

CANADIAN APPLE INDUSTRY RESEARCH AND DEVELOPMENT STRATEGY (Final)

2007



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CANADIAN HORTICULTURAL COUNCIL
CONSEIL CANADIEN DE L'HORTICULTURE



Agriculture and
Agri-Food Canada

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Agroalimentaire Canada

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Background: The Canadian Apple Industry

In 2005 Canada produced approximately 400,000 metric tonnes of apples at a farm gate value of \$130,000,000 (Statistics Canada, 2006). This production is concentrated in Ontario (43% of production), British Columbia (31%), Québec (16%), and the Maritimes (10%).

Apple production has been and continues to be a key contributor to Canada's horticultural sector. The need for a Canadian apple industry is demonstrated clearly by the strong market that exists for Canadian apples. Canadian producers have no trouble selling the apples that they grow, and research shows that consumers want to buy Canadian. Like other agricultural sectors, the Canadian apple industry is vital to Canada's economic success.

However, apple producers are receiving returns that are below their costs of production and the industry has been facing a number of significant challenges over the last few decades. These include:

World oversupply: Huge production increases in China, which represent about one third of the total world production, are displacing North American exports to Asian markets and driving prices down. The excess supply is squeezing the U.S. out of the Asian market, resulting in the U.S. expanding its share of the Canadian market and flooding its own market with low-priced apples. Exports to the United States, our largest foreign market, have declined significantly, as a result.

Foreign penetration of the domestic market: The increasing penetration of foreign apples from the United States, Chile, New Zealand, South Africa and Argentina into the Canadian market are shrinking domestic growers' share of the market and lowering prices. In terms of quantity, Canada now imports significantly more apples than it did 10 years ago.

Weather-related disasters: The 1990s brought more than the usual number of extreme weather conditions to Canadian producers, varying from severe drought, hail, sun damage, winter thaws and the ice storm of 1998 in areas of Ontario and Quebec. The trend towards extreme weather patterns has so far extended into the new millennium. Drought-reduced crops have almost become a pattern over the last four or five years.

Static consumption: Consumption of apples has remained static over the last fifteen years, while market share for other fruits – notably imports such as bananas, mangoes, melons, papayas, citrus, guavas, pineapple, and others – has been rising steadily. Although fruit consumption overall is on the rise, apples face greater competition in the marketplace than ever before.

Retailer consolidation and category management: The number of major retail buyers in Canada has been declining, as a result of acquisitions driven by the advantages of economies of scale. With so few grocery retailers, power is concentrated in just a few entities. The loss of a major account by a Canadian supplier means the loss of access to a significant part of the market. The supply lines to major chains are becoming increasingly fixed. Retail buyers at national chains want "one-stop shopping" when it comes to stocking their stores. This structure makes it easier for foreign competitors to enter the market.

The Canadian apple industry has responded by re-planting with newer cultivars, such as Gala, Gingergold, Ambrosia and Honeycrisp, to meet changing retail and consumer demands. Planting systems are also evolving rapidly - high-density orchard systems with trees planted on dwarfing rootstocks have allowed apple producers to increase the numbers of trees per acre and grow higher quality fruit more efficiently on less land. Storage technology allows for improved quality and extended storage capability to allow more flexibility in meeting retail demands. Many packing and storage facilities are now HACCP certified and some have developed on-farm food safety guidelines. The industry has implemented integrated pest management (IPM) programs, which has led to a dramatic reduction in pesticide use over the last several decades, and under the coordination of the Canadian Horticultural Council developed a national Integrated Fruit Production (IFP) program, which promotes the on-going development and adoption of sustainable production methods.

However, the Canadian apple industry continues to face many production, pest management and marketing challenges. These exist in the face of an on-going and significant reduction in federal research dollars for production agriculture and a reduction in technology transfer to farmers due to dramatic down-sizing of provincial government crop/pest management specialists over the last decade and a half.



Identifying Our Research Needs

In January 2007 the CHC Apple Working Group coordinated a national apple research workshop in which representatives from the apple industry, provincial extension and research staff and consultants laid out the framework for a national research strategy to assist the industry in identifying key research priorities.

Development of a national research strategy for the Canadian apple industry complements AAFC's science priorities and functional capacity to conduct science and research under the Agricultural Policy Framework. Research is needed in a number of APF areas, including Environment, Food Safety and Quality, Science and Innovation, including opportunities for value-added products and operations.

The Canadian apple industry's development and adoption of national Integrated Fruit Production (IFP) guidelines plays a strong role in helping prioritize the establishment of research priorities. IFP is a whole farm approach to farming, which promotes sustainable agriculture through economic viability, environmental responsibility and societal well-being. Specifically, the link between a national research strategy for apples and the national IFP project is complementary and corresponds directly to APF pillars as follows:

Environment: Ecologically-friendly, sustainable practices are the cornerstone of IFP. These range from minimizing use of pesticides to effective land stewardship to providing the consumer with a safe and healthy product. IFP entails trials and research on the effects of best/beneficial practices, environmental impact modeling and measurement, postharvest technology, etc.

Food Safety and Quality: On-farm food safety is a key component, and quality fruit is the ultimate end goal of any IFP program. Cultivar and rootstock evaluation, replant trials, food safety systems evaluation, are examples of the important areas requiring further research and development.

Science and Innovation: Developments in the areas of disease resistance through breeding, gene-mapping and genetic modification show promise for reducing environmental impacts of pesticide uses in orcharding. As well, further research of nutraceuticals and bioproducts processing will provide additional value-added opportunities for the industry. Lining up of industry priorities with AAFC's science themes under the APF will ensure a consistent industry-government approach to research.

Renewal: IFP as a whole represents a plan for the future sustainability of the industry, which includes technology transfer and adoption of new systems (eg. higher density planting of new varieties to improve crop management). IFP includes elements of grower training, mentoring, networking and information-sharing, as well as working on a continuum of changing practices to improve performance.

This Canadian apple industry research strategy is intended as a living document, and as such, will need to be updated on a periodic basis. It is anticipated that this exercise will produce a list of short-term and long-term strategies for the Canadian apple industry. Short-term strategies will have to be reviewed annually, while long-term strategies will be reviewed every 3 to 5 years. These reviews and updates will be coordinated by the CHCs Apple Working Group, in partnership with provincial apple associations.

CANADIAN APPLE INDUSTRY VISION STATEMENT

To enhance the sustainable production of high quality, safe and nutritious apples and apple products for domestic and export markets, through science and innovation.



Goals of the National Apple Research Strategy

The development of a national research prioritization process and strategy will assist our industry in clearly identifying our short-term and long-term research needs and convey those to the proper research and regulatory institutions. Specifically, development of a national research prioritization and strategy for the Canadian apple industry will:

1. Provide consumers and global markets with the highest quality, safe and nutritious fruit in the world.
2. Increase global competitiveness through research, leading to improved products and production strategies.
3. Protect the environment, including human health and safety, through research leading to reduced pesticide use, enhanced land stewardship practices and promoting the consumption of local food to Canadians to reduce greenhouse emissions.
4. Provide Agriculture and Agri-Food Canada (AAFC), and other research institutions, with clear national research priorities for the Canadian apple industry.
5. Provide the Pest Management Regulatory Agency (PMRA) with current information on reduced risk pesticide industry needs.
6. Increase and enhance partnerships between researchers and industry, and encourage interdisciplinary research directed by needs from producer to consumer.

Fit of the National Apple Research Strategy within the Agricultural Policy Framework

Overall, the development of a national research strategy for the Canadian apple industry has the potential to complement several objectives of several APF elements:

1. Reduction of agricultural risks by implementing good environmental practices, which can increase the profitability of the industry through enhanced market access and value-added marketing, while benefiting the environment. The Canadian apple industry recognizes that agriculture must co-exist sustainably with the natural environment to ensure its long-term vitality and profitability.
2. Technology transfer to accelerate the greater adoption of Good Agricultural Practices (GAPs) by the industry to reduce agricultural impacts on the environment.
3. The apple industry continues to build on existing food safety measures while also investigating new approaches to enable the tracing of food products back to the farm, improve food quality and share critical information. These measures will improve the sector's ability to identify and respond to food safety issues and concerns, while improving market access and opportunities for the sector.
4. Consistent industry-government prioritization of research needs under the Agricultural Policy Framework's 2006 science themes.

Research and Development Priorities of the Canadian Apple Industry

The following are the identified research and development needs of the Canadian apple industry, based on results of the national apple industry strategic planning workshop held January 12th, 2007 in Toronto, as well as consultations with various sectors of the industry (including provincial grower associations, wholesalers, retailers, researchers, provincial extension staff and private consultants).



New Variety and Rootstock Development

APF Science Theme: Sustainable Production Systems

a) Development and adoption of new apple cultivars

New cultivars that break through onto retail shelves demand a higher price, providing higher profit margins for apple growers that are able to supply these cultivars to the food chain. There is a need for on-going development and adoption of new cultivars with high consumer visual and sensory appeal, and which are not prone to bruising and have a good shelf-life.

From a production point of view, ideally, new cultivars should have a number of grower-friendly traits – i.e. compatible with dwarfing rootstocks, exhibit annual bearing, have manageable growth habits, exhibit disease resistance, be hardy in various geographic production areas, and provide niche opportunities.

Research and Development Needs:

- Support and expand breeding programs to develop cultivars that are adapted to Canada’s diverse growing regions. Current breeding programs at the following must be maintained at AAFC-Summerland and AAFC-Saint-Jean-sur-Richelieu, and evaluations of controlled crosses at AAFC – Kentville and AAFC- Bouctouche
- Promising cultivars under development need to be field-tested in different geographic apple production areas in Canada.
- AAFC researchers should expand collaboration with international agencies (i.e. exchange of plant material/field test results).
- AAFC should actively monitor pace of genomic (apple gene) mapping internationally for potential opportunities

b) Rootstock development

Development and testing of rootstocks for Canadian conditions needs to be expanded. Canadian apple growers require dwarfing rootstocks that exhibit precocity, winter hardiness, disease (e.g. fire blight) and insect (e.g. wooly apple aphid) resistance, etc.

Research and Development Needs:

- Evaluate apple rootstocks to determine those best suited to the various Canadian apple growing regions.
- AAFC should collaborate with international rootstock developers and access rootstocks with desired traits for testing under Canadian geographical conditions.



Increase Fruit Quality and Yield through Cultural Practices and Postharvest Management

APF Science Theme: Sustainable Production Systems

a) Annual production of quality fruit

There is intense competition for shelf-space due to the fact that there is a surplus of apples being produced throughout the world, resulting in greater foreign penetration of the market, and retailer consolidation. To compete, Canadian apple growers must continually advance their orchard management practices in an effort to produce the highest apple quality and yield possible, in an effort to maximize a higher farm gate value. Apple growers are also annually challenged by various climactic, physiological and economic conditions.

Research and Development Needs:

- On-going research to develop the ideal planting systems, densities and canopy management of standard and new cultivars to allow early and high production of quality fruit under Canadian conditions.
- Regionally increase the emphasis on production level pomology and pest management research by AAFC.
- On-going research with plant growth regulators to allow maximum production of quality fruit.
- Research into optimal nutrient/fertilizer programs to maximize storage life of fruit.
- To meet increasing market demand, organic production systems for apples must be developed for Canadian conditions.
- Develop improved pesticide application technologies and machinery to aid in thinning, pruning and harvesting.
- Development of enhanced knowledge of optimum harvest timing for new cultivars via development of prediction models.
- Develop strategies to decrease the amount of bruising that occurs at harvest and in transport.

b) Maintain fruit quality in storage

Produce buyers are becoming more demanding with excess supply to choose from and quality problems such as bruising, internal browning, low sugars, low fruit pressure, 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.

Research and Development Needs:

- Ongoing evaluation of new compounds and technologies to improve fruit quality and maintain fruit firmness
- Research into further reducing decay and fruit losses due to storage rots
- Develop optimum handling and storage recommendations for new cultivars (e.g. Honeycrisp, Ambrosia)
- Develop methods to measure and monitor internal quality for specific cultivars.



Develop and Implement Sustainable Pest Management Strategies

APF Science Theme: Environment

Integrated pest management has been widely adopted by Canadian apple growers resulting in the reduction of pesticide use by more than 50% over the last few decades. The development and adoption of the national Integrated Fruit Production guidelines has also been a positive development and will potentially provide more avenues for meeting increasingly demanding requirements by buyers.

Due to the imminent threat of the loss of some broad-spectrum pesticides (e.g. organophosphates and carbamates) apple growers are looking to incorporate reduced risk pesticides into their current IPM programs. Although reduced risk pesticides are more environmentally friendly, there are a number of barriers to their commercial adoption – these include their specificity resulting in possible additional sprays for other major pests and the potential increase of secondary pests, need for enhanced knowledge of monitoring and timing of product, and higher costs as compared to more conventional products.

There is also an increasing interest in organic production of apples. Small pockets of organic orchards already exist (e.g. Similkameen Valley in BC, Grey County in ON) but production and pest management technology is largely lacking for producers that wish to grow organic apples.

Research and Development Needs:

- Evaluate reduced risk products under commercial conditions and find fit in current IPM programs
- Establish baselines for resistance testing of reduced risk products and evaluate resistance for reduced risk products in the field.
- Conduct regional evaluations for the development of resistance to fungicides (e.g. S.I.s, strobilurins, and dodine).
- Conduct regional evaluations of IFP production systems to determine environmental and economic benefits, and increase grower adoption
- Develop and evaluate organic pest management strategies.
- Evaluate efficacy and fit of new products in integrated fire blight strategies, to attempt to reduce use of streptomycin.
- Evaluate effects of cultural management tools (e.g. mulching, pruning, Apogee) on pest populations, disruption technologies for management of lepidopterous pests, and biological management of pests and introduce methods of conserving native populations.
- Increase the level of apple IPM and toxicology research by AAFC to reflect the importance of the industry to the Canadian economy at a regional/provincial level.

Value-added Food, Wellness Products and Industrial Uses

APF Science Theme: Bioproducts, Food Safety and Quality

Apples are a versatile fruit that can be eaten fresh, cooked, baked, grilled, pureed, juiced, dried, frozen, sliced, and used as a garnish or as a component of various culinary dishes. The disease-fighting profile of apples provides a multitude of health benefits, including a potential decreased risk of cancer and heart disease. Several recent studies suggest apples may provide a “whole-body” health benefit. A number of components in apples, most notably fiber and phytonutrients (e.g. polyphenols, flavonoids), have been found in studies to lower blood cholesterol and improve bowel function, and may be associated with a reduced risk of ischemic heart disease, stroke, prostate cancer, type II diabetes and asthma. These attributes provide opportunities for new marketing avenues. Apples also have potential for use in cosmetics and pharmaceuticals.

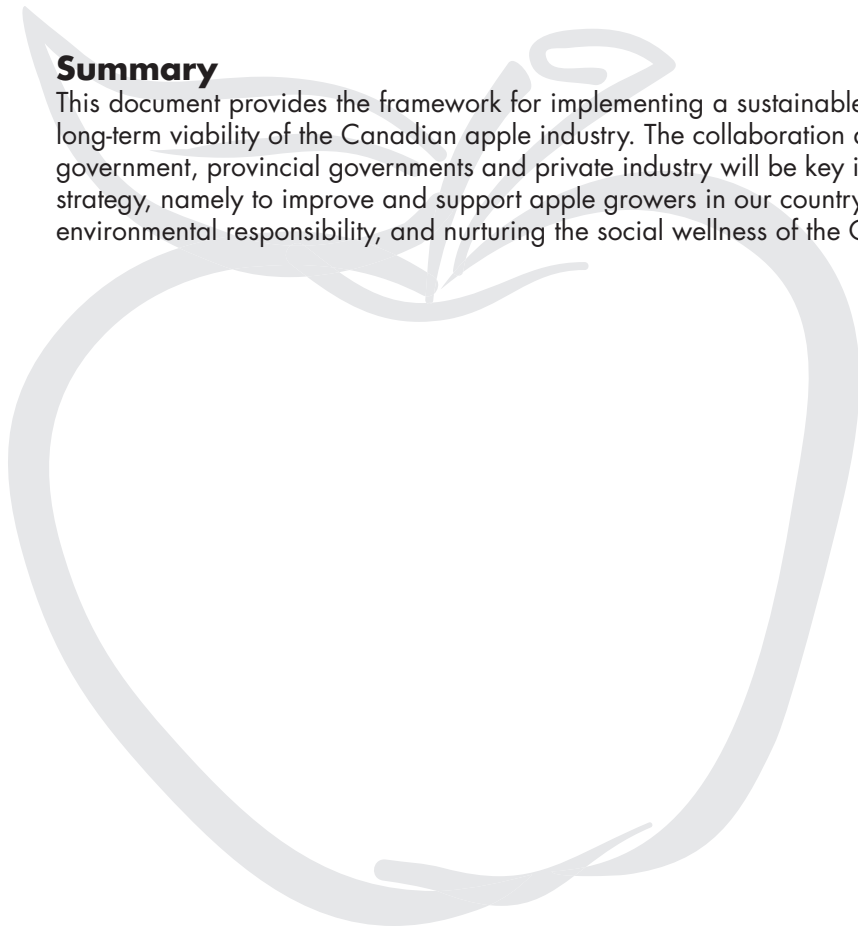
Research and Development Needs:

- Develop new apple-based foods
- Develop uses for apples in industrial products, cosmetics, and food additives.
- Study flavonoids in apples as an integral antioxidant of the human diet, due to their demonstrated strong anti-carcinogenic activity and inhibition of tumor cell proliferation, as a method to help market the health benefits of apples.
- Develop consumer friendly packaging and value-added products.
- Develop technology to reduce browning, and improve packaging and handling of apple slices for fresh sale.



Summary

This document provides the framework for implementing a sustainable research and development strategy plan to ensure the long-term viability of the Canadian apple industry. The collaboration and partnership between the apple industry, the federal government, provincial governments and private industry will be key in implementing and bringing to fruition the goals of the strategy, namely to improve and support apple growers in our country by improving the economic viability, strengthening the environmental responsibility, and nurturing the social wellness of the Canadian apple industry.



Appendix I: Canadian Horticultural Council Apple Working Group Strategic Planning Workshop Report

Friday, January 12, 2007

Toronto Airport Hilton

Participants

- Bill Craig, Horticulturalist, AgraPoint International, NS
- Dela Erith, Executive Director, Nova Scotia Fruit Grower's Association, NS
- Doug Nichols, Grower and NSFGA research, NS
- Mélanie Noël, Agente D'information, Fédération des Producteurs de Pomme du Québec, QC
- Steve Levasseur, Chair, CHC Apple Working Group and Grower, QC
- Stephanie Levasseur, Grower, QC
- Gérald Lussier, Grower, QC
- Vincent Phillion, Pathologist, IRDA, QC
- Daniel Cormier, Entomologist, IRDA, QC
- Harold Schooley, Grower and Research Chair, Ontario Apple Growers, ON
- Murray Porteous, Grower and Chair, Agricultural Research Institute of Ontario, ON
- Brian Gilroy, Grower and Director, Ontario Apple Growers, ON
- Cathy McKay, Grower, Consultant and Director, Ontario Apple Growers, ON
- Ken Wilson, Consultant, ON
- Margaret Appleby, IPM Systems Specialist, OMAFRA ON
- John Gardner, Apple Specialist, OMAFRA, ON
- Kathryn Carter, Apple IPM Specialist, OMAFRA, ON
- Glen Lucas, General Manager, BC Fruit Growers Association, BC
- Joe Sardinha, Grower and President, BC Fruit Growers Association, BC

Staff

- Amy Argentino, Project Coordinator, Canadian Horticultural Council, Ottawa
- Anne Fowlie, Executive Vice President, Canadian Horticultural Council, Ottawa

Consultant

- Bernie Solymár, EarthTramper Consulting Inc.

Facilitator

- Lyn Russo, Lyndan Communications, Welland, ON

Welcome and Presentations

Welcome –

Steve Levasseur, Chair, Apple Working Group, Canadian Horticultural Council

Introduction –

Bernie Solymár, EarthTramper Consulting Inc.

Apple Research in Canada –

Dr. Brian Freeze, National Program Coordinator, Sustainable Production Systems, AAFC, Ottawa



Brainstorming

The exercise was for each participant to generate as many ideas as they could about what needs to be done regarding research for the Canadian apple industry. The task was to write each idea on a post it note and put them up on a wall in random order.

The facilitator invited participants to organize the post-it notes into clusters of ideas and then she helped complete the task with the following results.

Reduced Risk Strategies	Pesticide Resistance	Pesticide Application/ Delivery	Diseases
Reduced risk products/ OP replacements (6)	Scab resistance (5)	Pesticide application technology (4)	Fire blight (3)
Maintaining consulting service & IPM support (3)	Pesticide resistance (4)	Improve spray application technology (1)	Powdery mildew (1)
	Codling moth resistance (2)		Apple replant disease (1)
			Alternatives to chemical fumigants (2)

Pest Management Systems	Insects	Organic Systems	New Cultivar /Rootstock Development
Integrated fruit production (1)	Developing plum curculio traps (1)	Organic fruit production in East (2)	Apple breeding using new selection methods (e.g. gene markers) (2)
Biocontrol agents (2)	Thresholds for PC (1)	Organic management of scab (1)	Rootstock research (1)
Non-pesticide alternatives (1)	Codling moth research (1)	Pest management tools for organic apple production (3)	International collaboration of researchers re. breeding work (1)
Pesticides and impact on beneficials (1)	OBLR research (3)	Organic alternatives to chemical thinners	Regional cultivar and rootstock evaluations (6)
Development of IPM programs (2)	Woolly apple aphid (2)		Disease resistance testing and new cultivars (3)
Apogee & affect on insect populations (1)	Plant bugs (3)		Genomics of health constituents of apples (1)
Habitat management to improve biocontrol (1)	European apple sawfly (10)		
Wildlife control techniques (1)	Dogwood and clearwing borer (1)		
Mating disruption products (2)			

Crop Load Management/ PGRs	Fruit Quality And Yield	Mechanization and Technology	Adaptation to Climate Change
Increase yields (3)	Improve fruit quality from orchard to supermarket (1)	Machines to aid in harvesting/picking (1)	How to improve environmental friendliness – soil, air, water (2)
Tree canopy management for improved quality (1)	Nutritional studies as to how relate to quality and storage (6)	Development of machinery for leaf litter removal (1)	Carbon sequestration and apple trees as carbon sinks (3)
Orchard floor management (1)	Reduce russetting (1)	Robotics for thinning, pruning, harvest and grading/packing (1)	Effects of climate & climate adaptation research (2)
Thinner research – safer, reduce biennial bearing (3)			
Crop load management (3)			

Value-added Food, Wellness Products, and Industrial Uses	Post-Harvest Quality	New Packaging	Non-destructive Testing for Internal Quality
Apple bio-product development (3)	BMP to optimize apple bin sanitation (2)	New concepts for consumer packaging	Research on non-destructive measurement of internal fruit quality (4)
Research on health benefits (e.g. anti-toxicants, increased consumption) (5)	Non-chemical alternatives for PH diseases (2)		
Apple by-product for industrial uses (1)	Storage evaluation system to improve food quality (4)		
Apple slices research (2)	R&D for storage handling (2)		
Development of value-added uses for cull apples (1)			



Marketing Strategies	Regional Research Infrastructure	Communication and Liaison	Economics
How can we compete with the global market (2)	Lack of AAFC commitment to more researchers on apple in Eastern Canada – need to increase staff and \$\$ (6)	Encourage national liaison, communication and collaboration of AAFC apple researchers (2)	Increasing returns to growers (4)
Coordinated marketing of apples (growers and packers) (3)	Increase in pest management research (1)	Encourage international liaison, communication & collaboration between researchers (2)	Increasing labour efficiencies (1)
Promotion of locally produce (1)	Development of breeding program(s) in Eastern Canada by AAFC (2)	Grower communication via newsletters, workshops, etc. (1)	Develop cost of production models (1)
Labelling laws for fruit to be re-written (1)	Regional primary production research in Eastern Canada needed (3)	Need for strong extension/consultant networks (3)	
Researching consumer cultivar preferences (2)	On-farm demonstrations of new technologies (2)	Convince governments about the importance of agriculture (1)	
Develop low-cost IFP certification and promotion (1)	PMRA develop science-based decisions for re-entry periods (1)		

The next task was for participants to break into small groups, one for each theme, with representation from geographic and areas of expertise, where possible. Each group identified duplications and like ideas, distilling the list to the common denominators. They wrote this list on flip chart paper.

Choosing Priorities

Each participant was provided with six red dots and asked to vote for the themes that were most important to them. They could choose to put all six dots on one theme or spread out the dots among as many as six themes.

The themes below are listed in order based on the number of votes each received.

Sustainable Production	Pest Management	Value-Added Innovation	Communication/ Marketing/ Economics
New Cultivar/Rootstock Development (10)	Reduced Risk Strategies (13)	Value-added Food, Wellness Products, and Industrial Uses (16)	Marketing Strategies (13)
Organic Systems (6)	Pesticide Resistance (6)	Post-Harvest Quality (7)	Regional Research Infrastructure (13)
Crop Load Management/PGR (6)	Pesticide Application/Delivery (5)	New Packaging (2)	Communication (btw. researchers, tech transfer, & consumer education) (10)
Fruit Quality & Yield (6)	Diseases (4)	Non-destructive Testing for Internal Quality (2)	Farm Profitability and Sustainability (5)
Mechanization and Technology (4)	Pest Management Systems (e.g. IFP, organic) (1)		
Adaptation to Climate Change (2)	Insects (WAA, OBLR, CM, etc.) (1)		

This was followed by an extensive discussion about which themes should be discussed further. The participants finally agreed upon the following:

- Value-added Food, Wellness Products, and Industrial Uses
- Reduced Risk Strategies/Pest Management
- New Cultivar/Rootstock Development
- Pre- and Post-Harvest Quality/Yield
- Crop Load Management/Plant Growth Regulators
- Mechanization and Technology

Participants were invited to join a small group dealing with the theme that interested them the most. Groups formed for each theme with the exception of Mechanization and Technology. The themes of “pre- and post harvest quality/yield” and “crop load management/PGRs” were combined and addressed by one group.

Action Steps

The final exercise was to flesh out each theme and start developing action steps. Each small group reported back to all participants on its recommendations. The results are provided in the following tables.

