immediate need for pathology expertise in greenhouse ornamentals. The greenhouse ornamental industry is the largest horticultural sector by farm gate sales in Ontario and Canada with 2005 sales of \$766 million and almost \$1.42 billion respectively. As an industry of great economic importance provincially and nationally, it is important that governments and universities support it with appropriate research. From a pathology point of view in particular, there is an immediate concern. A major priority for the industry in recent years has been the responsible use of irrigation water through the use of recycling technologies. Recycling of nutrient solution increases problems of root diseases spread. The retirement of our resident pathologist Dr. John Sutton jeopardises continuity of research on ornamentals after 2004. Disease management issues can become a barrier to even wider adoption of recirculating technology. If the industry is to fulfil its environmental obligations under new nutrient management legislation, it is important that associated disease issues be resolved by more team activities.

Recommendation:

FCO and the diagnostic services of OMAFRA at Guelph can in the short term help by integrating more closely the ongoing activities of extension experts and researchers to conduct and improve efficacy studies for utilizing new micro-array analyses and bar coding procedures. In addition efforts should be made by researchers and extension experts to work more closely with the new diagnostic facilities to help identify the most effective research to obtaining more data that will assist in registration programs and alleviation of cross border identification problems.

Target Agencies

Flowers Canada (Ontario), Flowers Canada Growers, OMAFRA diagnostics service, University of Guelph (EVB).

Issue #3: Training of a skilled labour force for the industry

The Issue

The greenhouse floriculture industry is the third largest agricultural industry sector in the province. Dairy and hogs are the only sectors with a larger farmgate. There are many excellent career opportunities for skilled work force. Individuals with training in basic computer science who also have horticultural training, specifically in greenhouse crop production are rare. Employees currently working in the industry need the opportunity to upgrade their knowledge and skills.

Current Activities

The Ontario Greenhouse Alliance (TOGA) HR committee has been working with Flowers Canada (Ontario) Inc. and the Ontario Ministry of Training, Colleges and Universities (MTCU) to address this need for the industry. TOGA undertook a HR survey to identify needs. MTCU has committed to instituting an apprenticeship program for the greenhouse industry, but as yet efforts have not been finalised.

Gaps/Barriers/Deficiencies

There is a shortage of skilled labour trained in Canada in this industry. Educational programs designed for greenhouse production are needed to provide new graduates with the necessary skills for a career in greenhouse floriculture. Additionally, a campaign at schools is needed in order inform young people of the opportunities that exist in the industry. For growers and employees already in this industry, more continuing education opportunities are required.

Workshops and night courses put on by OMAFRA and the University of Guelph are very well received. The Ontario Greenhouse Alliance (TOGA) HR committee need to work more vigorously with Flowers Canada (Ontario) Inc. and the Ontario Ministry of Training, Colleges and Universities (MTCU) to address the need for this industry and the greenhouse vegetable industry.

Recommendation: The committee supports the initiative of TOGA and Flowers Canada (Ontario) in establishing its education program and recommends it continue to work with educational institutions in achieving its objectives. It is also important that these industries address the need for continuing education as part of their mandate.

Target Agencies

Flowers Canada (Ontario), TOGA and University of Guelph

GREENHOUSE AND PROTECTED CROPS

EXECUTIVE SUMMARY

The Ontario greenhouse vegetable acreage in 2005 was about 591 ha, with an estimated farm gate value of 515 million dollars. During 2006, high energy costs and lower than average commodity prices at times, particularly for tomatoes, were sources of concern as well. Generally low light levels and wet weather conditions outdoors contributed to reduced yields. Growers have continued to experiment with new cultivars and adopt new cultural techniques in efforts to maximize yields and income. There is also a move towards the culture of novelty cultivars of the traditionally grown crops, more interest in new crops, such as eggplant, and in organic production. The industry is also particularly concerned about the potential for new invasive species of arthropods and plant pathogens via imported product, and the general lack of resources for addressing plant pathology issues in the greenhouse vegetable sector.

INTRODUCTION

This is the Annual Report of the Greenhouse and Protected Crops Sub-Committee within the Ontario Horticultural Crops Research and Services Committee.

COMMITTEE ACTIVITIES

The Greenhouse and Protected Crops Sub-Committee of the OHCRSC (without the Working Group on Mushrooms) met on October 12, 2006, (9:30 a.m. - 3:30 p.m.) at Wilson Hall, Ridgetown College, Ridgetown for their Annual Meeting.

Present: G. Ferguson (OMAFRA)(Chairperson), Shalin Khosla (OMAFRA)(Vice-Chairperson), Mirjam Hall, OMAFRA)(acting Secretary)

Government & Research: Annette Anderson, Denise Beaton, Brian Hamilton, Ray Cerkaskas, Jim Chaput, Xiuming Hao, Barry Micallef, Tom Papadopoulos, Les Shipp, Peter Toivenen.

Grower Representatives: Kristen Callow, James Cornies, Tom Ferencevic, Peter Haakman, Craig Hunter, Margaret Ingratta, Gerry Mastronardi, Tony Mastronardi, Tamara Stokes, Dean Tiessen, Jan Vanderhout, Ron Voorberg.

Industry Representatives: Kelly Devaeres, Richard Groen, Jennifer Hale, Sebastien Jacob, Scott MacDonald, Bill Straver.

SIGNIFICANT RESEARCH/SERVICE ACCOMPLISHMENTS

A. GREENHOUSE VEGETABLES

- **Emergency registration of Pristine** for control of powdery mildew on greenhouse cucumber -March 15, 2006 - December 31, 2006
- **Emergency registration of Previcur** for control of Pythium root rot on greenhouse pepper in Ontario, BC and Alberta - from August 15, 2006 - July 31, 2007
- **Emergency registration of Tanos** (from Aug. 30, 2006 - Aug. 31, 2007) **and Manzate Pro-Stick** (Sept. 15, 2006 - Aug. 31, 2007) on greenhouse cucumber for downy mildew

Full registration of Floramite on greenhouse tomato, cucumber and pepper was granted in April, 2006.

- **Biological control of whiteflies** – Researchers at Greenhouse & Processing Crops Research Centre, Harrow, determined that the whitefly parasitoid, *Eretmocerus eremicus*, is a superior biological control agent compared to the industry standard, *Encarsia formosa*, during the fall and winter months. Results from greenhouse trials conducted in summer and winter showed that *E. eremicus* is the recommended whitefly biological control agent on a year round basis.

- **Use of Botanigard** - Researchers at Greenhouse & Processing Crops Research Centre, Harrow, determined that 6.24×10^{10} conidia of *Beauveria bassiana* per gram of formulated product (Botanigard 22WP) is the optimal concentration for bumblebee vectored inoculum for maximum pest control and minimal negative impact on the bee vector for greenhouse tomato and sweet pepper.

REPORT OF ACTIONS TAKEN ON 2005'S RECOMMENDATIONS

RECOMMENDATION #1: It is recommended that appropriate CFIA personnel be invited to the next annual Protected Crops Sub-committee meeting to address the issue of new invasive species in greenhouse vegetables.

ACTION TAKEN: An Invitation was extended to Charles Briscoe, Horticulture Specialist, CFIA, to attend the Greenhouse & Protected Crops Subcommittee meeting on October 12, 2006.

RESPONSE: Meeting was attended by CFIA Horticulture Specialist, Brian Hamilton

RECOMMENDATION #2:

We appreciate the steps that the Pest Management Regulatory Agency has taken to improve their responses to Minor Use registration requests. We ask that they continue this improvement, and in particular, provide incentives that would bring more new active ingredients into Canada for registration

ACTION TAKEN: Note of appreciation forwarded to Pest Management parent committee.

RECOMMENDATION #3: Given that 60% of the Canada's greenhouse vegetable industry is in Ontario, and given that 90% of Ontario's greenhouse vegetable industry is situated in Essex County where the Greenhouse and Processing Crops Research Centre is also situated, it is highly recommended that resources in greenhouse vegetable pathology at this Centre be at least increased to its former level of 1.50 person years to assist the industry in addressing disease issues.

ACTION TAKEN: Recommendation was forwarded to Gary Whitfield, Science Director, Crop Protection, AAFC.

RESPONSE: None received.

RECOMMENDATION #4: It is recommended that the greenhouse research program at Agriculture and Agri-Food Canada be strengthened to assist growers in addressing climate and production issues.

ACTION TAKEN: Recommendation forwarded to Peter Hicklenton, Science Director, Crop Production Systems

RESPONSE: Letter was received from Peter Hicklenton and the essence of his message was provided to the Sub-Committee on October 12, 2006.

STATE OF THE INDUSTRY

A. GREENHOUSE VEGETABLES

Crop Report

General Comments

The sunlight in the first two months of 2006 was below the 10-year average, slowing down the establishment of new crops. Subsequent sunlight levels were at, or slightly higher than, the average allowing for good fruit development and production. However, from week 25 to week 45 the sunlight levels were below the average. During this period, the maximum temperature achieved was lower than that in 2005. The late summer and fall production did not reach anticipated levels due to poor fruit settings, lower fruit grade and weight, and increased incidences of diseases. The

2006 season started with below average prices for greenhouse vegetables (especially tomatoes). The prices improved as the season progressed except for tomatoes, especially TOVs (tomato on the vine). The price of this commodity remained below traditional levels all season. Energy continues to be a major cost of production (30 to 45%). There is an increase in the number of greenhouse operations using alternative fuels (e.g. biofuels).

Cucumber

Yield varied from above average to below average amongst the growers. Several factors, such as planting time and climate resulted in this variation. The production ranged from 110 – 150 cucumbers/m². In general, the winter crop was higher in production, the summer crop normal and the fall crop below normal. The majority of the greenhouse cucumber growers have adopted the 3-crop system with some evaluating a 4-crop system in order to supply the market with high quality cucumbers year round. Growers used various cultivars at the different planting dates to achieve high quality and productivity. They also continue to evaluate new cultivars annually. The mini cucumber acreage in Ontario increased slightly to 15 hectares (38 acres). This is a small developing component of the greenhouse cucumber industry with grower and shipper/packers looking at all avenues to further develop it. The production ranged from 44kg/m² to 60kg/m².

Pepper

The low light conditions in the early stages of production caused difficulty in setting of the first flowers without aggressive altering of the greenhouse climate and plant habit. Some growers were able to do so successfully while others had more difficulty. The latter part of the season was disappointing for some growers as the low light levels did not allow the plant to carry a full load of flowers into the fall resulting in slightly lower production. Two new cultivars Facinata and Red Glory were the main red coloured peppers. Most growers preferred Facinata because of its size, colour and plan to increase the production area in 2007 despite the higher tendency to BER. The Red Glory cultivar had a higher tendency to blossom end star crack. Adjustments to watering strategies solved this problem. The Striker cultivar continues to be the most popular yellow coloured pepper. The Sympathie cultivar is still the most popular orange coloured cultivar although several new cultivars will be tried at a much larger scale in 2007.

Tomato

The beefsteak tomato crop established well despite the low light conditions. Early harvest was slightly delayed, and subsequent harvest was above normal but the late summer and fall harvest was delayed. Overall production was slightly lower than expected mainly due to the poor fruit setting in the late summer and fall. Throughout the season, there were periods when BER was prominent in some greenhouses. Two new cultivars, Big Dena and Macarena, were the most popular. Both cultivars require aggressive leaf pruning to maintain plant balance, high quality fruit (tendency to become blocky if plants are too vegetative) and minimize disease incidences. Production varies from 50kg/m² to 60 kg/m². Some growers interplant to maintain fruit quality and decrease down time between crops while others continue to grow a single long season crop.

The TOV acreage has remained relatively stable over the last year with increased production per unit area. Clarence remains the main cultivar with increased acreage of Grandella, Bizarre, Tricia and Tresco planted. Growers continue to look for new cultivars that are shorter, have an even flower cluster development, colour and flavour. Grafting continues to be popular especially when growers are planning to grow a single long season crop.

Eggplant

There is a small group of growers producing greenhouse eggplant in Ontario (3.5 Ha). The size and shape grown vary, depending on the market. The short mini-eggplants are grown for specialized niche markets while the larger globular cultivars are grown for specific market places

Greenhouse Vegetable and Protected Crop value (Millions of \$), and production volume (Millions of Kg, or dozen), since 1992

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Greenhouse Vegetables														
Tomatoes (\$ M)	24	33	39	42	55	79	126	145	177	217	232	226	244	274
kg (000,000)		18	23	31	38	49	80	106	131	148	153	149	161	181
Cucumbers (\$ M)	23	32	334	41	46	62	77.8	91.9	97.5	113	118	114	120	128
doz. (000,000)		4.4	4.7	5.3	6	8.3	9.8	11.9	12.8	14.4	14.6	14.2	14.8	15.9
Lettuce (\$ M)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweet Peppers (\$ M)	4	4	4	5	11	12	27	27.6	32.7	52.3	80.5	72.3	83.3	112
kg (000,000)		1.5	1.3	1.4	3	4.4	6.7	7.4	9.7	14.9	21.7	18.1	21	29
SUB-TOTAL (\$ M)	52	70	78	89	113	154	232	266	308	383	432	413	448.3	515
[Greenhouse Vegetables]														
Mushrooms (\$ M)	77	85	98	109	104	111	117	110	141	143	154	165	162	154
kg (000,000)	29	32	33	35	34	36	38	33	44	43	46	49	53.2	44
TOTAL (\$ M)	129	155	176	198	217	265	349	376	449	526	586	578	610.3	669

EMERGING ISSUES

A. GREENHOUSE VEGETABLES

1. Energy: High energy costs are having an increasingly negative impact on the profitability of the industry.
2. Competition from countries in tropical/semi-tropical climates; increase in seasonal pattern of foreign product availability.
3. Urbanization of agriculture and associated issues
4. New invasive species of pests and diseases
6. Non-tariff trade barriers – increasing protectionism by US due to increased imports from southern countries.
7. Decreasing profitability of older, smaller facilities
8. Focus by news media on food safety\
9. Environmental impact of alternative fuels

FERTILIZER RECOMMENDATIONS

A new edition of Publication 371 was printed in 2005 and no new recommendations were required for this meeting.

RESEARCH PRIORITIES

1. Develop production technologies for more efficient energy use. Such technologies could include environmental controls, gutters, greenhouse design, new products such as polyfilm, new varieties for our conditions, alternate crops, automation, closed greenhouses, alternative fuels, sources (wind, biomass, etc.), conservation, (demand side management, thermal screen in poly), boiler efficiency (bunker efficiency, etc.), software improvements, greenhouse waste (affordable biodegradable twine/clips, alternative techniques/products).
2. Maintain research on pest management issues including integrated control techniques (e.g. biocontrol strategies) for managing current, new, emerging, and potentially invasive pests and diseases of economic concern, new and biocompatible products for registration, and plant and arthropod community systems for pest and disease control, interaction of field production practices and greenhouse pest & disease incidence.
3. Develop production technologies to enhance productivity and contribute to economic viability. Research areas include the following:
 - Alternative products (crops, fruit types)
 - Genetics - evaluation and development of new cultivars/varieties that grow under our conditions, and provide societal and health benefits e.g. nutraceuticals, biopharmaceuticals and functional foods.
 - Physiology (i.e. what temps can optimize production)
 - Fruit Quality – (1-MCP, taste, keeping quality/shelf life, packaging/modified containers,)
 - Tiered cropping (growing above/below in greenhouse, maximizing light, different crops at one time)
 - Growing media (relationships among microbes)
 - Recirculation solutions (nutrients, emitters clogging)
 - Development of tools to enhance trade opportunities e.g. traceability
4. Address environmental impact issues such as re-circulation, waste, Nutrient Management Act, organic production, alternate and renewable fuels, emissions, noise and light pollution.
5. Develop innovative technologies for more efficient use of labour and automation.
6. Investigate areas within the Food Safety Program that require research.

SERVICE PRIORITIES

Needs for the following services were expressed by the Committee members:

- Increased dissemination of relevant information generated from within Canada and other jurisdictions;
- Increased extension staff for greenhouse vegetable growers;
- Increased resources to address import and export issues;
- Increased support for addressing environmental issues;
- Expansion of market support services;
- Education and training geared to the greenhouse industry;
- Development of protocols for management of crises or emergencies;
- Economic data to assist in building strong cases for funding and research.

RECOMMENDATIONS FOR 2006

RECOMMENDATION #1

BACKGROUND:

The current farm gate value of the greenhouse vegetable industry in Ontario is about 550,000 million dollars, and therefore constitutes a principal horticultural sector. Ontario also has approximately 60% of Canada's total area of greenhouse vegetables. The greenhouse vegetable industry has experienced much growth within the last 10 years. Currently however, the industry is at a crossroads where it must maintain maximum productivity in a fiercely competitive market place, and at the same time, address numerous challenges that include the high Canadian dollar exchange rate, high energy costs, and production problems associated with pests and diseases. The viability of the greenhouse vegetable industry hinges on growers' abilities to maximize efficient production, and to prevent, or at least minimize, the impact of pests and diseases. It is in this regard that Agriculture and Agri-Food Canada (AAFC) plays a major role. However, during 2006, two plant pathologists, who were actively involved in greenhouse vegetable research programs, retired from AAFC. The greenhouse vegetable industry continues to face numerous plant pathology issues and is therefore vigorously seeking replacement of these positions by AAFC.

Principal reasons why AAFC should maintain the previous complement of plant pathologists for greenhouse vegetable disease research are as follows:

1. **Available Funds** – Up until 2005, there were two AAFC research plant pathologists involved in greenhouse vegetable research in Ontario. During 2006, one of these pathologists retired (Dr. M. Tu formerly from the Greenhouse & Processing Crops Research Centre, Harrow), leaving just one research Pathologist, Dr. Ray Cerkaskas, with 0.8 person years in greenhouse vegetable disease research. It would be reasonable to suggest that funds that were previously utilized to support the recently retired research pathologist could be used to provide additional research support needed to address the multitude of disease issues experienced by the greenhouse vegetable industry.
2. **Numerous Recurring and New Diseases** – Greenhouse vegetable growers perennially face the challenges of chronically occurring diseases such powdery mildew and gummy stem blight in cucumbers, *Pythium* root rot in all crops, and *Botrytis* stem rots in all crops. Yield losses resulting from of these diseases can be as much 20% or more, and growers are constantly seeking more efficient tools and strategies to minimize the impact of such diseases. During this past year, numerous growers suffered significant losses due to *Botrytis* stem rot. Losses were estimated at 20%. Incidence of Bacterial canker (*Clavibacter michiganensis* subsp. *michiganensis*) also affected many crops and was a major concern to many greenhouse tomato growers during 2006.

New Diseases - In addition to the more commonly occurring diseases mentioned above, the greenhouse vegetable industry has experienced several new diseases within the last eight years. These diseases include first incidence of *Fusarium* stem and root rot in cucumbers (*Fusarium oxysporum* f. sp. *radicis-cucumerinum* (FORC)) and Bacterial stem and peduncle canker (*Erwinia carotovora*) in 1998, Pepper powdery mildew (*Leveillula taurica*) in 1999, Pepino mosaic virus (PepMV) in 2000, and *Fusarium subglutinans* in pepper in 2004. Plant loss attributed to FORC in cucumber crops can be high. Growers have reported as much as 40% plant loss due to this wilt disease. Yield losses attributed to PepMV have generally been about 20%.

3. **Current Resources are Inadequate** – The volume of work necessary to address the abundance of disease problems faced by the Ontario greenhouse vegetable growers far exceeds the physical capability of the sole research plant pathologist currently in place for addressing such problems. Lack of replacement of the previous complement of greenhouse vegetable research plant pathologists threatens to place Ontario greenhouse vegetable growers at a serious disadvantage compared with their international market competitors. Lack of timely information necessary to mitigate the consequences of the onslaught of old and new diseases could result in economic losses due to reduced yield and lowered product quality. Yield reductions could in turn lead to potential loss of markets because of inability to fulfill market demands for a consistent supply of high quality product.

In summary, the Ontario greenhouse vegetable industry is a major economic contributor to the horticultural sector in Canada. However, recent challenges posed by fiercely competitive markets and high energy prices have made maximum productivity an even greater priority with greenhouse vegetable growers. Growers risk losing markets if yields are not maximized, and quality optimized. Every effort must be made to minimize the effects of both recurring and new diseases. The greenhouse vegetable industry considers the immediate replacement of the recently retired plant pathologist for greenhouse vegetable research to be of the highest priority.

RECOMMENDATION: The Greenhouse and Protected Crops Sub-Committee strongly recommends and urgently requests that AAFC immediately replace the recently retired greenhouse vegetable research plant pathologist in order to adequately assist the greenhouse vegetable industry in addressing its numerous economically significant disease challenges. It is believed that such support from AAFC is absolutely necessary for the industry to remain competitive and economically viable.

RECOMMENDATION #2

BACKGROUND:

The current farm gate value of the greenhouse vegetable industry in Ontario is about 550,000 million dollars, and is a major horticultural sector in Canada. Ontario also has approximately 60% of Canada's total area of greenhouse vegetables. The greenhouse vegetable industry has experienced much growth within the last 10 years and looks forward to continuing its success in the coming years. Currently, the industry is at a crossroads where it must maintain maximum productivity in a fiercely competitive marketplace and, at the same time, address numerous challenges including the high value of the Canadian dollar, high energy costs, and production problems associated with pests and diseases. Not only does the industry have to continually manage chronically occurring pests and disease-causing organisms, but they have had to contend with numerous new ones with recent years.

Between 1991 and 2004, the greenhouse vegetable industry in Ontario has experienced at least six new diseases and four new arthropod pests. Introduced diseases include first incidence of tomato powdery mildew (*Oidium neolycopersici*) in 1995, *Fusarium* stem and root rot in cucumbers (*Fusarium oxysporum* f. sp. *radicis-cucumerinum* (FORC)) and Bacterial stem and peduncle canker (*Erwinia carotovora*) in 1998, Pepper powdery mildew (*Leveillula taurica*) in 1999, Pepino mosaic virus (PepMV) in 2000, *Fusarium subglutinans* in pepper in 2004. Introduced arthropod pests include Tomato Pinworm (*Keiferia lycopersicella*) in greenhouse tomatoes in 1991, Tomato bug (*Engytatus modestus*) in 1991, *Echinothrips americanus* in greenhouse peppers in 1999, and Potato psyllids (*Paratrioza cockerelli*) in 1998.

Incidence of new pests and diseases is very disruptive to existing pest management programs primarily because of lack of experience and strategies in place to manage them. Of even greater significance is the lack of compensation programs for growers who must subject their crops to destruction in the case of regulated diseases. Despite the possibility of emergency registrations to assist in managing new pests and diseases, such registrations cannot be effected with sufficient rapidity in most cases. The greenhouse vegetable industry believes that prevention of entry of new pathogens and arthropod pests into the country constitutes its first line of defence against them. Thus, strict vigilance at ports of entry is considered to be of insurmountable value to this industry.

At the same time that imports are monitored for new and regulated pests and diseases, consideration could be given to tests for pesticide residues. It is believed that this exercise is necessary to ensure that imports are in compliance with PMRA's Directives on pesticide residue limits.

RECOMMENDATION:

It is recommended that the Canadian Food Inspection Agency increase the resources required for enhanced surveillance of imported greenhouse vegetables. Such measures are necessary for detection of potential new invasive pests and pathogens, and for preventing their establishment in Canadian greenhouse vegetable crops. It is also recommended that such resources be used to monitor imports for pesticide residues to ensure that they are compliant with Health Canada's Directives on pesticide residue limits.

RECOMMENDATION #3

BACKGROUND:

Greenhouse vegetable growers need to keep abreast of all the latest information relevant to their production systems if they are to maintain a competitive edge. As such, greenhouse vegetable growers have expressed the desire for improved and efficient transfer of new information from researchers to the industry. They also appreciate the value of research carried out closer to home, under more local conditions. However, the transfer of such information from Canadian researchers to growers has not been proceeding either adequately, or in a timely fashion, in recent years. This gap in information transfer has resulted partly because greenhouse vegetable researchers do not currently compile their research reports into a single publication as was practised in the past. This compiled publication provided a valuable single source of Canadian research data for Canadian greenhouse vegetable growers. Another source of research information was the national network meetings. These meetings facilitated exchange among researchers, growers, and industry, and three such meetings were successfully held in the past in Ontario, BC, and Quebec respectively. These meetings improved communication among researchers, extension staff, and growers, both intra- and inter-provincially. However, no meetings of this nature have been held in recent years.

RECOMMENDATION:

It is recommended that Agriculture and Agri-Food Canada (AAFC) resume national network meetings that involve all key sectors of the greenhouse vegetable industry (researchers, extension staff, growers, industry) to facilitate exchange of information and to provide updates on research and other activities. It is also recommended that AAFC re-instate national reporting of research results for the greenhouse vegetable industry.

Note: The subject of increased extension from OMAFRA for greenhouse vegetables arose at the meeting and was addressed by Annette Anderson, Manager, Greenhouse & Specialty Crops, OMAFRA

LOW ACREAGE

EXECUTIVE SUMMARY

The Low Acreage and Special Crops Research Sub-Committee identifies issues, prioritizes research and service requirements, and makes recommendations with respect to 14 or more crops. Twenty three individuals (growers 2, input suppliers 2, processors 4, researchers 7, and extension 8) participated in the November 15, 2006 meeting.

July and August of the 2006 growing season were good for crop growth, with adequate sunshine, heat and rainfall in most regions. The wet, cloudy conditions experienced in both the early and late seasons did result in some problems. The occurrence of purple spot in the asparagus crop resulted in high harvest losses, and the wet fall made harvesting of many LA&SC very difficult, typically resulting in lower yields and product quality. Another major disease problem in 2006 was the severe downy mildew outbreak, which primarily affected the vine crops. Control of this disease was a big challenge, and pointed out the need for increased education in this area. There is general consensus that the downy mildew originated from infected Ontario greenhouse transplants, and a committee has been established to address this issue. Tarnished plant bugs are becoming more of a problem in a number of crops, including asparagus, cucumbers, tobacco and peppers. The number of buyers and retailers of fresh and processed produce continues to diminish causing rationalization and consolidation in the industry.

The viability and expansion of those crops identified as Low Acreage and Special is somewhat limited by a number of issues including: 1) a general reduction in research funding for production agriculture; 2) a reduction in research capacity at AAFC due to vacancies brought on by staff retirement, 3) a lack of grower education programs for IPM, particularly sprayer workshops, 4) marketing challenges, 5) escalating energy costs; 6) an influx of new growers into limited markets, 7) a need for enhanced GMO research; 8) IPM restrictions that make it difficult to compete on the global market and 9) concerns by growers about the implementation of new HACCP regulations.

The Low Acreage and Special Crops Research Sub-Committee identified several research and service priorities indicating attention be directed to 1) pest management; 2) education programs/workshops for IPM, particularly dealing with spray equipment, 3) nutrient management; 4) water management; 5) development and evaluation of horticultural crop production systems, 6) food safety, and 7) the promotion of frozen/processed Ontario produce.

Recommendations being forwarded for this sub-committee 1) harmonization of the PMRA and U.S. regulations for IPM registrations 2) increased funding, and a relaxation of the requirements for obtaining funding for production oriented agricultural research, 3) introduction of programs to educate the public on the nutritional qualities of frozen and/or processed Ontario produce.

It is important that these research and service priorities and recommendations to the OHCR&S Committee be acted upon to ensure future agri-business viability within Ontario's rural communities during a time of increased production pressure and global competition.

INDUSTRY/SECTOR SCAN

2006 Crop Updates and Research and Service Accomplishments

Sweet Potatoes: An estimated 800 acres of sweet potatoes were grown by 20 producers, which represents a 200 acre increase over 2005. One grower alone accounted for more than 300 of the total sweet potato acreage. The crop looked to be doing well in the early to mid-season, but the cool, overcast August/early September weather kept yields in the 11000 to 13000 lbs/acre range. The wet fall soil conditions also resulted in 40 acres of the crop not being harvested. Sweet potatoes are not covered by crop insurance. The prolonged harvest also caused some growers to experienced difficulties with their offshore labour, many of whom were anxious to return home. Weed management was aided by the registration of the herbicide Command, which saved growers approximately \$150/acre in weeding costs. Damage to the crop from millipedes and wireworms ranged from minor to severe, raising the concern that future crop quality and yield could be dramatically affected by increased infestation of these insects. Insect pressure appeared to be reduced if the sweet potato crop followed tobacco rather than rye in the

rotation. Several new curing/storage facilities were built in 2006, but some crop was left in the field because of a lack of curing/storage space. A local farm equipment company redesigned a 4 row harvester which works very well, and should save the growers both time and money when harvesting, through enhanced quality. 2006 saw an increase in the number of potential markets for Ontario sweet potatoes. There is a renewed interest in Ontario markets for fresh sweet potatoes, and one fast food restaurant chain has added them to their menu. A large food processing company is looking at incorporating sweet potatoes into their product line, and a dog food company has begun adding them into their pet food.

Asparagus: Approximately 3000 acres of mineral soils are planted into asparagus. The cool, wet spring weather contributed to the onset of a severe purple spot outbreak. Harvest losses were high, and many growers are unsure of how this problem can be prevented in future crops, as managing purple spot during harvest is almost impossible given that all fungicides are preventative, not curative. There is some concern that fusarium may be spread through the crop by the activity of Japanese beetle grubs, but this has not been confirmed. One positive was that the cool, wet weather had a severe impact on the asparagus crop in the U.S. east coast, resulting in the opening of new markets for Ontario growers. Another common concern was the apparent lack of loyalty of the major food chains towards buying Ontario grown asparagus. There were two URMULE sponsored registrations for asparagus in 2006: Bravo was registered to control rust and purple spot, Matador/Warrior was registered to control aphids. (D. Wolyn & P. Banks, University of Guelph, Guelph/Simcoe)

NB: Asparagus Research and Services Sub-Committee meeting minutes appended.

Pickling Cucumbers: The lack of markets in the food service industry resulted in there being no machine harvested acres this year. Total crop acreage declined, and the number of grading stations went from 6 to 3. Downy mildew was a major problem this year. The disease appears to have originated from infected greenhouse transplants, and a committee has been established to deal with this problem. The severity of the disease resulted in many growers only meeting about 70% of the tonnage they were under contract for. The general consensus was that the disease is manageable if growers apply the right chemicals, at the right time and in the correct amounts using suitable spray equipment. Unfortunately, unless all growers follow these practices, the disease will still maintain an active presence in the region. Admire 240F (control of cucumber beetles at planting), Dual II (herbicide), Milstop (fungicide) and Apron XL LS (seed treatment), all received full minor use registration. Emergency use registrations were obtained for Command (control of broad leaf weeds), and Tanos (downy mildew control). D. Robinson, U. of Guelph, Ridgetown, continues to conduct weed management studies. J. O'Sullivan, R. Grohs and R. Riddle, U. of Guelph, Simcoe continue to conduct trials with respect to multi-pick, herbicide and efficacy evaluations.

Melons: It was reported that there was a slight decrease in the watermelon acreage in 2006. In general, the watermelon harvest came earlier than usual, and was over more quickly. Late season melons, and those over 10 lbs appeared to be more susceptible to hollow heart. Verticillium stem rot was prevalent in areas with high nightshade weed pressure. Viruses are still a major problem, but were overshadowed this year by the downy mildew outbreak. CaMV problems tend to occur near no-till corn or soybean fields.

Pumpkins: The 2006 pumpkin crop was good, but the fruit were a little smaller than normal. The wet fall weather resulted in higher than normal fruit rot. Downy mildew was less of a problem with the pumpkin crop and was generally kept under control with proper spray program. There were some occurrences of soft rot with growers who failed to spray when required. Some issues with grub feeding and fusarium infection were also reported. Both D. Robinson, U. of Guelph, Ridgetown and J. O'Sullivan, U. of Guelph, Simcoe conducted weed management and herbicide evaluation trials for pumpkins.

Squash: The squash yield was good this year, but the crop took longer to mature, resulting in more green fruit in the fields at harvest. The wet fall weather resulted in higher than normal fruit rot, and will also result in soil compaction problems next year. Downy mildew was less of a problem with and was generally kept under control with proper spray program. Disease pressure was not great, with both weed and insect control programs working well. The contract demands were down this year, and there is a need for more sales. D. Robinson, U. of Guelph, Ridgetown, conducted a trial to examine the tolerance of squash to pre-emergence applications of various herbicides. J. O'Sullivan, U. of Guelph, Simcoe conducted a trial to evaluate herbicides for weed control in squash. M.R. MacDonald, U. of Guelph, is studying the control and progression of powdery mildew.

Peppers: All contracted tonnage was harvested by October 17th, with yields ranging from 10-22 tons/acre depending on the variety and field location. There were some quality issues due to water retention in the fruit leading to rot. Pepper crop diseases were dependent on the source of the transplants, Problems were seen with bacterial soft rot in the fruit, and bacterial leaf spot. Tarnished plant bugs are becoming more of an issue. Other insect problems were European corn borers in the early season, wire worm feeding in the mid-to late season on fruit resting on the ground, and slugs on the fruit in late season. Weeds remain a major problem, but did provide some early season frost protection. Five field surveys (586 acres in total), were done for pepper powdery mildew in Essex and Kent counties. There was a relatively low incidence of occurrence, with disease severity ranging from mild to moderate. Two sites near Harrow were positive for *Phytophthora capsici*. Both of these diseases occur in the field and in the greenhouse. J. O’Sullivan, R. Grohs, and R. Riddle, U. of Guelph, Simcoe conducted three cultivar trials evaluating hot banana, sweet banana, hot cherry and Jalapeno peppers. Pre-emergence herbicide evaluations were also conducted at U. of Guelph, Simcoe.

Sugarbeets: Growers and processors report above average yields, but below average sugar content. The harvest was hampered by the wet fall weather. The sugarbeets were often too muddy and some loads were rejected at the piling yard. *Rhizoctonia* root & crown rot and *Cercospora* leafspot were the main disease issues. A few fields were replanted due to wireworm damage in the spring. Weed management was the biggest pest challenge. With the regular rains, weed seeds kept germinating throughout the season.

Culinary Herbs: It remains difficult to estimate the acreage for each of the many culinary herbs. Generally growers report that the heavy rainfalls experienced during the season resulted in significant problems, particularly with respect to disease pressure. *Alternaria* blight in rosemary and downy mildew in sage were reported. Leaf hoppers represented the main source of insect pressure. Pest pressures remain difficult to manage since the culinary market prefers to source pesticide free product. There was severe weed pressure in the oregano crop grown without plastic mulch, with weeding costs of \$21000 for August alone. The main problem with organic production remains being able to maintain adequate nitrogen in the soil. It was reported that 3 of the 4 major grocery chains would not accept product labelled as organic, even though it was produced under certified organic practices. There is also strong competition from an organic herb producer in Montreal, but his product is more poorly packaged and so has a shorter shelf life. Jan Schooley, OMAFRA and A. McKeown and C. Bakker, U. of Guelph, Simcoe, have expanded their lavender research to include other herbs. Production practices, variety selection, essential oil extraction and IPM issues are being studied as well. A lavender working group of 6 local growers, has been established to examine the issues around developing a lavender industry in the Norfolk area. Their initial focus will be on developing production practices.

EMERGING ISSUES

- 1) **Funding:** There is a strong concern about the lack of emphasis on basic production oriented research by the provincial government. The difficulty of obtaining grants without having matching funds was identified as a significant challenge. The high overhead charged on grants, and the field costs charged by the University of Guelph leave little money for conducting research. Growers recognize that Ontario has many good researchers, and they want to support Ontario research, but in many cases they feel they can get more “bang for their buck” if they take their funding out of the province to places like Michigan State University.
- 2) **AAFC Research Staff Vacancies:** Recent retirements of 2 scientists at AAFC have left only a single plant pathologist for the entire greenhouse industry. Retirement of senior research staff is also a problem, or will shortly become one, in the university system and in the Ontario government. Parent research committees, grower groups and industry need to work together to prepare business cases that support filling these vacancies with new research staff.
- 3) **Grower Education Programs for IPM:** The severity of the downy mildew outbreak during the 2006 growing season demonstrated a need for better education programs for growers on the proper implementation of disease control programs. It was suggested that demonstrations and workshops should be organized to inform growers about the control issues such as the proper timing of product application, and rates of application, with particular emphasis on the proper setup and use of spray equipment.

- 4) **Marketing:** The lack of loyalty exhibited towards the growers by the main domestic retailers is becoming more of a problem as marketers tend to be more concerned with consistent supply rather than where any particular commodity is grown. The possibility of doing an economic study to show the benefits of buying Canadian produce and how buying foreign produce negatively affects our economy was raised. Local growers want the government to address the subsidy issue (both foreign and provincial), because they are being forced to compete on a playing field that is not level. They would like to see the Ontario government support farming to the levels given their competitors (e.g. Quebec and the U.S.). The high Canadian dollar has also hurt the export market for Low Acreage and Specialty Crops. There remain barriers to exporting Low Acreage and Special Crops including zero tolerance pesticide residues, quarantinable pests, USA homeland security policy and bio-terrorism issues. The shortage of options for registered pesticides puts Ontario producers at a trade disadvantage
- 5) **Energy Costs:** Rising energy costs are a major problem for the majority of producers. The increasing cost of fuel (natural gas, oil, propane, diesel) and electricity is significantly impacting cost of production, since most production practices, including field operations, irrigation, fertilizer inputs and post harvest conditioning, are dependant on energy unit inputs. Producers need assistance in reducing energy costs. Growers did recognize that in some cases there was an “up-side” to rising energy costs, in that the high cost of shipping was forcing retailers to look locally for produce.
- 6) **Influx of New Growers:** There is a general concern that growers exiting the tobacco industry will turn to other crops currently grown by existing operations. This will have a negative impact on the price of these commodities, something already seen in the asparagus pumpkin and sweet potato markets. It was voiced that it is the government’s responsibility to identify new opportunities and solutions for these transitioning growers. It was felt that the policy makers need to ensure that those policies they put forward are sustainable and actually bring some tangible benefit to the Low Acreage and Specialty Crops sector.
- 7) **Genetically Modified Organisms:** There exists a need to move research forward in establishment of GMO varieties. Consumers must be educated with respect to acceptance of such food products. If Ontario fails to move forward, growers may be unable to compete effectively in the market place thus loss of market and economic development opportunities.
- 8) **Pesticide/Herbicide Issues:** In the course of discussion, the several concerns were raised by the attendees. The lack of registered chemicals is hindering the ability of growers to compete against foreign producers who have access to cheaper control methods. There was strong agreement that there needs to be better alignment between the U.S. and Canadian regulations covering pesticide and herbicide use.
- 9) **HACCP Implementation:** There is confusion among growers on exactly how the new HACCP program is going to be implemented. The following questions need to be addressed: Is implementation going to be committee driven, or will each individual commodity have to develop its own program? Will Ontario be developing its own guidelines, or will growers just adopt current US regulation? Will the timelines for implementing the new regulations be flexible or rigid? Will something like the farm safety booklet “Developing a basic health and safety program for your farm” be available, or will it need to be developed for each commodity? Growers are already receiving requests from buyers for certificates of verification, so implementation of the new regulations is quickly becoming a major issue.

RESEARCH & SERVICES PRIORITIES

1) **Pest Management Systems:**

The Issue:

There exists a shortage of registered pesticides (for aphids in particular), a lack of qualified IPM consultants, scouts and a declining interest in cultivar research. Viruses (e.g. CMV), are becoming an increasingly significant problem. Variety research and demonstration trials are vital for Ontario producers to stay competitive in the marketplace and for continued economic viability of the agri-business community.

Current Research/Extension Activities: John O'Sullivan and Darren Robinson, University of Guelph are conducting herbicide screening trials for Low Acreage and Special Crops. University of Guelph researchers (John O'Sullivan, Al McKeown,) are performing cultivar trials for some of the Low Acreage and Special Crops.

Gaps/Barriers: Replacements for traditional pesticides are either slow in getting approval from the PMRA, unavailable to the Canadian market, too expensive or no research is being completed to find replacements. Unlike the EPA, efficacy data must be submitted to the PMRA in Canada. Furthermore, agricultural chemical companies do not have a keen interest in small markets.

2) Grower Education Programs for IPM:

The Issue:

The severity of the downy mildew outbreak during the 2006 growing season demonstrated a need for better education programs for growers on the proper implementation of disease control programs. It was suggested that demonstrations and workshops should be organized to inform growers about the control issues such as the proper timing of product application, and rates of application, with particular emphasis on the proper setup and use of spray equipment.

3) Nutrient Management Information:

The Issue:

Growers are concerned about the shortage of reliable and current information on which to base fertility recommendations for specific crops. In many instances, the fertilizer rates being used are above current OMAFRA recommended rates, but growers are hesitant to reduce fertilize amounts for fear it could affect yield and quality. The Nutrient Management Act (NMA), which does not currently require horticultural commodities to have nutrient management plan was also touched on. Similar to last year, the points of concern are:

- A shortage of human resources dedicated to implementation of nutrient management planning for Low Acreage and Special Crops
- A shortage of personnel dedicated to nutrient management research, especially in the area of Low Acreage and Special Crops
- Extra expense for the grower. Will the Ontario grower be able to compete against imported products from abroad where nutrient management is not an issue.

Current Research/Extension Activities:

Little if any current research is being conducted in Ontario with respect to nutrient management recommendations for specific Low Acreage and Special Crops. The lack of research is likely due to the difficulties in obtaining funding for projects addressing the needs of Low Acreage and Special Crops.

Gaps/Barriers

Agronomic research with respect to all aspects of nutrient management planning criteria for all Low Acreage and Special Crops requires completion. The criteria for soil nutrient deficiencies, pH, different soils, nutrient removal rates, nutrient values for waste, cull piles and wash water, for respective yields of those crops considered Low Acreage and Special must be developed as soon as possible at a reasonable cost to the agri-business community.

4) Water Management:

The Issue:

Although the 2006 growing season was not as hot and dry as 2005, there continues to be a heightened awareness of the importance of efficient water usage. There is concern that watering restrictions could become enforced if dry conditions persist. Such enforcement would impact growers of Low Acreage and Special Crops since most require irrigation during a normal

growing season. There is a need to educate growers transitioning to new crops on the use of unfamiliar irrigation systems and proper water/fertigation management.

Current Research/Extension Activities:

Rebecca Shortt, OMAFRA's Irrigation Specialist is available for consultation.

Gaps/Barriers:

Gaps still remain for identifying critical irrigation times for crops. It is important that research continues on the scheduling of trickle irrigation and fertigation practices. Many of the Low Acreage and Special Crops are grown on fragile sandy soils, The AAFC Research Biologist position at Delhi not being reinstated significantly impacts progress in water management on drought prone soils.

5) Development and Evaluation of Horticultural Crop Production Systems:

The Issue:

In recent times both Agriculture and Agri-Food Canada and the University of Guelph crop research programs have shifted to a more diversified approach encompassing food and health, environment, bio-products, etc. The competition for limited research dollars amongst researchers is of concern to farmers, food processors and the general agri-business community. Of particular concern is the need for research on energy efficient production methods (e.g. reduced/conservation tillage), on post-harvest storage issues, and on cultivation practices for herbs used in the essential oil, nutraceutical and bio-actives industries.

Current Research and Extension Activities:

Traditionally both AAFC and University of Guelph researchers conducted applied agronomic research i.e. variety trials, plant spacing, date of planting, fertilization, northern vigour, cold tolerance, etc.

Gaps/Barriers:

Crop researchers indicate that in order to acquire research dollars they must partner with outside interest, however work within the mandate of their program directive. It is often the interest of a researcher to publish scientific papers therefore agronomic research may not get the attention it has had in the past. It remains important to identify resources, develop and evaluate production systems for Low Acreage and Special Crops.

6) Food Safety:

The Issue:

Public liability with respect to food safety continues to be an issue for those involved in the production, distribution and retail distribution of Low Acreage and Special Crops. The market continues to express concern over chemical residues, wash water quality, irrigation water quality, processing equipment cleanliness and worker hygiene. The trade continues to indicate the need for HACCP certification or equivalent from field to fork. Growers are concerned over the added cost of record keeping, liability insurance and the ability to compete in the market place with imported product from countries that are not subject to quality food safety standards.

Current Research/Extension Activities:

Federal and Provincial governments continue to address the food safety issues. Federally such a mandate is addressed through the CFIA, PMRA, Health Canada and Agri-Food Canada. Provincially an On-Farm Food Safety Program Lead position (Sandra Jones, OMAFRA, Guelph) and a Fresh Market Quality Program Lead position within Crop Technology, OMAFRA (Jennifer DeEll, OMAFRA, Simcoe), have been set in place. The Good Agricultural Practices manual for the Canadian Herb, Spice and Natural Products Industry is currently under CFIA technical review (Jan Schooley, OMAFRA, Simcoe), and should be available to growers in the spring of 2007.

Gaps/Barriers:

The Low Acreage and Special Crops fresh market and processing sectors could benefit from increased human resources and financial assistance towards implementation of food safety programs. Although some industry players have taken a pro-active approach to the implementation of HACCP, others have not.

7) Promotion of Processed/Frozen Produce:

The Issue:

There is a need to promote the value of processed/frozen produce to the general public. Consumer education is necessary to increase the acceptability of processed or frozen vegetables in the marketplace. Although the Foodland program is widely recognized as being beneficial to the industry, it only addresses the fresh market aspect of fruits and vegetables.

Current Research/Extension Activities:

The Provincial government is working on a branding Ontario food program, which will include produce grown in Ontario, whether it is sold fresh or frozen/processed.

Gaps/Barriers:

The Low Acreage and Special Crops processing sectors could benefit from increased education of the consumer on the healthy aspects of frozen and/or processed fruits and vegetables that were grown in Ontario.

RECOMMENDATIONS

Recommendation 1

The Low Acreage and Special Crops Sub-Committee requests that Federal and Provincial Governments work towards harmonizing the PMRA and U.S. regulations for IPM registrations. For example, although the fungicide Tanos is registered for use in both countries, the pre-harvest interval is 7 days in Canada, but only 3 in the U.S. There is a need to simplify the registration process (i.e. changes in product formulations should not require a completely new submission), reduce the cost of product registration, and increase the availability of products to Ontario growers. PMRA should adopt the same application rates as are used in the U.S. unless there is strong evidence to support not doing so. Using lower application rates often results in decreased product efficiency and a higher chance of resistance to the product developing in the target organism(s).

Recommendations 2

The Low Acreage and Special Crops Sub-Committee recommends that OMAFRA provide more money for basic field production research. Furthermore, the requirements for matching funds/in-kind contributions should be relaxed to help foster research on smaller projects designed to help the Low Acreage and Special Crops growers.

Recommendations 3

The Low Acreage and Special Crops Committee recommends that the Federal and Provincial Governments provide market development resources to promote minor crops, and educational resources to communicate the benefits of purchasing locally grown crops that fall under the Low Acreage and Special Crops umbrella. These benefits range from the nutritional quality to the positive economic spin-offs of buying Ontario produce. Market development

opportunities such as using the Royal Winter Fair as a venue to showcase some of these minor crops should be addressed by both levels of government.

NURSERY, LANDSCAPE AND TURF

SUBCOMMITTEE EXECUTIVE SUMMARY

The 2006 growing season was characterized by greater than average precipitation in late summer and autumn with cooler than average temperatures. Temperatures were extremely mild from Christmas through to the beginning of February. Luckily, the mild temperatures came before plants had received their chilling requirements and so the weather had very little effect on dormancy. The 2005/2006 winter was the warmest on record. We lost snow cover in February for a brief period of time, but overall we had 20% greater precipitation. Late frost hammered some landscape and nursery crops, predisposing them to weak pathogens. The spring was cool with moderate amounts of precipitation, which resulted in an extended leaf emergence period and some disease pressure on outdoor ornamentals. In general, 2006 was an excellent growing season for both woody and container grown nursery stock. However, ample precipitation in spring and fall hampered planting, harvesting, installation of new landscapes and therefore, resulted in some depressed sales for wholesale and retail of outdoor ornamentals. Many field production nurseries had no choice but to harvest off of wet fields. Soil structure was devastated in those fields and will likely take several years before drainage and good structure is returned.

The spring flush of growth that helps the turf recover from winter injury and snow mould injury, etc. did not materialize. Weeds took over in many of the thinned turf areas. The dry spring had a big impact on sod growers who were faced with irrigating turf much earlier than usual. Once July hit, there were some torrential scattered rains throughout the province accompanied by a long period of hot, humid weather. As a result, the summer turf diseases such as anthracnose, brown patch, summer patch and *Pythium* blight were the worst that we have seen in many years. Take-all patch continues to be a problem and the majority of turf samples submitted to the GTI Turf Diagnostics were diagnosed with take-all patch. There are no pesticides registered to control this disease in Canada. The weather conditions, coupled with intensive management lead to a lot of turf loss on greens, tees and fairways. Many areas lost their roots in the middle of the summer. That combined with the summer patch lead to a lot of turf loss. The weather also caused an explosion of crabgrass in the middle of the summer. This was the second season in a row for these types of turf problems. Moss continues to be a problem on golf course greens and there is no pesticide registered for use for control of moss. During the summer of 2005 a new disease was found in Ontario, bentgrass dead spot (*Ophiosphaerella agrostis*). There were no new reports of this disease in 2006. Another new disease has been reported in Ontario on turf called *Rhizoctonia zeae*. It too, does not appear to be too widespread at the moment.

Warm conditions and regular rainfall pushed the growth of many woody and herbaceous crops this year. Leaf blights were an issue. Insect and mite pests came on early and strong, mites and leafhoppers caused a lot of injury to the first spring flush of growth. Moderate to high levels of Gypsy moth were noted in several urban locations across southern Ontario. Regular precipitation helped trees recover from feeding damage and defoliation. Populations of Japanese beetle adults were reported to be higher than average in Niagara and Hamilton, with more than average foliar feeding damage. Borers and scale insects still present some of the greatest challenges to pest management in the nursery and landscape (e.g. bronze birch borer, emerald ash borer). Most of the new formulas that are being developed as insecticides do not have the systemic efficacy needed to target the types of insects that feed from within the protection of plant tissue. We should still expect to see dieback and mortality of large, established trees in the landscape due to the hot, dry conditions of 2005.

As far as insects go for 2006, there were a few abnormalities. The warm weather in early May that was followed by a fairly long cold snap resulted in two waves of black turfgrass anaenias flights. This made it a bit difficult to predict when to treat, but thankfully Merit has a long half-life so insecticide application timing is less critical. There continues to be calls this year about turfgrass ants. European chafers levels were normal and European crane fly and leatherjackets were back up significantly from last year. As well, conditions this fall were excellent for European crane fly egg hatch and early larval survival and growth. Lawn care operators will be very pleased that carbaryl is now labeled for use on home lawn turf for leatherjacket control beginning in 2007. Efficacy trials for reduced risk products and alternatives to pesticides for turfgrass management continue to be assessed at the University of Guelph, Guelph Turfgrass Institute.

Industry statistics point to continued growth in the nursery, landscape and turf sectors. The relative values of the US and Canadian dollar and border issues were reflected in a continued strain on the export market for ornamental nursery stock. Land use for nursery stock production decreased (by 8%) in the year 2005 while farm gate sales went up by 8%. Increased fuel prices have snowballed into increased costs for most nursery supplies (e.g. plastic pots, greenhouse plastics). Growers would like to raise prices for nursery stock but they fear it would not be accepted. The wet conditions have raked havoc on peat harvesting in the Maritimes this year. Growers are bracing for a spike in media prices and possible shortages in peat. The amount of land devoted to the production of sod dropped slightly from 2004 to 2005 (12,270 acres to 10,000 acres) and the value of sod dropped from \$49,212,000 to \$47,616,000. The cost of production of sod is going up, but prices are static and this is of some concern to sod growers. There is continued growth in the golf course construction sector. These are mainly high end golf courses in Muskoka, Georgian Bay and Niagara Falls areas. The demand for golf is static so there is concern that some of these golf courses will not survive.

The warm, wet summer put to rest many of previous year's concerns with water availability....temporarily. Water quality and quantity for irrigation is still the number one issue of concern for most growers. As water quality and availability is becoming the limiting factor for horticulture, nursery growers are constructing irrigation reservoirs and recapturing ponds. Growers are also incorporating more low volume irrigation technology into their production systems (e.g. underground drip tape in high-value field budding blocks).

Water and nutrient management continues to be on the radar screen for most growers. Although they are relieved that the provincial government is focusing on large livestock operations right now, growers are still very concerned about implications of the regulations in the future. OMAFRA specialists and nursery growers have been working closely to characterize leachate and runoff from container production nurseries and help develop BMP's that will improve irrigation/nutrient use efficiency and minimize off-site movement of runoff (e.g. phosphorus and turf). Growers would like to see more research regarding nutrient and irrigation efficiency that minimize leaching from container production. There is also room for improvement of irrigation delivery systems for container crops (e.g. ebb and flow systems that are applicable for outdoor production). The nursery research team at the University of Guelph is addressing some of these research needs (e.g. water and nutrient requirements of selected nursery container crops, recycling systems and utilization of waste products for propagation media). Some of this research is being supported by CORD funding.

Pesticide use on turf continued to be an issue in Ontario in 2006. To date there are seventeen municipalities in Ontario which have enacted pesticide by-laws but not all are in effect. The municipalities are: Toronto; Caledon; Archipelago; North Bay; Cobalt; Thorold; Peterborough; Perth; Windsor; Waterloo; Georgian Bay; Cobourg; London; Newmarket; Orangeville; Georgina and Gananoque. Within these municipalities with pesticide by-laws there are off label recommendations being made for control of turf insects with products such as Endal and neem. There are also many home remedy recommendations that have not been tested for efficacy or for toxicity to humans.

The IPM/PHC Council of Canada voluntary turf IPM accreditation program has been in place for five years for lawn care and four years for golf courses. Approximately 148 lawn care companies and 196 golf courses are enrolled in the program. Many of the municipal bans are directed at the entire landscape and not just home lawns. IPM accreditation for landscape and nurseries will be much more challenging due to the huge range of crop species grown and their related array of pests. Because of this diversity, much needed action thresholds do not exist for outdoor ornamentals.

Quarantined pests have had an enormous impact on nursery production in the last few years. Emerald ash borer (EAB) continues to plague ash trees in the southwest and has moved on to Elgin and Middlesex counties in the last year. It is estimated that over 15 million trees have been killed by EAB so far in Michigan and Ontario (ash trees make up 25-80% of woodlots). Because of EAB, many Ontario nurseries are unable to sell inventories of ash and many are being destroyed, some after 7 years of cultivation. In 2006, no new detections of Asian Long Horned Beetle have been found infesting trees within the ALHB quarantine zone of City of Toronto and Vaughan. This indicates that the eradication program has been effective. ALHB presents a huge threat to the urban forest and nursery industry since a) so many of the host tree genera (e.g. maple) are found in the landscape and sold in the nursery industry and b) the centre of infestation is not very far away from large caliper tree nurseries. The action of

quarantine at a nursery (e.g. moratorium on shipping for ALHB host trees) could easily put a caliper tree nursery out of business within a period of a few months. The host species for EAB and ALHB make up the top 10 to 15 species of trees grown in Ontario nurseries. OMAFRA specialists actively participate on science committees and taskforces related to Invasive Alien Species, often communicating impacts of draft regulations to government and technology transfer (e.g. biology, detection) to industry stakeholders. An emergency use for Confidor (injectable insecticides against EAB, ALHB) was registered in 2006 and the company will support a continuation of the emergency registration while they get ready to submit the full registration package in the next month.

Several positive detections of *Phytophthora ramorum* (Sudden Oak Death, SOD) in several US states (and in B.C.) have increased the probability of Ontario growers importing this disease via the nursery trade. Luckily, all SOD testing has come up negative for Ontario nurseries. The unpredictable behaviour of this pathogen and the every-increasing host list make it a real threat to Eastern forests and horticulture. OMAFRA specialists have given numerous presentations to industry stakeholders on SOD biology and BMP's for nursery production. U of G Pest Diagnostic Clinic is on standby should *P. ramorum* testing become a needed service for Ontario. Industry awarded CORD funding has been used to support research regarding the disinfection of recycled water for water born pathogens (e.g. *Phytophthora* and *Pythium*) at the University of Guelph. To help prevent further spread of this disease, systems-based, voluntary certification programs have been implemented by the BC nursery industry. BC and ON are working together to make registered fungicides available to the ornamental industry. Changes in Japanese beetle infested zones in Quebec and the new Japanese Beetle D-memo has designated Ontario and Quebec to be partially or generally infested. This puts more pressure on Quebec and Ontario growers to become JB certified in order to ship to other provinces. This certification is also required in order for nurseries to sell to facilities that are under the Canadian Nursery Certification Program.

Skilled labour shortages are still a large issue in turf and ornamentals. Off-shore labour continues to be the backbone labour force for the nursery industry but the recent discussions around unions and tightening of labour protocols are of concern. Landscape Ontario has been sending recruiters to high schools to attract young people into the field of ornamental horticulture. In addition, the industry is working on models for scholarships and horticultural internships (more structured than co-op terms) that will add educational value to diploma and degree courses. Many nursery growers are looking toward increased mechanization as a solution to the skilled labour shortage in nurseries.

EMERGING ISSUES

Budget Cuts at the University of Guelph

After technician cuts and announcements regarding overhead charges on research at the University of Guelph last year, researchers are very concerned about the future of their programs. There is a need for long term industry support to support the lost full-time technicians in the ornamentals programs at the University of Guelph. The subcommittee is also concerned over the retirement of two nursery faculty positions (one has just retired, the other will be retiring soon). There has been no indication of OAC planning to fill these positions when they become vacant. It appears that the University is actively reducing faculty in OAC. It should be noted that aside from these two positions, there are no other university-level research programs for nursery crops in Canada. The industry will need to continue to voice their concerns to OAC directly.

Exotic Pests/Invasive Alien Species

EAB, SOD and ALHB have huge implications for the nursery and landscape sectors. The agencies devoted to the management of quarantinable pests do not seem to have adequate resources to deal with the high volume of issues. In addition, there are still major research gaps regarding the pest biology in its new environment (e.g. emerald ash borer, Asian long horned beetle), mechanisms for dispersal, host range, detection and management strategies. Although these two pests are urban forestry issues to date, they have already had a huge impact on the nursery industry (e.g. significant decrease in ash sales). If the quarantine zone for ALHB were to include nurseries, a moratorium on shipping ALHB-host species (e.g. maple) could put some caliper tree nurseries out of business within one growing season. Landscape Ontario has hired a Risk Management Coordinator (Christoph Kessel) to help implement certification programs that will limit the impacts of Invasive Alien Species (IAS). The Canadian Nursery Landscape Association has been working with CFIA and APHIS to develop national nursery certification

programs that will deal with IAS preventatively, with a better system of record keeping that will streamline trace back and trace forward activities. The Ontario nursery industry is very concerned about the movement of SOD (Sudden Oak Death, *Phytophthora ramorum*) into Eastern Canada. Growers are very keen to support research projects that will help eradicate or slow the spread of this waterborne pathogen. Industry-awarded CORD funding is being used to support research into disinfection of recycled irrigation water (*Pythium*, *Phytophthora*) at the University of Guelph. The impact of exotic/introduced pests on outdoor ornamentals is often difficult to quantify due to lack of industry statistics. There is a need to develop more data regarding plant groups (e.g. deciduous trees, value, acreage and pests).

Pesticide Issues: Access to Effective, Low Risk Products

Many of the older formulation pesticides are the backbone of chemical pest management for nursery and turf producers/maintenance professionals. PMRA's re-evaluation and manufacturers voluntary discontinuations are leaving the industry with gaps in pest management. Old formulations are being replaced by new ones and often, ornamental uses have been lost due to lack of "bridging data". Companies who produce biopesticides often complain that they are too small to meet the requirements to register their product in Canada. The turf industry is concerned about the over-reliance on Sevin T&O as the only curative insecticide in the near future. Increasing requirements for occupational health and exposure data by PMRA are also bogging down label expansion requests. Chemical registrants have reported lack of industry data on ornamentals with which to make business decisions regarding new product uses. The industry needs to develop more data regarding plant groups (e.g. deciduous trees, value, acreage and pests).

Irrigation and Water Management

The industry wishes to see more research regarding irrigation and nutrient efficiency and have more specific information on the timing of application(s) to minimize leaching of nutrients. The industry is also concerned about implications of the Source Water Protection Act and wishes to work with government to come up with solutions that are applicable for horticulture. There is considerable scrutiny of nitrogen and phosphorus levels in urban runoff in the United States, with many areas banning phosphorus fertilizers for use on turf. These nutrients are the first line of defense against weeds and some diseases. There is a need to educate the industry on the best management practices for utilizing these nutrients in the turf setting. The industry is also very concerned about water quality and availability and would like to see more research dedicated to the efficient use of irrigation water (or someone to interpret the latest research that exists and transfer the knowledge into the nursery, landscape and turf industries). There is also room for improvement on irrigation delivery systems for container crops (e.g. low volume systems that are applicable for outdoor production)

Pesticide Issues: Integrated Pest Management

With the industry focusing on IPM as the solution to pesticide bans, it is becoming apparent that there are information gaps on pest biology, monitoring and detection techniques and thresholds. The registration of low risk, IPM friendly pesticides is also crucial to the adoption of IPM in maintenance and plant production. The increasing number of municipal pesticide bans is proof that the activists are not accepting IPM accreditation. In many cases for landscape plants, a lack of pest population/pest damage action thresholds is preventing the acceptance of IPM as an alternative to pesticide bans. Research is needed to verify the action thresholds in the literature for pests on turf in Ontario. Action thresholds need to be established for outdoor ornamentals.

Pesticide Issues: Use of Alternative Products

The University of Guelph and the Guelph Turfgrass Institute are addressing the need for research into alternative products to pesticides (e.g. non-chemical and low risk replacement pesticides). The research trials for these alternative products are more difficult to design and carry out, given they are part of a systems approach to the integrated management of a particular pest. The industry is concerned about the illegal use of alternatives products (i.e. those without PCP numbers) and off label recommendations from municipalities for homeowners (e.g. acetic acid, hot water, horticultural soaps, etc.). This problem has also been discussed at the Healthy Lawns Working Group and PMRA is putting together factsheet on this topic.

Phosphorus Use on Turf

Many municipalities and regions in the United States and the province of Manitoba have restricted or are looking at restricting or banning phosphorus fertilizers on turf. Some of these bans are complete bans and some restrict the use of phosphorus fertilizers adjacent to water bodies. In some states, phosphorus has been taken out of all turf and lawn fertilizers. In Manitoba, the ban will apply buffer zones of 15-30 metres to water bodies and it will apply to homeowners, farmers and golf courses.

Phosphorus fertilization has come under scrutiny because phosphorus usually does not exhibit a visual response and deficiency symptoms are rare on turf. Secondly, higher levels of phosphorus contribute to algal blooms and decrease water quality of ponds, lakes, and streams. Since phosphorus is extremely immobile in the soil, elevated phosphorus levels in bodies of water likely result from phosphorus moving on eroding soil particles, which would be expected in agricultural fields or on newly planted lawns or other turf areas. However, there is some question as to whether phosphorus enters surface water in other unexpected ways. One study in Wisconsin showed that phosphorus can leach from turf leaves during the growing season.

There is a need for research in Ontario to determine current phosphorus levels in turf soils in Ontario, to determine the effects of eliminating phosphorus from turf fertilizers and to examine both phosphorus rates and phosphorus distribution in soils at time of turf establishment. This research will help develop best management for phosphorus on turf in Ontario.

RECOMMENDATIONS ARISING FROM GAPS/BARRIERS/DEFICIENCIES

Title: Biology and Management of New and Emerging Pests

Research

Recommendation:

The subcommittee on Nursery, Landscape and Turf recommends support of research efforts into the detection, biology and management of emerging pests which have the potential to become economically damaging. This research request includes necessary efficacy trials for quarantined pests as these trials can only be carried out at registered government quarantine pest facilities. Pests of concern include Asian long horned beetle, emerald ash borer, sudden oak death, bentgrass dead spot and European crane fly.

Details:

Many of the emerging pests are new to Ontario and their biology, detection and management are not well understood in our region. There is real concern as to the eradication and management practices that will keep the pest population from expanding. To ensure the economic sustainability of the industry, these pests need to be managed. The Canadian Food Inspection Agency needs more resources to act in a more effective and timely manner (e.g. support certification and auditing or verification of audit process of such programs). The industry needs access to more university-level research into pest management solutions for these high priority pests.

Background:

- New and emerging pests are responsible for significant losses in sales (e.g. EAB causing decreased ash sales) as well as crop losses each year. Quarantinable pests have a great effect on access to markets (e.g. moratorium on shipping). Registered pesticides are not available for most of the quarantined nursery and emerging turf pests. The economic future of these industries is at risk unless more rapid pest management solutions to these new and emerging pests are found.
- **Target Agencies:** Canadian Food Inspection Agency. University of Guelph
- **Title: Water and Nutrient Management**
- **Research/Service**

Recommendation:

The subcommittee of Nursery, Landscape and Turf recommends a concerted effort to support more research on nutrient uptake, N and P content in leachate and have more specific information on the timing of application(s) to minimize leaching of nutrients (e.g. CORD funded research of Dr. Calvin Chong in container nurseries). The industry is very concerned about water quality and availability and would like to see more research dedicated to the efficient use of irrigation water and reduction in off-site movement of runoff. The industry feels that there should be a reward for being proactive about collecting water for irrigation (reservoirs from roof runoff etc.). Also needed is the transfer of new technology to the industry.

Details:

OMAFRA has been working with the industry to characterize leachate/runoff and develop BMP's that will minimize the off-site movement of leachate/runoff. U of G nursery research team has evaluated fertilizer placement and timing as well as specific research into the uptake of N and P throughout the season. Further research is needed to address quantification of nutrient uptake and N and P losses in leachate, to establish more practical protocols for handling spent leachate and minimizing its off-site movement. Given the impact of regulations such as the Source Water Protection Act, the industry is in full support of research that can improve irrigation efficiency.

Background:

Research data regarding N and P uptake by ornamental nursery crops and sod is lacking. The industry appreciates the nutrient uptake research being conducted at the University of Guelph and would like to see the support for this kind of research to continue. Water quality and quantity have been identified as limiting factors in the production of nursery crops (especially containers) in Ontario. Unless this issue is addressed, there will be increased crop losses and reduced quality and limitation on the expansion of this industry. The long-term changes in climate and weather (e.g. hot, dry growing seasons over the last decade) have resulted in low water availability, which is limiting production and harvest and sales of turf and ornamentals. Areas that could be addressed include irrigation delivery systems (e.g. fertigation and recycling), irrigation scheduling, use of grey water and the development of low water use systems.

- **Target Agencies:** OMAFRA, University of Guelph
- **Title:** Registration of Reduced Risk Pesticides and IPM
- **Research/Service**

Recommendation:

The subcommittee of Nursery, Landscape and Turf recommends continued support for research on the development and adoption of integrated pest management and registration of new, lower risk, IPM-friendly pesticides (e.g. curative insecticides) for the turf and nursery production and landscape.

Details:

The aim of this recommendation is to improve the ability to manage insect, disease and other pests in the in the face of reduced availability of registered pesticides and increasing concern about their effect on the environment. Current initiatives by the nursery industry have included the hiring of an IPM technician (Peter Isaccson) who also functions with minor use coordination. The committee is looking for increased collaboration with government and universities to fill research gaps and product registration gaps.

Background:

Despite the loss of older formulation pesticides (e.g. organophosphates) and possibility of municipal pesticide bans, landscape/turf maintenance and nursery growers are still expected to produce high quality plants with reduced pest management tools. The minor use system has been effective, but candidate products must already be registered in Canada. Most reduced-risk products for the ornamental sector are not registered in Canada. Research needs to address the registration of pesticides as a component of an IPM program, as well as the development and adoption of low risk alternatives to current practices.

- **Target Agencies:** Pest Management Regulatory Agency, Agri-chemical industry, University of Guelph
- **Title:** Development of Stronger IPM Programs
- **Research/Service**

Recommendation:

The subcommittee on Nursery, Landscape and Turf recommends that more information on pest biology in Ontario (with emphasis on action thresholds for pest populations and pest damage) be developed for outdoor ornamentals and turf.

Details: The industry has spent a great deal of time developing an IPM accreditation program to give more confidence in the responsible use of pesticides by licensed applicators. The increasing number of pesticide bans is proof that IPM accreditation is not being accepted by the activists. In many cases, the lack of damage/action thresholds for landscape plants is not available and therefore preventing the acceptance of IPM as an alternative to pesticide bans.

Background:

It is becoming apparent that there are information gaps on pest biology, monitoring and detection techniques and thresholds. The registration of low risk, IPM friendly pesticides is also crucial to the adoption of IPM in maintenance and plant production. Research is needed to establish action thresholds for pests on turf and outdoor ornamentals.

- **Target Agencies:** University of Guelph (and other institutions for horticultural research)
- **Title:** Acquisition of Current Industry Economic/
- **Research/Service**

Production Data

Recommendation:

The subcommittee on Nursery, Landscape and Turf recommends that current economic industry data specific to nursery production (e.g. value and acreage of crop groups, energy use), assessment of CO₂ credits and the overall value of the turf industry be acquired.

Details:

Although the industry supports the research into opportunities for skills-based training (Ridgetown College), there is a need for specific data regarding the land base dedicated to production of various crop groupings (e.g. number of acres in Ontario used for production of field grown conifer trees). Similarly, the total value of the turf industry in Ontario is not known. Quantification of the sizes of these two industries could justify more resources being diverted to deal with research and service needs (e.g. economic implications of EAB).

Background:

The nursery and turf industries in Ontario are large and are increasing in value every year. Turf industry statistics would help to designate the position relative to other commodities and its applicability for research funding. Statistics for individual nursery crop groups are required in data submission packages for minor use registrations and industry impact data (such as the impact of EAB on the shade tree market). This type of data is difficult to procure and often must be estimated.

- **Target Agencies:** University of Guelph, OMAFRA, industry
- **Title:** Support Replacement for Nursery Faculty Position
- **Research/Service**
- **at U of Guelph**

Recommendation:

The subcommittee on Nursery, Landscape and Turf recommends that nursery faculty position, previously held by Dr. Glen Lumis, be filled following his retirement from U of Guelph (April, 2006).

Details:

The industry is very concerned over OAC's recent trends towards reducing faculty at the U of Guelph. A faculty position dedicated to nursery production research and teaching is a necessary part of ornamental horticulture at the University of Guelph and in all of Canada.

Background:

The Ontario nursery industry is responsible for over half the farm gate value for nursery crops in Canada. To date, there are only two Canadian nursery faculty positions (Glen Lumis, Calvin Chong) in all of Canada and these faculty members are retiring. The Ontario nursery industry would like to see nursery crop production research and teaching continue at the University of Guelph, a recognized facility for its excellence in horticultural education.

- **Target Agencies:** University of Guelph
- **Title:** Management of Phosphorus in Turf
- **Research**

Recommendation:

The subcommittee on Nursery, Landscape and Turf recommends support of research efforts into current phosphorus levels in turf soils in Ontario, the long term effects of eliminating phosphorus from turf fertilizers on turf and both phosphorus rates and phosphorus distribution in soils at time of turf establishment. This research will help develop best management for phosphorus application on turf in Ontario.

Details:

The current OMAFRA recommendations for phosphorus application to turf recommend annual applications of phosphorus even if soil phosphorus tests are in the medium to high range (21-50 ppm P). As well, most turf fertilizers contain in the range of 5% P₂O₅. The question of whether Ontario turf managers are applying too much phosphorus needs to be answered and if so, recommendations to reduce phosphorus applications should be made.

Background:

Many municipalities and regions in the United States and the province of Manitoba have restricted or are looking at restricting or banning phosphorus fertilizers on turf. Some of these bans are complete bans and some restrict the use of phosphorus fertilizers adjacent to water bodies. In some states, phosphorus has been taken out of all turf and lawn fertilizers. In Manitoba, the ban will apply buffer zones of 15-30 metres to water bodies and it will apply to homeowners, farmers and golf courses.

Phosphorus fertilization has come under scrutiny because phosphorus usually does not exhibit a visual response and deficiency symptoms are rare on turf. Secondly, higher levels of phosphorus contribute to algal blooms and decrease water quality of ponds, lakes, and streams.

Target Agencies: University of Guelph

APPENDIX

2005 Research and Service Priorities for OHCRSC Subcommittees

1) Biology and Management of New and Emerging Pests

- Research

2) Water and Nutrient Management

Research/Service

3) Registration of Reduced Risk Pesticides and IPM

- **Research/Service**

4) Development of Stronger IPM Programs

Research/Service

5) Acquisition of Current Industry Economic Data

Research/Service

6) Nursery Faculty Positions at U of Guelph

Research/Service

6) Management of Phosphorus in Turf

Research

POTATOES

STATE OF THE INDUSTRY

There are 135 commercial potato growers in Ontario growing 37,000 acres (11% of Canada's potato acreage) in 2006. The fresh market consumes 56% of this. The Process market uses 39% for chips and 5% for soup and prepeel.

The main potato-production areas in the province are Alliston, Shelburne, Leamington, Ancaster, Simcoe-Scotland-Burford, Grand Bend and Mount Albert. Potato production is also located around population centers in the north, such as Thunder Bay and Sudbury.

The most planted fresh market potato varieties were Superior, Goldrush and Yukon Gold, each at the 3000acre level, with Onaway at the 700 acre mark. Shepody, Kennebec and Cal White each at the 1000 acre level are used for table and prepeel or soup. Most planted for the Potato chip market are FL1867, Snowden, Atlantic, FL1879 and Dakota Pearl. Significant acres of FL1833, FL1207 and Andover, are also planted.

Extensive variety testing of new cultivars, approved by the Ontario Potato Board are conducted by the University of Guelph, the ON-Farm potato variety program and as well by our provincial potato specialist. This has peaked grower interest so that approximately 30 other varieties not mentioned above were grown in lesser acreage in Ontario in 2006, some in commercial trials others gaining in popularity.

THE WEATHER was moderate in temperature with good rainfall and better yields than 2005 (a very hot year). It was a great year for our southern extremity Leamington and for our Northern growers and a good year for Shelburne and a few other locations. Alliston had a dry July-August. For many it was a wet, slower and more expensive harvest

THE MARKET PRICE for table stock November 2006 was \$13/cwt, chip contracts were \$10/Cwt with good and steady prices all through 2006. Process contracts were negotiated in 2006 without going to final arbitration for the first time since 2001 .

MARKETING

1. Grading has changed from government grades to one that satisfies the buyer or the load goes home.
2. The elimination of “ mom and pop” food stores means you market fresh potatoes usually under contract to two or three big food chains or you don't market at all. Farm market sales or occasional feeding a contractee is the alternative for those out of the loop.. In other words our old notion of a free enterprise open market to all, no longer exists to Ontario's potato grower. Herein lys the answer to queries of why doesn't Ontario increase acres.
3. **QUALITY DEMANDS IN THE PROCESSING INDUSTRY**, have risen steadily over the last ten years. New contracts pay a bonus for higher gravity and demand low defects in processed chips. Marginal quality loads acceptable 5 years ago would certainly now be rejected.
4. **QUALITY DEMANDS IN THE FRESH MARKET** have changed in the past 5 years as well. The change is from one of “real eating quality to one of superficial appearance. If it is smooth and looks pretty then real eating quality is very secondary.
5. **NEWER FRESH PRODUCTS**
 - a) premium priced bulk potatoes in several colours for pick your own,
 - b) Certified organically grown potatoes, and
 - c) several new mini sized potatoes now in white flesh, and more recently yellow gems (mini) or mixed colour mini.are available Other than a few promotional names e.g Klondyke Rose, there is still no push in Ontario to sell potatoes by their variety name.

ORGANIZATION PROGRESS

The Ontario Potato Board has for 30 years set fresh prices for Ontario growers and negotiated contracts for the process market with power to collect grower fees to operate on. The benefit to the grower, good market information and speaking as the potato voice of Ontario in provincial and international issues. At their lowest ebb in time the board directors all put up \$1500 with no guarantee of getting it back to keep the board going. The Board is now in

its second and third generation of member potato growers. It now has good economic viability, has influenced process contract prices in the USA and nationally and prevailed against sources outside the province bent on cheap and massive exports into Ontario and others with a mean spirit trying to break the Board's resolve. Over time the Ontario quality has been upgraded so it competes well even in surplus years. The Ontario potato growers have chosen collective responsibility instead of each grower doing their own thing. Many of the original Board organizers are either deceased or retired, but there is still one non-board member who has seen this unfold called The Shadow "and the Shadow knows".

The Ontario Seed Potato Growers' Association, is also 30 years old, and is the potato group the Ontario Potato Board does not speak for. This group pays minimal membership fees and each grower does their own individual thing. This is a small group (20) without an office and with an unpaid elected executive. They work in a partnership with OMAFRA. The SPUD Unit, an up to date tissue culture lab was built for the Ontario Seed Potato Growers in 1985 and was one of the few things that survived the meltdown of the New Liskeard College of Agricultural Technology. To-day, the SPUD Unit also services the berry growers and other horticultural crops. In recent years, The Ontario Seed Potato Growers Association have annually paid back half their free grant to help support the SPUD Unit. In addition they annually generate about 1.5 million dollars in gross seed sales. Their seed quality has evolved from one of the worst to one of the best. Blessed are those who do not take but receive with gracious and responsible hearts for they shall work hard and give back and make their partners look good.

EMERGING ISSUES

Emerging Issues –for 2007 are non-specific comments.

The ever acceleration of regulations and change means long term planning in farming is very difficult, so you just jump on the merry-go round. As the merry-go round speeds up you can adjust and hang on or you can lose your grip and be thrown off or you can sell out to an Asian-based farmer or land investor. Either way it will be an exhilarating ride in a worthy profession.

Hopefully, someone will thank you for the tasty Ontario grown food you produce, and hopefully they will perceive farmers as the salt of the earth.

RESEARCH PRIORITIES

1) Production and Productivity

- a) identification and evaluation of new germplasm for characteristics that increase productivity and profitability
- b) further research into seed and soil-borne diseases, (including, but not limited to late blight, scab, verticillium, fusarium) and the impact of infected seed on Ontario production
- c) future research into the use of integrated pest management practices and the control of pests, diseases and weeds which may have an impact on production
- d) examination of factors regulating post harvest storage and strategies to extend storage life while maintaining quality.
- e) further research regarding the use of mini-tuber technology to produce high quality seed.

2) Food for Health

- a) investigate nutritional qualities and variability of potato germplasm and possible application of this data in production and marketing. Examine the healthy aspects of potatoes (e.g., a good source of energy, vitamin C, fibre etc)
- b) identification of factors (pre and post harvest) regulating storage quality and strategies to extend storage life while maintaining all quality characteristics.

3) Marketing

- a) promote the health aspects of potatoes (e.g., a good source of vitamin C, fibre etc)
- b) better promote the high quality of disease free Ontario seed potatoes through mini-tuber research
- c) improved branding of regions and varieties (e.g., Ontario potatoes, Yukon Gold)
- d) identification of value-added end uses of potatoes
- e) identification and exploration of new markets and lucrative niche markets

- f) assessment of cost-competitiveness of Ontario production practices in the North American marketplaces
- g) monitoring and evaluating present production practices to determine efficiencies and enhance competitiveness

SERVICE PRIORITIES

1. Extension Services

provided by the OMAF potato specialist are essential to the potato industry. The strong liaison with USA counterparts and local agri-business and the Ontario Potato Board as well as strong grower education programs have kept the grower industry up to date and competitive. This potato specialist's chores include a timely weekly fax on real-field conditions and pests, training field scouts, conducting technology transfer trials and organizing field days, a potato school, and most recently as author of a pictorial guide to potato pests and problems acclaimed by growers on both sides of the border

2. Registration of Pesticides for Potato Pests

Pesticide registration is an issue for Canadian potato producers. Producers in other countries, namely the US, have access to pesticides not currently registered for potatoes in Canada. New pesticides often pose a reduced risk or are effective resistance management tools. Many times the pesticide company will make a submission for registration of one of these pesticides in Canada. However if they don't, IR-4 data is usually not available as potatoes are not a minor crop in the US. It is very costly to obtain the data required for residue levels, occupational exposure, crop tolerance, efficacy, etc to support registration.

3. Nuclear Seed Potato Production

The Seed Potato Upgrading and Distribution (SPUD) Unit is the foundation of the Ontario seed potato program supplying Ontario seed potato producers with high quality Nuclear minitubers. This service is essential to the seed potato industry in Ontario.

ONTARIO POTATO RESEARCH AND SERVICES SUB-COMMITTEE

RECOMMENDATION # 1

ISSUE:

Potato Pesticide Recommendations in OMAFRA publication 363

BACKGROUND:

Publication 363 provides recommendations for vegetable growers. It is not a compendium or list of registered products by intent, thus only effective products should be recommended..

DETAILS:

In some cases, even though a pesticide is labelled for a pest, the pesticide may no longer be effective because either the pest has developed resistance or new strains appear that are no longer affected by the pesticide. In other cases, although the pesticide is labelled to control a pest, actual pest control under field conditions is not satisfactory for growers using the product.

RECOMMENDATION-SOLUTION:

To ensure that OMAFA Publication 363 continues to recommend effective materials to potato growers, the potato committee has formed a sub-committee to review the potato pesticides recommended in Publication 363 before it is published and before supplements are issued .

TARGET AGENCY:

The proposed members of the Publication 363 sub-committee are the members of the Potato Board Research Committee in consultation with dealers and field professionals.

ROOT, BULB AND LEAFY VEGETABLES

State of the Industry

1. Carrots:

- Some early season losses due to heat canker. Good season overall. Some harvesting issues for the processing market due to rain and mud in the late fall. Harvests of dicer carrots are still underway. Due to high incidence of insect damage, many loads of slicer carrots were rejected this season.

- Overall, aster leafhoppers numbers and the incidence of aster yellows was low this year. Carrot weevils and carrot rust fly continue to be an issue for growers. As mentioned in the emerging issues section, high levels of possible millipede damage was recorded in Chatham-Kent area. Mid-season, bacteria problems were recorded in the Holland marsh. Weed control continues to be an issue for both fresh and processing market growers.

2. Onions and Other Alliums:

- Onion thrips continue to be a challenging problem for onion growers across the province. Similar to the carrot industry, limited weed control products affect onion growers across the province.

- Bulb and stem nematode continues to be an issue for garlic growers in Ontario. Positive identification and extensive damage was reported from Eastern Ontario through southwestern Ontario, and as far north as Sudbury. Identification of this pest in a garlic field north of the Holland Marsh has raised concern about possible spread to onion growing fields. Leek moth continues to be an issue for growers in eastern Ontario and Quebec. Efficacy trials performed in 2006 will be used to pursue URMULE registrations for the 2007 growing season.

- Approx. 150 acres of shallots are grown in Norfolk county. Excellent yields but the grower does have some issues with storage problems.

3. Celery:

- Fresh and processing market tonnage was good this year, approx. 25-40 tonnes/acre. Hot weather midsummer an issue resulting in some varieties of celery setting seed. Increase in leaf blights and bacterial diseases mid-to-late summer. End of season harvest found high levels of centre rot /decay.

4. Lettuce:

- This season overall was better than 2005; however, wet conditions late summer early fall resulted in disease pressure.

5. Spinach:

- Good growing season for spinach; however, due to the outbreak of E.coli 0157:H7 on Californian grown spinach, Ontario spinach sat in the field in the absence of buyers. Resulting in an increase in anthracnose. One of the reasons Ontario spinach wasn't sold during this crisis is because the packer packs under a U.S. label.

6. Chicory/Belgian Endive:

Three fresh market growers producing Belgian endive in the Norfolk area. There are also about 150 acres of chicory root production in the Tillsonburg area. Chicory root is primarily grown for inulin production. Issues these growers face include bolting mid-summer, Sclerotinia and phoma canker in storage and competition among producers.

Emerging Issues

1. Emerging pests include: millipedes and wireworms in carrots; bulb & stem nematode in garlic; and Iris yellow spot virus of *Allium* spp.
2. There continues to be a need to identify the health benefits (i.e. bioactive compounds) of many of the crops represented by this committee that could be incorporated into marketing strategies to increase consumer awareness and market share of Ontario grown produce.

Research Priorities:

1. **Funding Issues.** A reduction in available research dollars coupled with rising overhead costs at the University of Guelph is directly impacting pest management research on root, bulb and leafy vegetables, as well as other horticultural commodities.
2. **Pest Management Systems.** Integrated management of insect, disease and weed pests, including development of thresholds and monitoring practices, relevant biological and ecological research, and research on disease–nutrient interactions is required to:
 - I. Improve upon and update existing IPM programs;
 - II. Integrate reduced risk pesticides into current IPM programs;
 - III. Aid in the development of programs for new and emerging pests

Finally, a cornerstone of IPM is pest identification. Accurate and timely diagnostic services are paramount. Research dollars are needed to help further the development and validation of PCR diagnostics in Ontario.

3. *Crop Fertility and the Clean Water Act*

Nutrient management research is still required to update and complete provincial recommendations for all vegetable production systems. This research needs to be completed on various soil types throughout Ontario.

4. **Cultivar Evaluations.**

Particularly the simultaneous evaluation of cultivars from different seed suppliers for agronomic characteristics under uniform conditions. In addition, collaboration among different growing regions should be pursued to offer a competitive advantage to Ontario root, bulb and leafy vegetable producers.

5. **Nutritional Value.**

Research is required to better understand the nutritional value of root, bulb and leafy vegetables. A comprehensive literature review of bioactive compounds in these crops will provide the essential information needed for research to proceed and advance the profile of these crops provincially, nationally and internationally.

Service Priorities:

1. Lack of scouting companies in some regions of the province continues to be a serious concern. OMAFRA should help to address this issue by providing training and support to growers, crop scouts and consultants in all regions of the province. One suggestion is to create on-line training materials that would allow growers/consultants/scouts to learn at their own pace and fit into their specific work schedules.
2. OMAFRA must continue to ensure that IPM programs are updated with respect to newly available products and information related to new thresholds, application timings, etc.
3. With limited scouting services being offered, the development of a website/blog would allow growers, scouts/consultants to have access to up-to-date insect and disease trends throughout the growing season.
4. Cost analysis of scouting services and the types of services currently being provided in Ontario should be documented.

Recommendations:

Five recommendations, ranked in decreasing priority, were recorded in 2006.

Recommendation #1 - Nutrient Management and the Clean Water Act

Recommendation: The ORBLVRSC recommends that OMAFRA continue to support and fund research on nutrient use, nutrient management and nutrient recommendations that will allow growers to continue to produce horticulture crops in an economically productive, and environmentally responsible, way

Target Agency: OMAFRA

Background: Growers continue to be concerned about the impact of Nutrient Management and Clean Water legislation pertaining to horticulture crops and how new regulations will impact the production of root, bulb and leafy vegetables in Ontario. Research is still required to develop and/or fine tune recommendations for many of the crops that fall under the purvey of this sub-committee.

Recommendation #2 - Loss of applied researchers

Recommendation: The ORBLVRSC recommends that OMAFRA, University of Guelph and Agriculture and Agri-Food Canada work together to identify existing and future gaps in applied research programs and work together to support the continuation of applied research in the horticulture sector.

Target Agencies: OHCRSC (Annette Anderson), OPMRSC (Hugh Berges), AAFC (Dr. Gary Whitfield), University of Guelph (Dr. Craig Pearson, Dr. Michael Dixon, and Dr. Rene Van Acker)

Background: The horticulture sector continues to feel the loss of both federal and provincial applied researchers. Lack of delivery and implementation of IPM programs in Ontario continues to be a priority for a number of sectors. The keystone of IPM is research, from identification to the development of economic thresholds. Without researchers investigating and gaining insight into how economic pests and weeds affect Ontario horticulture, IPM programs can not be developed or continue to evolve.

Recommendation #3 - Lack of delivery and implementation of IPM programs in Ontario -

Recommendation: The ORBLVRSC is pleased to see the number and diversity of training sessions offered by OMAFRA in 2006, and recommends that OMAFRA continue to address the barriers to IPM implementation and delivery in Ontario. Additionally, this committee recommends that an on-line training module be developed that will enable growers, crop scouts and consultants and other interested people to participate in IPM training at their own pace.

Target Agency: OMAFRA, Crop Technology Branch

Background: Limited availability of training opportunities for IPM consultants/scouts and/or lack of affordable services in some areas has limited the success of IPM programs for crops represented by this committee. While services dwindle, there is an increased need for IPM services as new, reduced risk pesticide products are registered.

Recommendation #4 - Nematode Research Capabilities

Recommendation: The ORBLVRSC recommends that OHCRSC & OPMRSC continue to coordinate and develop a business case to support the hiring of an applied nematologist by AAFC.

Target Agencies: OHCRSC (Annette Anderson) & OPMRSC (Hugh Berges)

Background: There are currently nine nematodes regulated by the CFIA that have the potential to become established and threaten the production of horticultural crops in Ontario including known pests of alliums (stem and bulb nematode, *Ditylenchus dipsaci*), and carrots and parsnips (potato rot nematode, *Ditylenchus destructor* and

Columbia root-knot nematode, *Meloidogyne chitwoodi*). In 2006, stem and bulb nematode continued to devastate garlic growers across the province. There are also a number of established nematodes including northern root-knot (*Meloidogyne hapla*), root-lesion (*Pratylenchus penetrans*), root-knot (*Meloidogyne spp.*) and sugar beet cyst nematode (*Heterodera schachtii*) that cause economic damage to carrots, parsnips, celery, spinach, lettuce and onions grown in Ontario.

In addition to correct identification of nematode genera, applied research is critical to determine thresholds and control options when dealing with these economic pests.

Recommendation #5 - Limited Funding for Pest Management Research

Recommendation: The ORBLVRSC recommends that the Office of Research (U. of Guelph) and OMAFRA work together to identify ways that pest management and basic field production research can better fit into the current Sustainable Production Systems Program.

Target Agencies: University of Guelph (Dr. John O'Sullivan, Dr. Michael Dixon, Dr. Rene Van Acker), OMAFRA (Ken Hough, Sandi Christopher)

Background: A reduction in available research dollars in both OMAFRA-UofG Research Programs and competitive funding programs, coupled with rising overhead costs at the University of Guelph is directly impacting pest management research on root, bulb and leafy vegetables, as well as other horticultural commodities. In addition, some grower organizations are reluctant to fund research that requires overhead costs. And finally, the paperwork associated with bringing research dollars into the university has become arduous and requires extensive time commitments for fewer research dollars.

SWEET CORN, PEA AND BEAN

Sweet Corn, Bean and Peas Research and Services Committee Meeting

November 23, 2006

Woodstock, Ontario

A. Attendance. Janisse Routledge (OFPA), Barry Cavanagh (processor), Charles Welsch (grower), Bob Allison (grower), Jim Reith (grower/OPVG), Rick DeBrabandere (grower/OPVG), Wade Bickle (processor), John Zink (seed industry), Steve Lamoure (processor), Amy Strom (grower), Elaine Roddy (OMAFRA), Darren Robinson (UofG – Ridgetown), Jim Chaput (OMAFRA)

B. Minor Use Update. Jim Chaput presented a minor use update for sweet corn, peas and beans. New registrations include: Quadris (sweet corn - rust), Accent (all sweet corn varieties – annual grasses), Apron Maxx (peas – seed/seedling diseases), Tilt, Quadris and Quilt (all legume vegetables – soybean rust, powdery mildew, Ascochyta, Anthracnose and Cercospora).

Active URMULE projects include: Snap Beans: Quadris, Allegro, Kocide seed treatment, Gaucho, Rimon and Apron Maxx), peas and beans (Cruiser), peas (Assail), and sweet corn: Assail, Lontrel, Corragen). Lontrel is still being held up by a lack of residue data for NS and AB.

C. State of the Industry

Record yields for fresh market and processing sweet corn were reported by growers and processors, and there were good markets to sell product into because of low US imports. The markets for the remainder of the season were typical. New varieties are not being grown as much by many growers, despite the fact that they last longer and are sweeter. One grower did comment that the old ‘Gourmet Sweet’ varieties are still performing well for them. Some problems with rust and earworm were noted, but did vary among farms, and Northern corn leaf blight was evident in sweet corn harvested in September. One of the biggest problems processors had to deal with was how to handle the volumes being produced because yields were so high in certain cases.

Though the growing season was wet and there were some emergence problems early on due to standing water, succulent pea and bean yields were good to excellent around Ontario, and quality was excellent. There were some harvest difficulties due to the wet conditions for later planted snap beans, and disease pressure (downy mildew and white mould) in peas. Few insect problems were noted but nightshade and pigweed escapes were problematic. Quebec and the Pacific Northwest United States faced tougher growing conditions than Ontario, so snap bean volumes are tight, and pea production was variable in other growing areas. This has helped the Ontario growers sell their product. Despite problems with volume, most processors did make their pack of all grades.

D. Emerging Issues

i. Northern Corn Leaf blight. Yield losses were experienced in 2006. This is an emerging problem, and our knowledge of thresholds and spray timing is limited as disease focus has always been on rust.

ii. PMRA. Canadian data requirements – geographic requirements don’t always match the availability of researchers. The number of zones has been reduced, but the number of trials required has not. There is still a lack of harmonization with the American seed treatments. As all sweet corn, bean and pea seed is imported from the US, seed companies must run separate lines for Ontario customers. This limits the responsiveness of ordering time. Reformulation of products impacts low acreage crop registrations

iii. Viruses. There was lower pressure in 2006, but genetic improvements are still the only means of control.

iv. Organics/Sustainable Production. Issues raised were:

- Local Flavour Plus developing contacts between food service industries and Ontario growers and processors.
- Traceability (use of farm names on packaging)

- Set of guidelines to establish sustainability ie: rotation, pesticide safety, worker safety etc....
- Consumer expectations will be difficult to meet (ie. Presence of worms in the product cannot be adequately controlled)
- Organic guidelines are not consistent
- Difficulties in managing the lines at the processing level.

iv. Occupational Health and Safety. This was raised by both processors and fresh market representatives, because compliance with the act is daunting, and with the apparent lack of precise regulations as of now, it is hard to know how to comply.

v. US \$. Most plants reduced capacity on peas and corn in 2006 due to lost profit margins in the US export market.

vi. Research Funding. Direct operating costs downloaded onto the research program, increasing the cost of research. Creative ways to get around it (ie grad students and NSERC)

vii. Rising Fuel and Input Costs. The OFA passed a resolution of own-use chemicals (importing), and many growers must now consider forward contracting for fertilizer and spraying – stronger demand expected within the next year.

viii. Nutrient Management/Vegetable Waste Management. Processors have been granted an extension for land applied waste until 2008, but a lack of training availability has slowed the processes down. There is significant concern among industry representatives that there will not be enough time to write the plan and submit it before the deadline. In addition to this, there is a growing need for alternative options (ie energy production) for vegetable wastes. As an industry we need to seriously consider and move upon these alternatives.

ix. Pesticide Resistance. Pyrethroid resistance in corn earworm was most noted among the members of the committee, and the primary concern was that though new products are in the pipeline, but they will be expensive. Others mentioned Pursuit resistance in pigweed as a problem, and possible Basagran resistance in many weeds that typically were controlled. The former is a significant concern because Pursuit is so widely used in the province and has been documented. The latter is less likely to be a result of resistance than poor performance due to environmental conditions, weed stage or coverage.

x. Poast Tolerant Sweet Corn. This would be a much preferable alternative to the use of Accent for annual grass control. We would need a Canadian registration (need company support).

E. Research Reports

i. Darren Robinson (University of Guelph, Ridgetown Campus)

Tolerance of Lima Bean to Preemergence and Postemergence Herbicides.

This trial was kept weed-free to test for the effect of preemergence applications of Impact and KIH-485 on lima bean. Some visual injury was noted at both rates of Impact, however the crop outgrew this injury and did not result in any reduction in height or yield of lima beans. Additional work should be conducted with Impact applied postemergence to determine its tolerance in lima beans. Significant visual injury and reductions in height and yield were observed in both KIH-485 treatments.

Tolerance of Snap Bean to Preemergence and Postemergence Herbicides

We observed significant visual injury (stunting, burning, leaf crinkling) at both rates of KIH-485 and the high rate of Impact. The crops did not outgrow the injury and there was a significant reduction in height and yield of all four varieties tested. Since Impact will be registered for field corn, subsequent studies will be conducted to determine the potential for carryover injury onto snap beans.

Tolerance of Processing Peas to Preemergence Herbicides

This trial was established to determine the influence of Impact and KIH-485 applied preemergence on pea visual injury, tenderness, yield, and weed control. None of the treatments caused injury to pea – emergence counts, tenderness and yield were all similar to the untreated check. Impact gave excellent control of ragweed, good control of chickweed and fair control of lambsquarters, wild buckwheat and lady's thumb. KIH-485 gave excellent control of chickweed, fair control of lambsquarters and poor control of ragweed, wild buckwheat and lady's thumb. Future work will focus on postemergence applications of Impact, as this is an excellent postemergence broadleaf herbicide.

Tolerance of Sweet Corn to Preemergence Applications of KIH-485

KIH-485 applied preemergence at 140 and 280 g/ac, to eight processing sweet corn cultivars (GG446, GG214, Harvest Gold, GH2041, GH9589, GG763, GG447 and GSS9299) did not cause visual injury and did not reduce height, marketable cob weight or marketable yield.

Tolerance of Sweet Corn to Accent

Visual injury was observed at 7DAT in all varieties tested, but by 14DAT the injury was no longer present. Height, marketable cob size and yield were not reduced by Accent. **The Accent URMULE has been re-written so individual varieties no longer have to be continually added to the label.**

Tolerance of Sweet Corn to Postemergence Applications of Sandea

Sandea applied postemergence at 14 and 28 g/ac to eight processing sweet corn cultivars (GG446, GG214, Harvest Gold, GH2041, GH9589, GG763, GG447 and GSS9299) did not cause visual injury and did not reduce height, marketable cob weight or marketable yield.

ii. Elaine Roddy (OMAFRA)

Sweet Corn Nitrogen Response

The on-farm demonstration project now has 23 site years in the database. Early analysis suggests that the PSNT could be a valuable tool for sweet corn growers to help them fine-tune their nitrogen rates. Soil type and planting date appear to have a strong impact on nitrogen response in sweet corn.

Corn Earworm Monitoring and Resistance

We conducted as part of the greater North Central IPM trials in co-operation with the mid-western sweet corn growing regions. The use of the hartstack trap greatly improves the level of accuracy. The timing of the initial two CEW sprays appears to have the greatest impact on control. Corn Earworm spray timing recommendations have been updated: first spray at 60% silk, second spray 2-3 days later.

Service Accomplishments

- The Vegetable Crop Update (Sweet Corn, Bean and Pea Edition) continued in 2006. It is distributed to over 200 email and fax recipients.
- OMAFRA continues to provide IPM scout training to industry, processing, research assistants and private scouts.
- Publication 363 – Vegetable Production Recommendations was reprinted in 2006.

iii. Laura Van Eerd (University of Guelph, Ridgetown Campus)

Cover Crop and Nitrogen Cycling Dynamics in Sweet Corn

Without Ontario data on cover crop nitrogen (N) uptake and the timing of N release to the following crop, N management practices are not modify. Research was initiated in 2006 model the influence of cover crops with fall or spring incorporation on N dynamics in a pea-cover crop-sweet corn sequence with the following cover crops: 1) no cover crop, 2) oats, 3) cereal rye, and 4) oilseed radish with cereal rye. Modeling of N cycling in winter cover crops system compared to no cover crop will be used to predict environmental N loss and release the following year in order to design best management practices in vegetable production. Beyond N cycling, the effect of cover crops on vegetable crop yield and quality, weed germination and emergence, insect and disease pressure, soil quality, and economics in order to express to growers the value of cover crops within their rotation.

iv. John Zandstra (University of Guelph, Ridgetown Campus)

2006 Processing Pea Cultivar Evaluation

Thirty-two pea cultivars were submitted to the 2006 trial, with Spring and Encore included as standards for comparison. Plots were monitored as they matured by harvesting a subsample of 0.5 m x 6 rows per plot, and combining the 4 samples (replicates) and shelling. Tenderometer readings were made using an F.M.C. pea tenderometer. A target tenderometer value of 100 was used to determine harvest date. At harvest, 2.0 m x 8 rows (2.88 m²) were harvested per plot, and shelled in a stationary pea sheller.

Table 1. Yield and plant characteristics of pea cultivars. Ridgetown Campus, 2006.

Cultivar	Tenderometer (psi)	Yield (lbs/acre)	Adjusted Yield (lbs/acre)	Canopy Height (cm)	Node Count
BSC 348	84	8668.6 a	9131 a	15.8 lm	9.7
BSC 610	91	8298.1 abc	8543 ab	18.0 j-m	13.9
BSC 364	101	8441.0 ab	8424 abc	22.8 f-m	11.5
CMG 395	87	7932.2 a-e	8307 a-d	28.0 e-k	9.4
CMG 389	93	8050.4 a-d	8250 a-e	36.1 cde	10.1
CMG 397	86	7757.8 a-g	8164 a-e	39.9 bcd	9.5
PLS 97	94	7813.7 a-f	7992 a-f	13.9 m	11
PLS 11	79	7324.0 b-i	7905 a-f	38.1 b-e	9.3
Encore	92	7572.1 a-h	7789 a-g	17.5 j-m	12
Tommy	82	7007.9 c-k	7526 b-h	27.3 e-l	12.6
08220679	90	7183.9 b-j	7457 b-h	38.1 b-e	8
BSC 328	89	7032.0 c-k	7340 b-h	34.4 c-f	7.7
Meridian	94	7117.6 b-j	7293 b-i	28.0 e-k	16.1
08530731	96	7126.2 b-j	7228 b-i	14.3 m	11.8
BSC 728	89	6879.2 d-k	7198 b-i	31.8 d-h	12.7
08540794	93	6899.8 d-k	7103 c-i	19.8 i-m	9.9
08530726	86	6630.1 e-k	7022 c-i	27.0 e-l	14.4
PLS 1	99	6927.6 d-k	6952 d-i	38.5 b-e	20.2
Zodiac	79	6344.5 h-l	6922 d-i	20.5 g-m	14.7
PLS 23	81	6342.0 h-l	6867 e-i	52.6 a	10.3
CMG 52221	81	6140.5 i-l	6680 f-i	20.0 h-m	13.8
CMG 52210	98	6589.0 e-k	6655 f-i	15.5 lm	11.6
Pendleton	101	6476.3 f-k	6462 g-j	20.0 h-m	14.2
CMG 406	90	6153.2 i-l	6430 g-j	32.0 c-g	14.5
PLS 182	80	5848.5 j-m	6401 g-j	17.3 klm	16
Sangria	83	5781.0 j-m	6260 h-k	47.5 ab	15.6
Cabaret	91	6005.7 i-m	6251 h-k	16.1 lm	11.8
BSC 7532	82	5711.4 klm	6222 h-k	33.8 c-f	14.2
Spring	79	5634.8 klm	6212 h-k	20.0 h-m	8.4
PLS 144	90	5931.0 i-m	6211 h-k	30.5 d-i	14.3
Chinook	112	6428.7 g-k	6100 h-k	29.3 d-j	14.5
PLS 183	107	6074.4 i-m	5878 ijk	20.3 h-m	13.8
Reveille	83	4764.4 m	5230 jk	30.0 d-i	8.8
Ice Pack	104	5017.5 lm	4909 k	43.4 abc	8.9
LSD (0.05)	-	1129.4	1162	9.7	-
CV	-	11.9	11.8	25.3	-

P-value	-	0.0001	0.0001	0.0001	-
---------	---	--------	--------	--------	---

G. Issues and Priorities.

i. Succession Planning.

Succession planning in research institutions (Ag Canada, UofG) is not being practiced. As researchers retire they are not being replaced. The continuation of applied vegetable pathology, entomology and weeds research is important to the needs of the processing and fresh vegetable industries.

ii. Training & Certification for Nutrient Management Planners (RE: Vegetable Waste Disposal).

H. Research Priorities.

i. Pest Management

Product registration continues to be the committee's highest priority as a result of loss of existing products, delays in registering replacement products, and the development of resistance to pesticides (eg. corn ear worm and Pursuit resistance in pigweed).

Research into the biology, management and control of new pests is also an important priority.

ii. Nutrient Management and Water Quality

The utilization and environmental fate of nitrogen, phosphorous and potassium (economic applications rates, efficient timing, crop uptake and removal values, evaluation of the phosphorous index for vegetable crops, environmental soil tests for vegetables (phosphorus), and livestock manure management for hort crops) is another important priority for the group.

In addition, research is encouraged on the effects of fertility on crop quality and the disposal of vegetable by-products and wash waters. The group expressed a need for alternative options (ie energy production) for vegetable wastes. As an industry we need to seriously consider and move upon these alternatives.

iii. Crop Culture for Quality and Yield

Breeding for heat stress tolerance in legumes, varietal response to environmental stresses, virus tolerance in legumes are important research priorities. As well, the committee encourages research on soil Management and variety evaluations.

H. Recommendations

1. OMAFRA provide the training necessary to provide the industry with people who can develop Nutrient Management and Vegetable Waste Management plans. Though the processors have been granted and extension for land applied waste until 2008 – lack of training availability has slowed the processes down, there will not be enough time to write the plan and submit it before the deadline

This committee would like to see the PMRA work towards harmonization with the US for all crop protection products.

TENDER FRUIT

INTRODUCTION

This report was prepared by the “Tender Fruit Research and Services Sub-Committee of the Ontario Horticultural Crops Research and Services Committee”. It summarizes the work of the subcommittee over the past year, especially the discussions at the Sub-Committee Meeting organized by Ken Slingerland, chairperson (OMAFRA) and Antonet Svircev, Vice-chair (AAFC) held on November 7, 2006 at the Ontario Tender Fruit Producers’ Marketing Board, St. Catharines, Ontario. This report is a summary of the accomplishments of the tender fruit industry, issues, research and service priorities, pest management issues, minor use priorities and recommendations affecting the industry.

STATE OF THE INDUSTRY

Weather:

Ontario’s tender fruit production areas experienced one of the warmest winters in several years but yet one of the most challenging growing seasons.

At Vineland Station, the dormant season started with 22 consecutive days from December 1st to 22nd when the minimum temperature was below freezing each day. The coldest temperature recorded during that time was -11.1° C on December 12th. The minimum temperature recorded for January was only -9.0° C. The coldest temperature recorded all winter (-13.9° C) came on February 16th.

The mean temperatures for January right through until June were 1-2 ° C warmer than average. The warmer winter and spring pushed the season ahead slightly creating some concern for spring frosts during May 6th to 8th. There were 15 days during July and August where the temperatures peaked above 30.0° C (2 days in 2004 and 28 days in 2005) and during most of the summer months the temperatures were in the high 20’s. Overall the average daily temperatures were 1.6° C warmer in July and 0.2° C warmer in August.

Fall temperatures were generally 1 –2° C cooler than the average.

The spring started with below normal precipitation, opposite to the 2005 season. For the months February to May, all were 10-20% below normal precipitation. Above normal rainfall in June (+26%) and July (+43%) provided needed moisture for a key time during the growing season. Precipitation during August was half of normal until a heavy rain (32.4 mm) on September 2nd replenished the soils. September was a very wet month with rains totaling 106 mm, 43% higher than the 85 year average. Steady rains continued in October saturating the soils (120.4 mm)

Crop Summary

Most of the tender fruit areas of the Niagara Region, home to over 90% of the tender fruit crops in Ontario, experienced a very mild winter. Fruit buds were healthy coming out of the winter and most trees experienced an early and heavy bloom. First bloom of Japanese plums started in the early areas of St. Davids on April 17th with peaches and sweet cherries following 4 days later. Full bloom occurred from April 26th to 28th in most areas. Cold temperatures during the last 5 days of April almost resulted in damage to blossoms but fortunately, only high risk, low lying areas experienced any damage. The sour cherry crop was the hardest hit with frost, especially in the Fonthill and Simcoe areas. Bloom was a full 2 weeks ahead of 2005. Throughout the early growing season, some 2 year old trees collapsed and died. This damage was a carry over from the winter of 2005.

The fruit trees needed irrigation early in June as the moisture in the soil was depleted. Growers in most areas irrigated several times in the early summer until heavy rains started around the 10th of July. Most peach cultivars had a heavy set and the peach crop needed thinning at least twice. There were very few split pits. The orchards should be in good shape heading into the winter even though heavy rains saturated the ground in October. 2006 can be summed up as a very mild winter with a warm growing season.

The nursery tree industry has been experiencing some recent challenges. Due to a change in the change in pull out directives from the CFIA and some uncertainty in the processing peach and pear industry, there was a surplus of nursery trees, especially processing peaches. There will be a shortage of fresh market peach trees available for 2007 sales. We expect to have more trees for 2008, but obtaining bud wood for newer varieties is still a challenge.

Market

Overall, the tender fruit crops were up except for cherries. Fresh market peaches were up 27% over 2005 and about 10% above the 5 year average. Processing peaches were also up 32% over 2005, and about the same as the 5 year average as areas outside Niagara had one of their largest crops. The pear crop also fared very well for both fresh (30% above 2005) and processing markets (53% above 2005). The sour cherry crop experienced the lowest crop in several years - down 62% from the largest crop experienced in 2005. The sweet cherry crop was affected by rain and the crop was reduced slightly by 17%. The Japanese plum crop was the largest in many years with double the crop compared to 2005, while blue plums remained the same. The quality of the fruit crop was excellent as there were lots of sunshine hours and heat to enhance fruit flavours.

Plum Pox Virus

Agricorp and CFIA collected and tested 942,196 *Prunus* samples for PPV from 8,664 orchard blocks in 2006. The number of positive trees found during the summer survey was 610. This is a significant increase in positive finds over last year, but three factors can account for this increase. The summer weather was much more conducive to the discovery of the virus, as the trees were growing more vigorously than they did in the dry and hot year of 2005. Over 500 blocks were sampled at a higher than normal rate as part of a study on viral spread. We know that PPV is very difficult to find, and by taking more samples per tree, the chance of discovering the disease increases. In addition, samples that had a reaction to the ELISA test that was just below the threshold at which they would be declared positive (formerly suspect samples) were treated as positives this year. In the past we have found that a tree that tests suspect will be found positive in future years.

Although this increase causes us concern, if we take into account the average trends since 2000 we are still moving in the direction of reducing the incidence of PPV in Ontario. What has caused us greater concern is the number of newly infected blocks (over 80) that were found this summer that had never tested positive or suspect on a test before.

The International PPV Expert Panel (IEP) met in Niagara Falls on November 1-2, 2006 to review the progress of the Canadian PPV Eradication program and make recommendations to improve the chances of successful eradication. The recommendations given this year include a move back to the removal of entire orchard blocks that are found to be infected above a specific threshold.

The recommendations of the PPV Task Force and the IEP will be considered over the next several weeks in order that a document requesting further funding can be created and approved by senior management. The higher than expected levels of virus found over the last two years, and the related removals of trees (both mandatory and voluntary) have depleted the funds available for financially assisting those growers who are affected by tree removals. CFIA compensation is still available, but the assistance provided by AAFC and OMAFRA has been virtually exhausted.

The nursery and fruit-growing industries are still supportive of a continued eradication effort, but a strong commitment of cooperation is necessary for us to carry on an effective eradication program.

Vineland Renaissance Advisory Panel

An Advisory Panel was initiated by Minister of Agricultural, Food Rural Affairs, Leona Dombrowski this past summer during the Vineland Centennial Celebrations. The panel will be tasked with developing a business case for the future of Vineland and serve as a model for other research stations in the province. Visions include a destination for world class horticultural and food/health related research scientists and an international hub for horticulture research, innovation and commercial activity.

2006 EMERGING ISSUES (not ranked)

1. Plum Pox

Plum Pox still remains the primary concern of the Ontario tender fruit industry. The 2006 International Expert Panel report supports eradication of the virus from the Niagara quarantine zones. Additional financial resources are requested for the program which would allow compensation for growers and resources for increased surveys.

2. Availability of nursery trees

The nursery industry is faced with the challenges of supplying the peach industry with large numbers of virus-free trees to replace the large numbers of PPV-infected trees and blocks that are being removed. It will be 2010-2012 before the Elite mother blocks set up in southwestern Ontario as part of the *Prunus* Certification Program can meet the needs of the industry. The appearance of Plum Pox Virus in two Michigan nurseries has compounded the problem of bud wood availability. Michigan nurseries were historically used as a source of bud wood.

3. Bacterial Canker on Sweet Cherries

Bacterial canker has been diagnosed in a number of Niagara sweet cherry orchards.

4. Sweet Cherries Competition

Annual competition from the United States in 2003-2006 resulted in a flat market for Ontario producers. It is imperative that Ontario producers compete with the US, by optimizing fruit size and firmness through the use of best management practices such as irrigation, fruit thinning, gibberellic acid, and size-controlling rootstocks.

5. Barriers to access of pest management products for minor use crops

URMUR program has been a failure on a number of fronts. Canada is still not harmonized with the US. Canada still requires occupational exposure data. Formulation changes are affecting minor use products, this is a made in Canada issue.

6. Deer damage in tender fruit

Deer damage to tender fruit trees has increased over the past few years resulting in significant losses to the industry.

7. Lack of technical support for breeding program at University of Guelph

The technical support position for the tree fruit breeding program at the Vineland Campus of the University of Guelph is currently vacant. There is no commitment from the University to fill the position due to funding reductions made by the department of Plant Agriculture at the University of Guelph in order to manage the shortfall of the University/OMAFRA contracts.

8. Winter Injury is causing on going crop loss in tender fruits

Although late spring and early autumn frosts can cause considerable damage to tender fruits, winter cold injury has been a more serious problem in recent years. There is a need to continue to investigate the impact of cultural practices on winter hardiness.

9. Roadside salt damage to tender fruit orchards

The province and local municipalities continue to use salt on roads adjacent to farm land. This has resulted in serious damage to fruit trees caused by salt spray. Alternatives to salt need to be researched and tested in order to mitigate the damage and the resulting financial losses being sustained by producers.

10. Renewal of research into micronutrients and transfer of information to grower community

Concerns have been raised about the over-application of micronutrients and the impact of this practice on the tender fruit industry.

Staffing of positions at Agriculture and Agri-Food Canada, Vineland

The Entomology (Toxicology), Entomology (Population Ecologist) and Nematology positions remain vacant and it is impacting the needs of the industry.

2006 SERVICE PRIORITIES (not ranked)

9. Delivery of support pest monitoring services and training if IPM personnel
10. “Tender Fruit Grapevine”, “Hort Matters” newsletters and web based information
11. Plum Pox Virus (PPV) Strategies
12. Safe and Healthy Food
13. Water Quality/Irrigation
14. Sound, Objective Financial Information for Growers
15. Support services for precision agriculture (e. GIS, software information/validation)
16. Water use, quality and conservation. Provision of services to ensure a reliable and high-quality water source is available.
17. Test and evaluate new cultivars and selections. Restructure OFTA and implement a provincial reporting and publishing system for new cultivars.

2006 SERVICE ACTIVITIES

Ontario Ministry of Agriculture, Food and Rural Affairs – Ken Slingerland, Neil Carter, Hugh Fraser, Leslie Huffman, Donna Speranzini, Jim Chaput, Jennifer DeEll, Michael Celetti, Hannah Fraser

Applied Projects (with Growers, Marketing Boards, Processors, U. of Guelph, AAFC, private consultants, etc.)

- CanAdapt Fire Blight Tolerant Pear Trials
- CanAdvance/CRESTech Wind Machine Project, through the Agricultural Adaptation Council of Agriculture and AgriFood Canada. The project will address an emerging issue - to reduce the risk of spring and fall frosts as well as winter injury to grapes and tender fruit. The project ties in air temperatures, wind speed, plant health, a bud sampling program to determine critical temperatures for the plants, and sound level studies. Best Environmental Management Practices information is one of the deliverables for the project to assist in establishing what normal farm practice for this equipment should be.
- Adaptation Measures for the Ontario Fruit Industry due to Climate Change Industry
- Nursery Budwood Program
 1. To coordinate and distribute “best available” PPV-tested budwood to all *prunus* fruit tree nurseries in Ontario.
 2. To assist the industry in the eradication of the plum pox virus by establishing and developing the virus-tested certified budwood block for the industry.
- Cost of Production for Tender Fruit in Ontario
- Evaluating peach cultivars from Michigan
- Lesser and greater peach tree borer monitoring project. Summary: Growers reported increasing difficulty in controlling peach tree borers in recent years. Monitoring showed a much higher level of borers than suggested by anecdotal historical accounts, both in numbers and in length of seasonal activity.
- SR9156 - Synchronizing Nitrogen Fertilization with Plant Demand in High Density Apple and Peach Orchards to Minimize N Losses Through Leaching
- SR9163 - Development of a Web Based Irrigation Scheduler for Ontario Grape and Tender Fruit Industries
- URMULE registrations for stone fruit and pears - Copper spray, Guardsman copper – cherries (bacterial canker)
- Other registrations via URMUR or Joint reviews – stone fruit, pears, Pristine – crop group 12, Stone fruits (*Monilinia*, p. mildew, leaf spot, Anthracnose)
- **There are several active URMULE projects underway with stone fruit, pears**
- The use of SmartFresh™ (1-MCP) technology to improve the quality of Bartlett’ and ‘Bosc’ pears; ‘Shiro’ yellow plums, ‘Fantasia’ nectarines, and ‘Redhaven’ peaches during storage was investigated
- Industry Committees – OMAFRA is represented at many different grower organizations and committees
- Workshops and Presentations – OMAFRA is involved in organizing many workshops and delivering presentations

Publications, Factsheets, Info-sheets, Newsletters

- OMAFRA Publication 360 – Fruit Production Recommendations 2006-2007.
- Reviewed Publication 75, Guide to Weed Control Ch. 15, Weed Management in Grapes & Tree Fruit.
- Editor of the Tender Fruit Grape Vine, 6 issues per year, 600 copies per issue + 100 electronic

- Editors of Hort Matters, a timely electronic/fax newsletter provided to agribusiness
- Article published in New York Fruit Quarterly, British Columbia Fruit Grower magazine and many other grower publications

Other Activities

- Regular “extension” day to day activities – diagnostics for growers, phone calls, emails
- Technical information for business, growers, consultants, other government agencies
- OMAFRA Crops Content Corners - highlights of new content on OMAFRA website of fruit information

Out of Province Travel

- OMAFRA travels to many conferences around the world to bring leading edge technology to delivery to their clients

Private Consultant – KCMS Inc. (Kevin Ker)

KCMS Inc. is an independent private entity that provides unbiased professional advisory services and has no direct affiliation as an agent/employee for any laboratory, supplier, buyer or manufacturer involved with the tender fruit industry. KCMS is the only independent research and service provider that monitors and assesses crops year round across the entire Niagara region for tree fruit and grapes.

KCMS Inc. employs 4 full time staff and 5 seasonal staff (2006) to provide expert research and services in Niagara, Eastern and Southwestern Ontario. These services involve development and delivery of crop nutrition plans and pest management advice to individuals, groups and the industry at large.

INPRAS Consulting, Maria Derkacz

INPRAS Consulting, independent entity, assists tender fruit growers in R&D aiming to improve product quality and profitability. The company investigates feasibility of various technologies (technology transfer/adaptation) customizing methods to particular fruits and environmental conditions. This includes:

- Using trunk girdling to Improve Fruit Size of Early Peach Cultivars (2005/2006)
- Application of Mycorrhiza Technology for Peach Orchard Establishment
- Effect of Misting on Postharvest Peach Fruit Quality

2006 RESEARCH PRIORITIES (not ranked)

1. Plum Pox Research

Plum Pox remains the primary concern of the tender fruit industry. Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency are encouraged to continue research that supports the eradication of this virus from *Prunus* in Ontario. Additional research into pathways of virus transmission and the role of aphid transmission in nearby planted orchards blocks is required immediately. There is an on going requirement for funding to maintain surveys and compensation for growers.

2. IPM including Minor Use for Tender Fruit Crops

Continued research on broad-based IPM programs in all tender fruit crops is necessary to keep the industry competitive. Research on alternative pest controls and new reduced risk products to replace the loss of older products such as organophosphates (e.g. Lorsban) is necessary. In addition, resistance management strategies must be developed to retain new products recently registered that have single site mode of action. The evaluation of unregistered and registered products for the control of new pests, as well as difficult to control pests such as plum curculio on tender fruit is also required.

3. Breeding and germplasm improvement for winter hardiness, resistance to pests, diseases and abiotic stresses

An integrated approach to breeding and germplasm improvement will help sustain the tender fruit industry and maintain the industry’s competitiveness in Ontario such as breeding and germplasm improvement for winter-hardy peach cultivars.

4. Tree Fruit Physiology and Management

Winter injury to tender fruit crops has been a more serious problem in recent years. An integrated approach to conducting orchard physiology and management research will help sustain the tender fruit industry and maintain its prominent place in Ontario.

5. Post-harvest and fruit quality

Several post harvest diseases, uneven ripening and other post harvest disorders cause significant losses to the tender fruit industry each year.

6. Plant nutrition and management of macro and micro nutrients

Research into the best rates of nutrients applied to tender fruit crops to ensure healthy trees as well as the quantity and quality of yields is critical to both sustainable production and the environment. A better understanding of the symptoms of micronutrient deficiencies, the rate of micronutrient imbalances as well as the effectiveness, timing and necessity of applying micronutrients is required by the industry.

Ontario Tender Fruit Research and Services Sub-Committee

2006 Recommendations

TFRSSC 2006-1 Requirement for funding for the Canadian Plum Pox Virus (PPV) Eradication Program

TO: AAFC, CFIA, OMAFRA

Background: The industry has been battling the eradication of PPV since 2000 and the results have been a continued downward trend in the percentage of trees with PPV. Research and improved detection methods have also contributed to the downward trend while compensation to the growers has ensured their cooperation. The current agreement with governments and industry has been depleted of funds mainly because of a large voluntary removal in 2005 and additional surveying and sampling costs.

Recommendation: The TFRSSC recommends that it is imperative to secure immediate funding for PPV eradication program, to prevent further hardships to the industry. The lack of knowledge on the funding situation has severely impacted grower, nursery, processing and marketing planning.

TFRSSC 2006-2 Establish new Ontario Fruit Testing Association (OFTA)

TO: OMAFRA, University of Guelph

Background: OFTA is an organization that tests new selections and cultivars and has existed for many years in South West Ontario until it was relocated and renamed in the mid 1990's. Due to existing contracts between Interplant and the University of Guelph, OFTA has been unable to propagate a large enough number of trees for testing and consequently has operating in a deficit situation for the last few years.

Recommendation: The TFRSSC recommends that the industry requires an OFTA "like" organization which will continue to test and evaluate new cultivars and selections suitable for Ontario growing regions. TFRSSC recommends a task force be established to assist OFTA to redefine its' goals, priorities and profitability.

TFRSSC 2006-3 New research positions at AAFC

TO: AAFC (cc. SCPFRC Research Manager, Science Director, Director General and Assistant Deputy Minister)

Background: Growers rely on research and recommendations for control of pests, diseases and nematodes in order to maintain a high level of fruit production. Several pests and diseases have been identified by TFRSSC, and IPM of pests and diseases is included in the research priorities of this committee. Vacant positions are not being refilled by

AAFC and when they are, they are refilled at other locations in the country and lack the research dealing specifically with the tender fruit crops.

Recommendation: The TFRSSC recommends that AAFC provides support for the needs of the industry by creating new research positions in Nematology, Entomology and Pathology at AAFC Vineland site.

TFRSSC 2006 -4 Support for the Vineland Renaissance

To: OMAFRA, AAFC, Brock University, University of Guelph, Ontario Grape Growers, Landscape Ontario, Floriculture Industry, Ontario Apple Industry OHCRSC, OTFPMB, CanGro Foods, Inc., NPF&VGA

Background: The Vineland Renaissance Advisory Panel needs continued support from all organizations to rebuild the Vineland Research Station. The research and extension capacities at Vineland have diminished in recent years with building closures and reductions in staff. Growers rely on research and extension for control of pests, diseases and nematodes; crop production advice and all other aspects of production in order to maintain a competitive level of fruit production.

Recommendations: The TFRSSC recognizes that any rejuvenation of the Vineland Research Station must be a collaborative effort and as such recommends that AAFC, University of Guelph, OMAFRA, OTFPMB, CanGro Foods Inc., NPF&VGA, shipper/dealers and the rest of the industry continue to give their support and co-operation to the Vineland Renaissance Advisory Panel in their efforts in rebuilding the Vineland Research Station.

TOMATOES

QUICK REFERENCE – OTRSS Issues & Priorities

	Emerging Issues		Research & Services Priorities	
	Processing	Fresh market	Processing	Fresh market
1	Bacterial disease	Fruit quality	Access to Crop Protection Materials/Minor Use Registrations	Access to Crop Protection Materials/Minor Use Registrations
2	Waste management of culled and extracted fruit	New and emerging pests (eg. spider mites – 2005)	Breeding and Cultivar Development	Fresh Market Tomato Quality
3	Irrigation/ fertigation scheduling and tomato quality (solids, colour disorders)	Bacterial disease	Integrated Pest Management in Field Tomatoes	Breeding and Cultivar Development
4	Identification and registration of bacterial disease control and transplant growth regulators	Waste management of culled and extracted fruit	Crop Water Management Through Irrigation and Fertigation	Integrated Pest Management in Field Tomatoes
5	Water volumes and application pressures in field and greenhouse pesticide application	Irrigation/ fertigation scheduling and tomato quality (cracking, colour disorders)	Soil Fertility and Crop Nutrition	Crop Water Management Through Irrigation and Fertigation
6	Phytophthora	Identification and registration of bacterial disease control and transplant growth regulators	Transplant Quality	Soil Fertility and Crop Nutrition
7	Water rights	Water volumes and application pressures in field and greenhouse pesticide application	Availability of Suitable Land and Land Selection	Transplant Quality
8	New and emerging pests (eg. spider mites – 2005)	Phytophthora		Availability of Suitable Land and Land Selection
9		Water rights		

State of the Industry:

The 2006 season had a cool wet start and continued to stay like this through most of the growing season. Precipitation was more than average and temperatures were moderate.

Accumulated Rainfall for Southern Ont May 1-Oct 2

	2006 May 1- Oct 2	Normal Oct 31	% of Normal
Barrie	373.4	504.3	74.0%
Delhi	521.5	520.7	100.2%
Hamilton	441.5	481.2	91.7%
London	458.3	512.5	89.4%
North Bay	529.0	594.1	89.0%
Ottawa	564.2	506.4	111.4%
Ridgetown	425.2	505.0	84.2%
Sarnia	392.8	466.7	84.2%
Thunder Bay	332.5	479.3	69.4%
Toronto	352.2	442.3	79.6%
Trenton	401.2	447.9	89.6%
Vineland	395.6	460.7	85.9%
Waterloo	481.0	489.1	98.3%
Wiarton	313.5	501.4	62.5%

Accumulated CHU Southern Ont May 1-Oct 2

	2006 May 1- Oct 2	Normal Oct 31	Difference
Barrie	2773.0	3092.0	-319.0
Delhi	3147.8	3409.0	-261.2
Hamilton	3187.6	3339.0	-151.4
London	3219.9	3299.0	-79.1
North Bay	2797.9	2634.0	163.9
Ottawa	3172.8	3302.0	-129.2
Ridgetown	3202.3	3665.0	-462.7
Sarnia	3227.8	3420.0	-192.2
Thunder Bay	2464.4	2396.0	68.4
Toronto	3423.4	3301.0	122.4
Trenton	3244.8	3222.0	22.8
Vineland	3420.8	3664.0	-243.2
Waterloo	2950.0	3094.0	-144.0
Wiarton	2859.3	2834.0	25.3

The combined farm value for processing and fresh market acres in Ontario for 2005 was \$77,820,000. This was up 7.9% from \$72,118,000 in 2004. Fresh market value made up a large % of the increase with the processing industry being down slightly, according to OMAFRA figures.

a) Processing Tomatoes

Acreage and contracted tons were down in 2005 for processing tomatoes. The final yield set a new record for Ontario. Approximately 200 were left unharvested with most processors using most of their tonnages despite the large crop.

Table 1: Recent trends in the processing tomato industry in Ontario. (Sources: OPVG, OMAFRA)

Windsor	531.5	493.2	107.8%	Windsor	3706.9	3878.0	-171.1
---------	-------	-------	--------	---------	--------	--------	--------

Year	Contracts	Measured Acres	Processed Tonnage	Avg. Yield (tons/ac)	Gross Farm Value
1996	222	15,940	502,000	31.2	\$52,475,000
1997	192	14,800	497,000	33.3	\$50,310,000
1998	183	15,060	562,000	37.0	\$58,942,000
1999	187	16,866	544,940	32.0	\$57,286,000
2000	173	15,818	450,490	28.4	\$44,233,000
2001	173	16,821	533,440	31.6	\$50,866,000
2002	176	17,126	618,830	36.2	\$62,015,000
2003	173	14,863	540,968	36.4	\$53,149,000
2004	169	16,464	651,890	39.6	\$61,218,000
2005	166	16,375	651,697	39.8	\$59,520,000p
2006		15,276	627,858	41.1	N/A

p = preliminary. N/A = not available.

The growers of the Ontario Tomato Seedling Growers' Marketing Board (OTSGMB) produced approximately 200 million seedlings in 2006, down from 216 million in 2005.

In 2006, transplant growers continued to follow a bacterial disease management protocol set out by the OTSGMB. This included five applications of copper for bacterial disease control. Most field growers also focused on applying copper early and often. It is generally felt that these measures have been beneficial in managing bacterial disease.

Some bacterial disease was detected in the 2006-growing season. In some areas the damage reduced yields. In most areas the plants were able to grow through the small amount of disease and produce a record crop.

Cool wet conditions that should have made disease growth prominent did not seem to promote growth more than other years. Colour and solids were lower this year due to the amount of rainfall that was received. However most processors were able to hit budgeted numbers needed. Peeled tomato recovery was excellent. Increased precipitation in the harvest season made it difficult at times to harvest the crop but a record yield was still possible. Again in 2006, the research and infrastructure in place (breeding, transplant production systems, irrigation, production and harvesting practices, and processing capabilities) allowed the industry to overcome adverse conditions and produce and process a high yielding crop.

The tomato harvest began August 15th and processing finished by early-October.

b) Fresh Market Tomatoes

Table 2: Recent trends in the fresh market tomato industry in Ontario. (Source: OMAFRA)

Year	Harvested Acres	Farm Value
1994	6,308	\$36,705,000
1995	5,217	\$26,454,000
1996	5,714	\$22,603,000
1997	5,500	\$19,800,000
1998	2,325	\$10,865,000
1999	2,200	\$11,400,000
2000	2,230	\$12,490,000
2001	2,560	\$14,480,000
2002	2,600	\$10,000,000
2003	2,500	\$10,900,000
2004	1,800	\$10,900,000
2005	2,500	\$18,300,000
2006	N/A	N/A

N/A = not available.

Fresh Market acreage saw a cold start to the season with frost causing problems with some acreage. Approximately 5-10% of the crop had to be replanted due to cold weather. The season went relatively well although there were some weather issues with the harvest season. Prices firmed up in the market in the later part of the season due to losses in Florida. Yields were good and disease and insect pressure was minimal this year. A small amount of early blight was detected and some weather checking was seen on the fruit. Food safety has become even more important for growers with audits required by Loblaw's for the 2006 season. Sobey's will also be requiring audits for the 2007 season and wide spread audits are expected for all chains in 2007.

Emerging issues/concerns (Processing Industry):

1. **Bacterial disease.** Although this is certainly not a new problem, current strategies and available products do not reach the level of efficacy needed by the industry. An action plan involving research, production, and industry activities implemented in 2003 has been beneficial. More effective control products, more reliable commercially available diagnosis, and more research are needed.
2. **Waste management of culled and extracted fruit.** This has become a more challenging and costly issue for tomato growers and processors in recent years.

3. **Irrigation/fertigation scheduling and tomato quality (solids, colour disorders).** Questions remain about irrigation levels, cut off dates, and other factors influencing solids. How can we optimize solids, quality, and yield with drip irrigation and fertigation? Research is underway to try to provide answers. Maximizing water use efficiency is also a priority.
4. **Identification and registration of bacterial disease control and transplant growth regulators.** Systemic Acquired Resistance (SAR) products exist which have the potential to reduce bacterial disease problems. Growth regulator products have been identified which could revolutionize transplant production and advance harvest by up to a week. This would dramatically increase the competitiveness of the Ontario processing tomato industry. To date, no progress has been made in registering these products for use in the Ontario processing tomato industry.
5. **Water volumes and application pressures in field and greenhouse pesticide application.** Do high-pressure field sprayers cause damage and disease infection? What is the optimum water volume for greenhouse and field copper applications? Are growers achieving effective coverage with fungicides and insecticides under current practices?
6. **Phytophthora.** Phytophthora blight (*P. capsicii*), affecting peppers, tomatoes, and vine crops has become a major pest issue in neighbouring states. The disease has been found in peppers in Ontario and is expected to become a major disease in vine crops as well. Tomatoes are susceptible to this disease, and rotations with vine crops, such as cucumbers, would be a problem if the disease became established. Screening for fungicides with efficacy against this pest, in co-operation with U.S. efforts, is essential. This work needs to be done before there is an Ontario outbreak. Pathologists feel that an Ontario outbreak is inevitable.
7. **Water Rights.** New legislation, regulations under development, international agreements will need to be monitored as to how they may impact the Ontario agriculture industry's access to water. This includes "Watershed Based Source Protection Planning" (see Ministry of Environment - <http://www.ene.gov.on.ca/envision/water/spp.htm>) and "Protecting Great Lakes Basin Waters" (see Ministry of Natural Resources - <http://www.mnr.gov.on.ca/mnr/water/greatlakes/index.html>).
8. **New and Emerging Pests** The lack of access to new pesticides in Canada gives Ontario growers a very limited range of choices for pest control. In many cases, no pesticide options are available for new and emerging or existing pests. With reductions in research funding and retiring researchers not being replaced, there is concern that sufficient infrastructure is not in place to deal with new and emerging pest problems.
9. **Replacement of Pest Management Research Positions**
In recent years and years to come there has been a trend in the amount of research positions that have become or are becoming vacant. Our committee feels that there needs to be some proactive planning to allow research to continue at the level that has been developed over the past years. It is necessary to bring new researchers with field experience to help the industry remain as one of the leaders in the world in the research sector.

Emerging issues/concerns (Fresh Market Industry):

1. **Fruit Quality.** Weather checking is a major problem for fresh market growers every year, causing losses in marketable yield of up to 60%. Other disorders causing quality problems include grey wall, blotchy ripening, cat facing, and fruit cracking. Post harvest technology is another area where research is needed.
2. **New and Emerging Pests (eg. spider mites – 2005).** See *Processing Industry*, above.
3. **Bacterial disease.** Although this is certainly not a new problem, current strategies and available products do not reach the level of efficacy needed by the industry. Many of the strategies implemented by the processing industry are also beneficial for the fresh market industry. More effective control products, more reliable commercially available diagnosis, and more research are needed.
4. **Waste management of cull fruit and vegetable waste.** This has become a more challenging and costly issue for tomato growers in recent years.
5. **Drip irrigation/fertigation scheduling and tomato quality.** Questions remain about irrigation levels, cut off dates, and other factors influencing yield and quality. Maximizing water use efficiency is also a priority.
6. **Identification and registration of bacterial disease control and transplant growth regulators.** Systemic Acquired Resistance (SAR) products exist which have the potential to reduce bacterial

disease problems. Growth regulator products have been identified which could revolutionize transplant production and advance harvest by up to a week. This would increase returns to Ontario fresh market tomato growers. To date, no progress has been made in registering these products for use in the Ontario tomato industry.

7. **Water volumes and application pressures in field and greenhouse pesticide application.** See *Processing Industry*, above.
8. **Phytophthora.** See *Processing Industry*, above.
9. **Water Rights.** See *Processing Industry*, above.
10. **Replacement of Pest Management Research Positions** See *Processing Industry*, above.

Research & Service Issues/Priorities:

There is a need for ongoing funding to support research and service (technology transfer) activities in support of the Ontario tomato industry. The following highlights the research and service issues.

Research & Service Issues/Priorities (Processing Industry):

1. Access to Crop Protection Materials/Minor Use Registrations.

Improved access to newer, safer, more environmentally friendly and biocontrol materials through the URMULE and URMUR programs is required. The following concerns need to be addressed.

1. Canadian growers require equal access to new pest control products and plant growth regulators available in the US and this can be accomplished with shared registration, residue levels, preharvest intervals, and re-entry intervals set at the same time and at the same levels as the US. Canada still has a number of registration requirements unique to Canada which increases the cost of Canadian registrations, slows the process and often results in denial of access to products in Canada.
2. The registration process needs to be speeded up so that Canadian farmers have access to the newer products at the same time as their US counterparts.
3. Adequate funding for the URMULE and URMUR programs is required.
4. GLP compliant facilities need to be available to ensure that residue and other data development work to support minor use registrations in Ontario that are not funded by AAFC may be carried out.

2. Breeding and Cultivar Development.

The availability of suitable cultivars is essential for the tomato industry to continue in Ontario. The Ontario breeding program has been a key factor in maintaining the competitiveness of the processing industry and has played a major role in yield and quality advances made over the last 15 years. Current research efforts are addressing the opportunities that will continue to provide a basis for sustained development of the Ontario processing tomato industry. Emphasis should be placed on earliness, disease and pest resistance, reduction in mould counts, fruit firmness, peeled colour, and field storage capability and field and factory yield. Bacterial diseases have been a persistent industry problem and breeding to select for field resistance (horizontal resistance) should be emphasized

3. Integrated Pest Management in Field Tomatoes.

The sustainability of the tomato industry depends on safe, blemish free produce. Continued research efforts are needed to address the current and new insects, diseases and weeds that compete with the production of tomatoes. The focus should be to identify safe and effective pest control materials such as herbicides, fungicides and insecticides, their proper rates, timing and application. Ongoing support into IPM development and delivery of IPM programs in Ontario are required.

The following are the issues that need to be addressed:

1. Bacterial diseases are persistent problems for both processing and fresh market growers. The development of diagnostic tools and management/control strategies, including biological control,

- greenhouse sanitation, disease screening of seed and improved methods for detection of bacterial diseases in seed and transplants is a high priority.
2. New pest (insect, disease, weed) control product development should remain a focus for tomato research in Ontario.
 3. Adequate diagnostic services for the identification of insects, diseases and weeds. An improved diagnostic service for bacterial diseases is required (PCR based).
 4. Erosion of IPM support by the public sector.
 5. Lack of control of variegated cutworm is a concern. Resistance testing is required. A degree-day model for variegated cutworm is also required.
 6. Improved use of the Ontario Weather Network for delivery of pest modelled information, IPM programs, irrigation scheduling.
 7. Pesticide and greenhouse sanitation registrations for the greenhouse tomato seedling industry.
 8. The organic market for both fresh and processing tomatoes is generating interest. There is essentially no research to assist any of these growers to adopt this technology.
 9. Food safety.
 10. Effect of new cultural practices on pest management.
 11. Effect of production practices on productivity of soils.

4. Crop Water Management Through Irrigation and Fertigation.

Research in the area of crop water management through efficient and environmentally benign irrigation and fertigation techniques is required.

The following areas require more research:

1. Efficient use of irrigation water to maximize yield and quality. More research is needed on scheduling of drip irrigation for tomatoes on a variety of soil types. What is the effect on tomato fruit quality such as soluble solids? What is the cost effectiveness of fertigation?
2. Water use restriction. Under drought conditions, water use restrictions are likely. More research is required to determine the critical stages for irrigation and to determine the impact on yield, quality and crop returns with restrictions on water use at various times.
3. Water quality. More research is required in the area of impact of irrigation water quality on yield and crop quality and food safety concerns.
4. Irrigation use expansion - availability of water sources.

In addition to these research activities, legislation which may have an impact on agricultural water use will need to be monitored and actions may be needed through the extension service.

5. Soil Fertility and Crop Nutrition

Soil fertility and crop nutrition research including evaluating current recommendations through crop response research (crop uptake/removal of nutrients and effects on nutritional aspects of tomato), assessments of nutrient application technology, best management practices, nutrient application timing and the environmental fate of essential crop nutrients, with particular attention to nitrogen and phosphorous, is required.

The following areas require more research:

1. Basis for the phosphorous recommendations. The nitrogen and potassium recommendations have had some work in the past 10 years, but few if any people appear to know the basis for the phosphorous recommendation. The phosphorous recommendation needs to be updated.
2. Losses/leaching. Information on the loss of nitrogen through leaching and other means during and after the crop and the use of cover crops to trap nitrogen is required.
3. Split application. Information on the efficient use of fertilizer and how to use split applications of fertilizer to best advantage with the least impact on the environment is required. The question of fertigation with many scheduled feedings is part of this.
4. Reduced tillage. The impact of reduced tillage on nutrient management is required.

5. Cover crops. Information on the uptake and predicting the release of nutrients is required.
6. Manure use and organic amendments. How does this impact on nutrient planning?
7. Fruit quality and fertilizer recommendations.

6. Transplant Quality

High quality healthy transplants are essential for a successful tomato crop. Continued research into crop management and pest management systems for the plug transplant crop is required.

Plant growth regulators have the potential to improve transplant health, transplant quality, and field establishment. Research on plant growth regulators has also indicated the potential for harvest to be advanced by several days. Plant growth regulators may also play a role in enhancing disease control when used in combination with disease control products. Further research is needed to identify compounds which can be registered in Canada and to determine how to use these products for maximum benefit.

7. Availability of Suitable Land and Land Selection.

Some of the yield enhancement that has occurred in the last several years has resulted from growers renting or purchasing land that has never been used for tomato production. This land produces heavy crops of tomatoes for the first few times it is used, but production seems to decline rapidly after the 2nd or 3rd crops. Cost effective methods to combat the 'replant syndrome' should be investigated, including proper field selection, tillage systems, irrigation and fertility practices, the use of soil amendments including cover crops, fumigation, different crop rotations and choice of herbicides.

Research & Service Issues/Priorities (Fresh Market Industry):

1. Access to Crop Protection Materials/Minor Use Registrations.

See *Processing Industry*, above.

2. Fresh Market Tomato Quality.

Weather checking is a major problem for fresh market growers every year, causing losses in marketable yield of up to 60%. Other disorders causing quality problems include grey wall, blotchy ripening, cat facing, and fruit cracking. Post harvest technology is another area where research is needed.

3. Breeding and Cultivar Development.

The availability of suitable cultivars is essential for the tomato industry to continue in Ontario. Most fresh market tomato cultivars used commercially in Ontario were developed outside our growing area, such as in the southern U.S. Emphasis should be placed on earliness, disease and pest resistance, fruit quality, good shipping and shelf life characteristics, and yield. Bacterial diseases have been a persistent industry problem and breeding to select for field resistance (horizontal resistance) should be emphasized

Cultivar evaluation for fresh market tomatoes should also continue. Growers need trial information to help them select cultivars well adapted to our growing conditions and market requirements.

4. Integrated Pest Management in Field Tomatoes.

See *Processing Industry*, above.

5. Crop Water Management Through Irrigation and Fertigation.

Research in the area of crop water management through efficient and environmentally benign irrigation and fertigation techniques is required.

The following areas require more research:

1. Efficient use of irrigation water to maximize yield and quality. More research is needed on scheduling of drip irrigation and fertigation for tomatoes on a variety of soil types. What is the effect on tomato fruit quality and yield? What is the cost effectiveness of fertigation?
2. Water use restriction. Under drought conditions, water use restrictions are likely. More research is required to determine the critical stages for irrigation and to determine the impact on yield, quality and crop returns with restrictions on water use at various times. How can water use efficiency be maximized?
3. Water quality. More research is required in the area of impact of irrigation water quality on yield and crop quality and food safety concerns.
4. Irrigation use expansion - availability of water sources.

In addition to these research activities, legislation which may have an impact on agricultural water use will need to be monitored and actions may be needed through the extension service.

6. Soil Fertility and Crop Nutrition

See *Processing Industry*, above.

7. Transplant Quality

Technology Transfer Priorities:

Technology transfer activities occur through a number of channels. In the processing tomato industry, OMAFRA, Ridgetown College – University of Guelph, AAFC – Harrow and London, processing companies, the Ontario Tomato Seedling Growers' Marketing Board (OTSGMB), and the Ontario Processing Vegetable Growers (OPVG) all play a part in disseminating information.

In the fresh market tomato industry technology transfer occurs through OMAFRA and some growers' associations. Less technology transfer occurs through researchers, as there is very little research funding available to allow them to work on fresh market tomatoes.

Consultants and agribusiness are involved in technology transfer in both the fresh market and processing industries.

A key aspect of technology transfer over the next few years will be transferring information on new crop protection products - where they fit in, and how to use them effectively. Many new reduced risk products will require higher levels of management skill and more intensive scouting to be used effectively and to avoid the development of resistance. They may need to be used in combination with other pest management techniques in order to provide adequate control.

MEMBERSHIP

Ontario Horticultural Crops Research and Service Committee 2006 Membership

Annette Anderson Chair OMAFRA Crop Technology Branch 1 Stone Rd. West, Guelph, Ontario N1G 4Y2 Phone: 519-826-3286 Fax: 519-826-3567 annette.anderson@ontario.ca	Stuart Budd OMAFRA Research and Innovation Branch 1 Stone Rd. West Guelph, Ontario Phone: 519-826-4189 Fax: 519-826-4211 stuart.budd@ontario.ca
Ron Pitblado U of G Ridgetown College, University of Guelph Main Street East Ridgetown, Ontario N0P 2C0 Phone: 519-674-1605 Fax: 519-674-1600 rpitblad@ridgetownc.uoguelph.ca	Rene Van Acker Chair University of Guelph Department of Plant Agriculture, University of Guelph Guelph, Ontario N1G 2W1 Phone: 519-824-4120 X 53386 vanacker@uoguelph.ca
Bill Curnoe U of G Kemptonville College, University of Guelph Kemptonville, Ontario K0G 1J0 Phone: 613-258-8349 Fax: 613-258-8477 bcurnoe@kemptonvillec.uoguelph.ca	Hugh Berges OMAFRA Crop Technology Branch 1 Stone Rd. West, Guelph, Ontario N1G 4Y2 Phone: (519) 826-3288 Fax: 519-826-3567 hugh.berges@ontario.ca
John Finlay OMAFRA Crop Technology Branch 1 Stone Rd. West, Guelph, Ontario N1G 4Y2 Phone: 519-826-6491 Fax: 519-826-3567 john.finlay@ontario.ca	Harold Schooley, OFVGA Research Committee Chair Ontario Fruit and Vegetable Growers' Association Elmira Rd. Guelph, Ontario 355 Elmira Road North, Unit 105 Guelph, Ontario N1K 1S5 (519) 763-6160 (519) 763-6604 fax schooley@kwic.com
John O'Sullivan University of Guelph Simcoe Campus 1283 Blueline Rd. P.O. Box 587	Charles Brisco CFIA Canadian Food Inspection Agency 709 Main St. W. Hamilton, ON

Simcoe, Ontario N3Y 4N5 Phone: 519-426-7127 ext. 336 josulliv@uoguelph.ca	Phone: Fax: briscoc@inspection.gc.ca
Mike Dixon, Chair Dept. of Environmental Biology University of Guelph Guelph, Ontario N1G 2W1 Phone: 519-824-4120 Ext. 52555 Fax: 519-837-0442 mdixon@uoguelph.ca	Scott MacDonald Specialty Products Manager BASF Canada 9 Pamela Place Guelph ON N1H 8C8 ph: 519.824.2724 macdonsr@basf.com
Gary Whitfield Agriculture and Agri-Food Canada Greenhouse and Processing Crops Research Centre Phone: 519-738-2251 ext. 402 Fax: 519-738-3756 whitfieldg@agr.gc.ca	Mary Ruth McDonald University of Guelph Department of Environmental Biology Phone: 519-824-4120 ext. 2791 Fax 519-767-0755 mrmcdona@uoguelph.ca
Dr. Dan Brown Agriculture and Agri-Food Canada Southern Crop Protection and Food Research Centre 131 Sandford St. N5V 4T3 London, Ontario Phone: (519) Fax: (519) 457-3503 brownd@agr.gc.ca	Irwin Smith /Jamie Albers Flowers Canada (Ontario) 355 Elmira Rd. N. Unit 107 Guelph, Ontario N1K 1S5 Phone: 836-5495 ext 222 Fax: 836-7529 Irwin@fco.on.ca Jamie@fco.on.ca
Tony DiGiovanni,/Christoph Kessel Executive Director Landscape Ontario 5th Line Milton, Ontario 1-800-265-5656 tony@landscapeontario.com christoph.kessel@landscapeontario.com	Kristen Callow General Manager Ontario Greenhouse Vegetable Growers' 245 Talbot St. W. Leamington, Ont. N1H 6N8 (519) 326-2604 phone (519) 326-7842 fax callow@ontariogreenhouse.com

Ontario Horticultural Crops Research and Services Subcommittee Chairs 2006

Annette Anderson

Chair

Ontario Horticultural Crops Research and Services Committee
Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
1 Stone Rd. W. 3rd Floor
Guelph, Ontario
N1G 4Y2
Phone: (519) 826-3286
Fax: (519) 826-3567
annette.anderson@ontario.ca

Subcommittee Chairs:

Agroforestry Naresh Thevathasan, Research Associate / Special Graduate Faculty Dept. Of Environmental Biology University of Guelph Guelph, Ont. Canada N1G 2W1. Phone: (519) 824-4120 X52565 Fax: (519) 837-0442 nthevath@uoguelph.ca	Apiculture and Pollination Geoff Wilson Ontario Beekeepers Association RR 1 Seeley's Bay ON K0H 2N0 Phone: (613) 387-3171 Fax: (613)-387-3171 beekeeper@honeypco.ca
Apple Jennifer DeEll OMAFRA Simcoe, Ontario Phone: (519)426-1408 Fax (519) 428-1142 jennifer.deell@ontario.ca	Berry Adam Dale University of Guelph Dept. of Plant Agriculture, University of Guelph, Simcoe, Ontario Phone: 519-824-4120 ext. 52792 or 519-426-7127 x333 adale@uoguelph.ca

Crucifer Crops Michael Brazeau Engage Agro Corp. 848 Gordon St. Guelph, Ontario N1G 1Y7 Phone: (519) 826-7878 ext 33 Fax: (519) 826-7675 michaelbrazeau@engageagro.com	Ginseng * Jan Schooley OMAFRA Simcoe Resource Centre Blueline Rd. and Hwy #3 P.O. Box 587 Simcoe Ontario N3Y 5N5 Phone: 519 426-4323 Fax: 519 428-1142 jschooley@ontario.ca * this committee deals with Technical Working Group reporting requirements for the Ontario Pest Management Research and Services Committee
Grape and Wine Kevin Ker KCMS Inc. 5 Park Road North Grimsby, Ontario L3M 2P2 ((05) 945-8228 (905) 945-2144 kker@brocku.ca	Greenhouse & Protected Crops* Gillian Ferguson OMAFRA Harrow Research Station Harrow, Ontario N0R 1G0 Phone: 519-738-2251 ext 406 Fax: 519-738-4564 gillian.ferguson@ontario.ca * this committee deals with Technical Working Group reporting requirements for the Ontario Pest Management Research and Services Committee
Greenhouse Floriculture* Bernie Grodzinski University of Guelph Department of Plant Agriculture Guelph, Ontario N1G 2W1 (519) 824-4120 X 53439 bgrodzin@uoguelph.ca * this committee deals with Technical Working Group reporting requirements for the Ontario Pest Management Research and Services Committee	Low Acreage and Special crops Jim Todd OMAF RA Schafer Rd., Box 186 Delhi, ON N4B 2W9 Phone: (519) 582-7220 X264 Fax: (519) 582-4504 jim.todd@omafra.gov.on.ca
Nursery, Landscape and Turf * Jennifer Llewellyn OMAFRA Edmund Bovey Building	Potatoes Sam Squire 109 Hutchison Drive Alliston, Ontario

University of Guelph Guelph, ON N1G 2W1 Phone: (519) 824-4120 Ext. 52671 Fax (519) 767-0755 Jennifer.llewellyn@ontario.ca * this committee deals with Technical Working Group reporting requirements for the Ontario Pest Management Research and Services Committee	L9R 1M4 Phone:(705) 435-4438 Fax: ((705) 435-5661 sam.squire@sympatico.ca
Root, Bulb and Leafy Vegetables Jennifer Allen OMAFRA Crop Technology 1 Stone Rd. W., 1st floor, Guelph, ON, N1G 4Y2 Phone: 519-826-4963 Fax: 519-826-3567 jennifer.allen@omafra.gov.on.ca	Sweet Corn, Pea and Bean Darren Robinson University of Guelph Ridgetown College Agronomy Building P.O. box 400 Ridgetown, Ontario NOP 2CO Phone: (519) 674-1604 Fax: (519) 674-1600 drobinso@ridgetownc.uoguelph.ca
Tender Fruit Ken Slingerland OMAFRA 4890 Victoria Avenue, Box 8000 Vineland Station, Ontario L0R 2E0 Phone: (905) 562-1639 Fax: (905) 562-5933 ken.slingerland@ontario.ca	Tomato Janice LeBoeuf OMAFRA Ridgetown Resource Centre Agronomy Building P.O. Box 400 Ridgetown, Ontario NOP 2CO Phone:(519) 674-1699 Fax: (519) 674-1564 janice.leboeuf@ontario.ca

ACRONYMS

AAFC: Agriculture and Agri-Food Canada
AAFC-GPCRC: Greenhouse and Processing Crops Research Centre - Agriculture and Agri-Food Canada
AFB: American Foul Brood
AFHRC: Atlantic Food and Horticulture Research Centre
APF: Agriculture Policy Framework
CARC: Canadian Agri-Food Research Council
CCOVI: Cool Climate Oenology and Viticulture Institute
CFIA: Canadian Food Inspection Agency
EPA: Environmental Protection Agency
EVb: Environmental Biology, University of Guelph
GAP: Good Agricultural Practices
GIS: Geographical Information Systems
GLP: Good Laboratory Practices
IPM: Integrated Pest Management
LCBO: Liquor Control Board of Ontario
MALB: Multicoloured Asian lady beetle
MFTIP: Managed Forest Tax Incentive Program
MNR: Ministry of Natural Resources
NMP: Nutrient Management Planning
NRC-IRAP: National Research Council - Industrial Research Assistance Program
NSERC: National Science Engineering and Research Council
OAC: Ontario Agricultural College
OAG: Ontario Apple Growers
OASCC: Ontario Agricultural Services Coordinating Committee
OBA: Ontario Beekeepers' Association
OBGA: Ontario Berry Growers' Association
OF&VGA: Ontario Fruit and Vegetable Growers' Association
OFGGMB: Ontario Fresh Grape Growers' Marketing Board
OFM: Oriental Fruit Moth
OGGA: Ontario Ginseng Growers' Association
OGVG: Ontario Greenhouse Vegetable Growers
OHCRSC: Ontario Horticultural Crops Research and Services Committee
OMAFRA: Ontario Ministry of Agriculture, Food and Rural Affairs
OMSPA: Ontario Maple Syrup Producers' Association
OPMRSC: Ontario Pest Management Research and Services Committee
ORBLVRSC: Ontario Root, Bulb and Leafy Vegetable Research and Services Committees
OSCIA: Ontario Soil and Crop Improvement Association
OTFPMB: Ontario Tender Fruit Producers Marketing Board
OTSPGMB: Ontario Tomato Seedling Plant Growers' Marketing Board
PCR: Polymerase Chain Reaction
PMRA: Pest Management Regulatory Agency
PPV: Plum Pox Virus
SCPFRC: Southern Crop Protection and Food Research Centre, Agriculture and Agri-Food Canada
SHB: Small Hive Beetle
SONG: Society of Ontario Nutgrowers
TFRSSC: Tender Fruit Research and Services Subcommittee
URMULE: User Request Minor Use Label Expansion
URMUR: User Requested Minor Use
US FDA: United States Food and Drug Administration
VQAO: Vitner's Quality Alliance Ontario
WCO: Wine Council of Ontario
WTO: World Trade Organization