COABC Research Needs Study

Prepared for

Certified Organic Associations of British Columbia (COABC)

Prepared by

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Executive Summary

This study was initiated by the Certified Organic Associations of B.C. (COABC) to assess the research needs of organic producers in the province.

The opinions of producers were collected through a combination of interviews and workshops, and analyzed and condensed to prepare the prioritized and annotated list of areas of interest presented in Table 3. The definition of research was expanded to include many topics beyond primary agronomic research in order to include the various interests presented to us.

The highest ranked priority, and the common thread connecting the very diverse interests and needs of the province's organic growers, is *soil fertility and management.* Other issues were ranked in order of their relative importance to the organic community as a whole, even though different groups or sectors may see these issues as less or more important.

In order to better understand these diverse interests, we have looked at some characteristics of the B.C. organic community itself. The needs and interests of B.C. producers appear to diverge according to 'product volume' and 'market focus'. Those producers with larger volumes of products concentrating on mass markets have more interest in, and generally are already involved with, formal agronomic research; producers working with more local markets, more diverse product lines, or smaller total volumes are more concerned with other business and socio-economic issues.

We have also reviewed other research needs studies and information sources to corroborate the findings from our participatory process. Although research methodologies, analyses and reporting styles vary widely, the issues discussed in all were remarkably similar in spite of the varying degrees of maturity of the organic industry in different countries. The ranking of these issues, in terms of importance to the local organic producers, does vary from study to study, and will no doubt vary over time as the industry undergoes the changes inherent in exponential growth.

In addition to the prioritized list of areas of interest in Table 3, we have recommended organizational and procedural changes that will assist the B.C. organic community to develop a research and education agenda in the short term, and ultimately accommodate the evolving professional development needs of producers.

Finally, this report suggests the possibility of inclusion of all the actors and sectors of organic production in the province by way of a subtle but important change in approach, that of focusing on investment in industry human resources, rather than exclusively on investment in research projects.

1. Introduction

The Certified Organic Association of British Columbia (COABC) 'research needs study' was initiated in February 2003. COABC, an umbrella organization that represents organic certification organizations (COs) in British Columbia, has been guided by a province wide strategic planning process completed in 2002. This strategic planning process coincided with a funding award of one million dollars from the Agri-Food Futures Fund (AFFF) to initiate the Organic Sector Development Program. This program distributes the AFFF funding on a cost-sharing basis and according to the strategic priorities.

The Organic Sector Development Program (OSDP) is a three-year initiative running from the 2002/2003 to 2005/2006 fiscal year. The strategic plan has set out a general funding framework totalling 2.3 million dollars. The strategic planning process identified three main goals, which cover many of the most relevant and present issues facing the organic sector in B.C.:

• Forty-five to sixty-five percent of the fund[1] is allocated to projects addressing production capacity.

• Thirty to forty percent of the fund is assigned to marketplace development and promotion.

• Five to ten percent is assigned to environmental stewardship projects.

The AFFF funds must be matched by industry with in-kind and cash contributions on a 50:50 basis, according to recent government research funding directives. Research projects addressing production capacity have been allocated between $450,000 and $650,000 from the AAFF fund[2] and will be matched with an equal amount from industry. This research needs study was given initial parameters that included roughly *one million dollars over three years* of funding, following the above accounting ($450,000 to $650,000 from AFFF plus equivalent from industry), and the broad goal of investigating potential projects that would *increase production capacity within the organic sector* of B.C.

The stated justification for funding research projects that will increase production capacity, taken from the Strategic Plan (OSDP Strategic Plan 2002, p. 3), is that "increased capacity is needed for the growth of the British Columbia market. Increased production will stimulate infrastructure development which will in turn enhance quality and encourage further market growth." The strategic plan is partially predicated upon the perception that "domestic organic production is insufficient to meet the strong consumer demand" and that "…present and future demand far outstrips supply in most commodities…and demand continues to be filled by imported products" (OSDP Strategic Plan 2002, p. 1,2).

The Strategic Plan has outlined a number of initial projects under the *production capacity* goal that are to be funded with both OSDP cash and partner (in-kind and cash) funding. These are:

1) A labeling handbook that outlines provincial and federal regulations with $1,280 OSDP cash funding (80% of total),
2) A technology transfer project (CyberHelp) that provides information technology training for producers and an on-line information resource with $30,000 OSDP cash funding (7.5% of total),
3) A brand name list that will provide up-to-date listing of organic inputs and Canadian brand name equivalents with $1,600 OSDP cash funding (80% of total),
4) This research needs study with $28,000 OSDP cash funding (80% of total),

[1] The 'fund' refers to a conglomerate of sector contributions, private funding, government programs and the AFFF Organic Sector Initiative funding. This fund totals 2.3 million dollars of which a portion is considered in-kind funding. Please review the strategic planning document for a more thorough outline of this funding.

[2] The funding provided from the AFFF cash fund will be referred to as 'OSDP cash funding' from hereon.

5) A project to improve farm planning tools with OSDP cash funding of $5,000 (33% of total),
6) A 'Canada Organic Initiative' that provides general base funding for advocacy with OSDP cash funding of $8,000 (80% of total),
7) Initial and general base funding for projects that explore improved access to capital and land for organic industry purposes with OSDP cash funding of $10,000 (50% of total).

Specific partners have been identified for four of these projects including the Pacific Agricultural Certification Society, the University of British Columbia, the Organic Agricultural Centre for Canada, the B.C. Farm Business Management Council, the B.C. Ministry of Agriculture and Agri-Food, and Human Resources Development Canada. The other three projects have only identified sectors that may be interested in partnering.

A careful interpretation of the seven prescribed projects and the general parameters of the research needs study shows that a number of priorities have already been assigned to the *production capacity* funding. The dollar values assigned to the different projects also indicate some of the weighting of priorities. The other significant project already underway is a marketing research and plan development project under the second strategic theme. This project has received $120,000 with OSDP cash funding of $60,000. Because of this strategic plan, this research needs study was directed to look at production capacity issues generally and primary agronomic research specifically. The results of our research identify some specific agronomic research needs, but also include other issues of equal or greater importance to the organic producers who participated with us in this project.

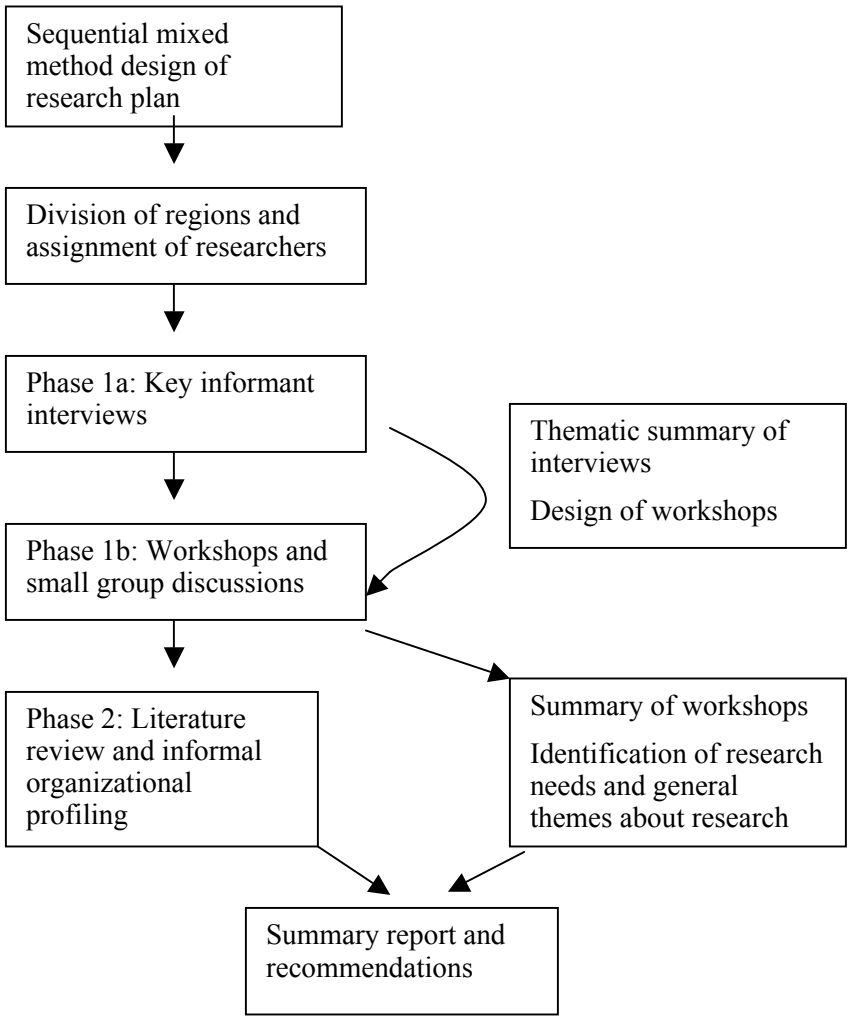
Many different factors affect the ability of a farm business or sector to 'increase production capacity'; among them: infrastructure development, technology transfer, access to information, access to capital (and land), regulatory constraints or benefits, organizational change, communications capabilities, business planning capabilities, marketing improvements, etc. as well as primary production research and information.

Different sectors and different regions of the province will have different needs depending on their proximity to new markets, stability of existing markets, influx of new organic producers, conversion to organic of existing conventional producers, and degree of current technological and research investment. This study will present findings from a series of interviews and workshops held across the province. The findings from this research indicates that some producers have specific production research needs that address quality and efficiency issues, while other producers have needs that fall well outside the realm of primary agronomic research. The stated industry strategy to 'increase production capacity' does not fit the business plans or interests of other producers. This report will strongly emphasize the need to expand the definition of 'research' to properly focus energy and finances on projects and issues that will *drive the industry for the benefit of all producers*.

2. The research process

This study uses three main techniques in the research process. Key informant interviews, group workshops, and secondary data collection through literature review and organizational profiles all provided important information at different stages throughout the research. The 'sequential mixed method design' used qualitative methods for primary data collection in the first stage of work and some quantitative research in the second stage. Figure 1 below diagrams the different stages of research used in this study.

Figure 1: The research process



Data collection

Phase one of the research included key informant interviews and a series of workshops or small group discussions. The key informants were determined by each of the researchers in the four regions of the province; the majority were organic producers. They were selected with a purposive sampling method, i.e. several were contacted based on prior knowledge of their interest or involvement with their particular sector and these participants were in turn able to direct the researchers toward other potential participants. The sample of key informants was not random and was not selected to be statistically significant. Each

of the key informants was asked questions based on a common set of questions (Appendix 1) and these questions varied only because of the particular sector in which the participant was involved. The workshops were held after the completion of the interviews. The design of the workshops was based on the results and key findings from the interview stage. Each workshop consisted of an average of ten participants, generally from five to twelve people and often included some of the key informants from the interview stage as well as additional people based on interest. These workshops were organized by the researchers in each of the four regions, in conjunction with in-kind support from a small number of certification organization representatives. The workshops used common focus group techniques with a facilitated discussion aided by participant handouts. Appendix 2 provides a copy of the handouts used in each of the workshops.

Regional variation

This research needs study is tasked with examining the needs of producers across the province, and in the many different organic sectors. The province was arbitrarily divided into four regions, and a separate researcher from the research team focused his/her efforts in each region (see Table 1).

Table 1: Research regions in British Columbia

Region	**Researcher**	**Main organic sectors**
Fraser Valley and Vancouver Island	Sarah Davidson	Ground crops, berries, tree fruit, poultry, dairy
Kootenays and South Okanagan	Oscar Somasco	Tree fruits, ground crops, beef, dairy
North Okanagan, Cariboo/Thompson	Elaine Spearing	Ground crops, tree fruits, seed providers, beef
Prince George, Peace River	Bill Smith	Beef, grain, poultry, ground crops

Organic producers in each of the regions of the province have a diversity of interests, although there are important regional differences. There is a focus on tree fruits in the South Okanagan/ Similkameen region, on ground crops in the North Okanagan and Thompson regions, and the Fraser Valley has a large number of producers and a high concentration of organic ground crop production, dairy and poultry producers, and berry producers. Vancouver Island mirrors this concentration although there are fewer producers. The Prince George and Peace River region has the fewest number of certified organic producers and the largest acreage in organic production, focused mainly on beef and grain production. Small dairy, beef, greenhouse, seed, herb, nursery, specialty field crop, ground crop and specialty livestock producers are scattered throughout each region. An important challenge in the research process was accounting for the differences in size of certified organic operations and the marketing foci of producers in each region. There is as much difference between the same sectors in different regions of the province as there are between different sectors. For example, the ground crop producers in the Kamloops area are relatively small, focused on local and direct marketing outlets, and generally have a broader business focus, while many of those in the Fraser Valley have larger production volumes and market into larger distribution channels. The research needs of these two groups are considerably different and this point will be elaborated upon in this report.

3. Setting the stage

At the outset of our work for this project, each of our researchers became immediately aware of the many different understandings of the current state and future direction of the organic sectors in British Columbia. There was a noticeable difference in the topics discussed at the various workshops, depending on the regional and the sectoral interests of the majority of participants. Some workshops consisted of producers well established in their sector, with larger operations and seasonal employees, and who placed considerable emphasis on marketing. These producers discussed issues such as the need to increase production to meet falling premiums, and to open new market channels.

In other workshops, attended mostly by 'small' producers[3], the primary concern was human resource constraints. Marketing was an issue, but was generally focused on penetrating local markets and maintaining the integrity of farmers' markets and home box delivery operations. These producers were most concerned about limitations of time and labour required for the scale of their operation. Very often a family team was doing most of the labour, accounting, and marketing as well as maintaining one or two off-farm jobs. These two producer characterizations are presented for illustrative purposes and can be seen as opposite ends of a continuum (see Figure 2). Many of the producers in the province fall somewhere along this continuum.

Another theme across the workshops was certification as a driver of increased marketing penetration and increased production capacity versus other, more process-driven models for the organic sector.

Some participants felt that certification and the accompanying COABC branding program (the checkmark), or better, a Canadian organic branding program, encouraged or could encourage new consumer loyalty. Stringent certification, improved labeling and handling procedures, increased food safety protocols, combined with grower or grower agent branding would ensure marketplace acceptance and increased market penetration. We will refer to this as a 'product-driven' approach.

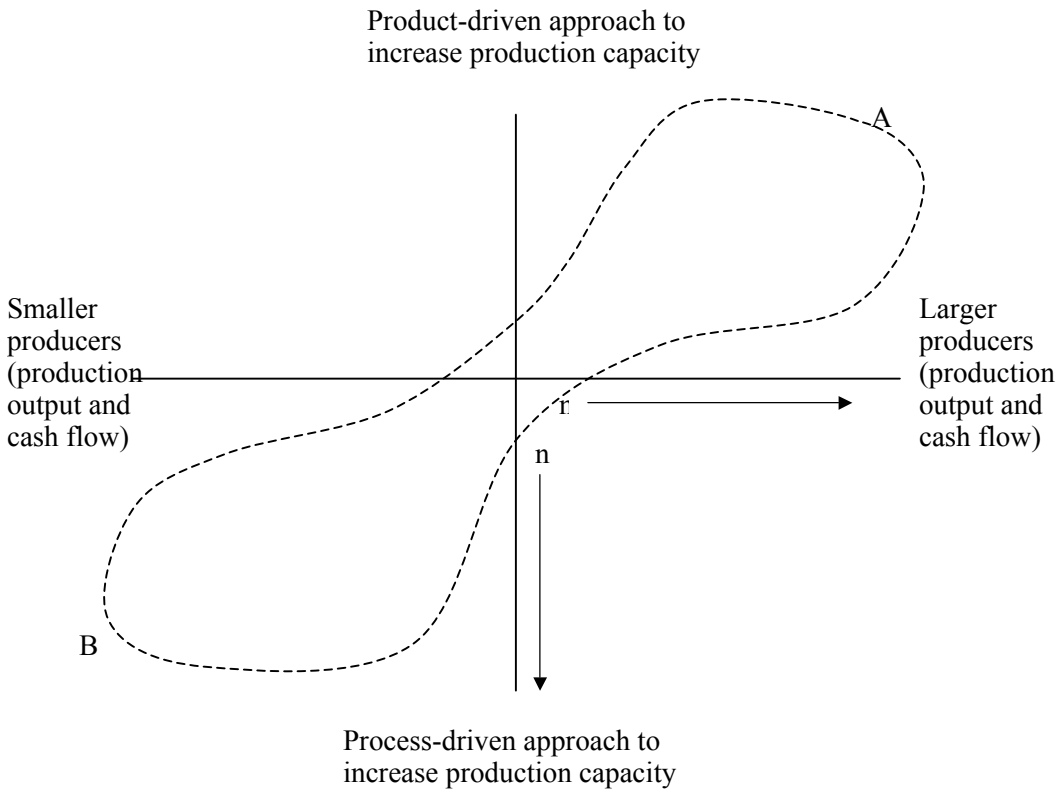
Other producers felt that this product-driven approach was at high risk of diminishing the real intent of organic production as a 'process-driven' approach. The main argument for a process-driven approach to increase production capacity was that it could be more resilient given potential and current pressures facing all agricultural industries. For example, advents in technology and monitoring capabilities may be able to find contamination in all farm products because of our industrial setting. This could jeopardize any purely product-driven approach that emphasizes only brand-name (certified organic) loyalty. A good example would be the recent finding of a bovine spongiform encephalitis (BSE) infected cow in northern Alberta, now jeopardizing all beef production in Canada. Regulators have been reiterating the procedural integrity of Canada's beef handling system, but face difficulty because marketing has always emphasized product quality.

Both possible approaches for increasing production, product-driven and process-driven, when applied to increasing production capacity, have merit and provide their own advantages to the industry as a whole.

These two recurring and cross-cutting themes, product- versus process-driven production approaches, and small versus large (for sake of characterization) producers help illustrate much of the energy in the interviews and workshops. These themes are not necessarily exclusive, but represent two foci to which many current efforts in organic production can be attributed. Organics as an industry and organics as a movement are descriptors that are used in the remainder of this report.

[3] The terms 'small producer' or 'large producer' are arbitrary and are used here to denote a difference, mainly in production volume or cash flow from organic production.

Figure 2: Research themes



A – Organics as an industry approach

B – Organics as a movement approach

Please note that this diagram is qualitative and based on researcher observations and our thematic approach. Its value is explanatory and descriptive rather than a quantitative representation of organic production in British Columbia.

'Organics as an industry' is often an apt descriptor for those producers falling into the upper right portion of the quadrant in Figure 2. This is not always the case, however, and it is possible to imagine scenarios where small process-driven operations were the drivers of organic production and faced increased competition, reduced premiums, and imposed regulation, although this is not the trend. It is 'organics as an industry' that is characterized by these falling premiums for organic products, increased competition from new entrants to organic production, especially large conventional farms who are converting to organic methods. This group also faces stiff competition from imported organic products, forcing (and allowing) producers to compete in an international marketplace. Organics as an industry in British Columbia

also places a good deal of effort on maintaining and developing distribution networks for organic products.

Section 4 describes the results of the research relevant to this approach, and the main research needs themes are import substitution, improved production and quality control techniques, and regulatory improvements. It is critical for the 'organics as an industry' approach to be ahead of the curve with their branding and certification process, quality control techniques, and be ready to proactively deal with new regulatory issues such as environmental farm planning or best management practices. These pressures are common to all agricultural industries in Canada, conventional and organic, and organic producers must be able to professionally work with and compete against other agricultural industries in Canada.

'Organics as a movement' is a conglomerate of different approaches to organic agriculture production, all especially concerned with location and rural environments (quite often these producers are outside the 'Lower Mainland/Okanagan' sphere of influence). In discussions with producers aligning with this approach, larger issues around community economic development predominate. Importantly, 'organics as a movement' is also concerned with being competitive and producing organic products for consumption in an economically viable manner. A common misconception is that this approach is somehow less professional or less business-oriented. In fact, innovation in business practices, such as that employed by Discovery Organics and others, may significantly change how this group is able to compete with or in mass markets. However, at the moment, the capture of local community markets seems to be a primary goal of this thematic group. Participants in this research study were directing much of their marketing effort at local customers, farmers markets, local stores, local restaurants, and local home box delivery. Education and consumer habit change goals tie in with this marketing effort. While this has some commonality with 'organics as an industry', increasing production capacity was *not* seen as the only or best way to accomplish this. (A portion of the production of this group already has some difficulty finding 'the market'.) Rural agricultural development and revitalization provide more of an inclusive driver of organics as a movement. In this way, the process of organic production provides a basis for sustainable development.

Section 4 also describes the results of the research relevant to this approach. The main themes were the need for:

• improved access to information (e.g. production techniques),

• information sharing, (market information, regulatory information),

• infrastructure development,

• organizational needs.

In contrast to the organics as an industry approach, there was little call for primary agronomic research. Producers in this category expressed more interest in organizational and business development that improves the ability of local organic agriculture to anticipate, respond, and/or lead socio-economic change in agriculture and in local communities.

In the opinion of the authors of this report, underlying these expressions is a concern for the viability of farming operations in all regions of the province. Some producers' corollary responses during the interview process provide evidence for this. This important fundamental concern is reflected in the assignment of priorities to the spectrum of 'research needs' identified by this group.

The divergence evident in the B.C. organic community is a reflection of trends observed in the rest of agriculture in North America, where the emergence of the increasing numbers and impact (in terms of production, socio-economic benefits, etc.) of smaller farms is being recognized. As the Serecon report to the Yukon Government observed, policy of governments and industry associations needs to reflect this changing reality (Serecon, 2000).

The preceding discussion underscores the need for the organic sectors in British Columbia to watch many of the upcoming structural issues within all agricultural industries. There are trends toward increased environmental regulation, increased labeling requirements, increased requirements for formal production protocols, and continuing consolidation and regulatory restrictions in the processing and handling sectors, concurrent with a decrease in government protection of agriculture, decreased subsidies to producers, and many challenges toward exclusionary industry practices such as quota systems. Commodity sectors in all agricultural industries face falling prices and more aberrant price cycles. These factors as they relate to research needs are explored in more detail in Section 6.

Given the trends facing agriculture, both conventional and organic, the OSDP decision makers should strategically place funding dollars and direct research and education into issues of critical importance to the various organic sectors in British Columbia. Encouraging the inclusion and participation of all the actors in the different organic sectors is vital. The diversity that is present within organic agriculture in B.C. at present, as portrayed with the 'organics as an industry' and 'organics as a movement' divergence model, is beneficial for all sectors and evidence of the many issues that must be addressed by organic agriculture. Research funding should also **encourage this diversity** and fund projects that examine aspects of both product-driven and process-driven production. **Long-term funding** is also important to provide continuity for research projects, and **organizational development** in support of research could potentially provide coherent direction for all producers.

This sets the stage for a discussion of the results presented in the next section. There exists a strong potential for the OSDP funding to account for the diversity within and between organic sectors in British Columbia and strategically address the priorities identified from this research.

4. Research Results

Introduction

The results presented in this section are the final product of the research process detailed in Section 2. The task of this study was to investigate the research needs of organic producers in British Columbia. These research needs were to be specific to topics that addressed production capacity issues, although these issues became somewhat more diffuse as we began to talk to producers. The results below are presented by region; these regions are the arbitrary research regions used by our four researchers and not ecologically or agriculturally organized.

Our definition of 'research' as explained to the participants initially was centered around agronomic research, including important components such as field trials, replication of findings, and statistically significant results that would help increase crop, flock, or herd production figures. Our researchers were told, in many cases, that 'production capacity' research must have a broader definition in order to include needs appropriate to different regions and sectors, and so the scope of our definition of 'research' expanded. Production capacity issues include things such as marketing, transportation, information needs, business planning, and organizational support. The OSDP strategic plan has addressed some of these different issues in a particular way (see OSDP 2002-2005), effectively placing them outside the terms of reference for this study. The project management and our researchers were faced with the task of accommodating our terms of reference and reporting what our research participants were telling us.

In fact, many of the research needs identified were beyond the primary agronomic production research level, and challenged the current priorities in the OSDP strategic plan. Given this, we reviewed the funding guidelines and previously approved projects under the OSDP fund. The fund has approved projects that both adhere to a single OSDP strategic plan priority (any one of the three identified) and approved projects that cut across all three goals (see Table 2). In our estimation then, there is flexibility within the fund to consider a wide range of research issues, even those that only loosely adhere to the current OSDP strategy. Further, there is an opportunity to provide the OSDP strategy with more concrete direction for spending priorities, based on our results.

kTable 2 will not be current at the date of publication of this report. Projects are being proposed and approved on an ongoing basis.

Table 2: OSDP projects approved as of June 01/2003.

Initiated[4]	Title[5]	OSDP goal addressed[6]	AFFF contribution[7]	Percentage each goal, respectively[8]
C	IFOAM conference	Market development	$19,914 (actual)	100
C	Marketing plan (phase 1)	Market development	$4,147 (actual)	100
C	Rural capacity through Organic Agriculture Project (RCBTOA) CyberHelp	Production capacity (budgeted)	$14,478 (budgeted)	100
C	Canada Organic Initiative	Production capacity / Market development	$20,000 (budgeted)	50 / 50
C	COABC Spring Seminars	Production capacity	$10,000 (budgeted)	100
I - Thomas du Payrat (Simon Fraser University)	Analysis of attitudes and beliefs of BC organic farmers	Production capacity / Market development / Environmental Stewardship	$2,100 (budgeted)	40 / 40 / 20
I – Kootenay Organic Growers	Feeding our Communities	Production capacity / Market development / Environmental stewardship	$8,800	33 / 33 / 33
I – Julia Jamieson (University of British Columbia)	Soil Health Assessment	Production capacity / Environmental stewardship	$10,000	50 / 50
C	Market development plan (phase 2)	Market development	$100,000	100
C	Improved farm planning tools	Production capacity	$8,000	100
I – (unknown)	Organic practice influence on various herbs	Production capacity	$13,594	100
I – (unknown)	Recordkeeping tools	Production capacity	$3,000	100
I – (unknown)	Root Sellar project	Production capacity / Market development	$4,000	25 / 75
I – (unknown)	Canadian farm writers conference	Market development	$3,000	100
C	Research needs study (this study, contracted to R.Smith & Associates)	Production capacity	$28,000	100

[4] C = a COABC driven proposal as per the OSDP strategic plan (see section 1 for more information; I = an industry driven proposal e.g. an individual producer, business, etc.)
Although these projects may be initiated by either C or I, this is not an indication of who is conducting the research.
[5] More detail on each project can be found on the COABC website or by contacting the COABC office.
[6] Please see section 1 of this report for more information on the three OSDP strategic priorities. (Actual) = money allocated already; (budgeted) = money set aside for project; note, these references may not be current at publication of this study.
[7] The AFFF funding is a total of $1 million to be divided over the three priorities; see section 1 for more information.
[8] This percentage breakdown indicates the dollar value attributed to each OSDP priority for those projects addressing more than one priority simultaneously. See section 1 for the overall percentage breakdown for the total fund.

Summary of Research Priorities for B.C. Organic Producers

The following summary table of research priorities is based on our research results and an expanded definition of research needs. Some of these priorities require primary agronomic research (field trials, test plots, replication, etc.) and others require primary socio-economic research (information collection and analysis, participatory methods, socio-economic data gathering, organizational development, industry data collection, business planning, etc.). The table is elaborated upon in the regional discussions of the results.

Table 3: Summary of research priorities for all regions (ranked)

Note	Research need identified	Relative cost of conducting research	Relative return on investment	Availability of research or information	Expected spread of research benefits	Priority (ranked)*
3.1	Soil fertility and management	Medium to high	High	Many & diverse sources	Many producers	1
3.2	Information needs	Low	High	Many & diverse sources	Many producers	2
3.3	Pest control	High	High	Scattered, little regionally specific work	Some producers	3
3.4	Marketplace development	Medium	High	Many sources of information	Many producers	4
3.5	Weed management, cover cropping, green manures	Medium	Medium	Many sources, many research projects	Many producers	5**
3.6	Infrastructure development	High	Medium	Many sources, requires private enterprise partners	Some producers	6
3.7	Livestock management and infrastructure	Medium	Low	Many sources	Some producers	7
3.8	Seed production	Low	Low	Many sources	Some producers	8

* Please see detailed notes for more information about ranking specific projects within each category

**Many potential projects in this category could overlap with projects in the first category (soil fertility and management).

3.1 Soil fertility and management issues were identified as the top priority, overall, in this research needs study. Because of the inclusive nature of this category and the importance of soil fertility and health to a wide variety of other factors (weed and pest control, crop production, etc.) site-specific research ranks as the first priority. Soil fertility and management contribute to the avoidance of many insect and plant disease problems; for this reason it ranks above those issues.

3.2 The need for improved access to and dissemination of information related to organic production of specific crops and livestock is ranked as the number two priority because of the frequency it was mentioned throughout the research process. Many of the needs mentioned by research participants did not require primary agronomic research, rather they needed access to existing agronomic research and results. This priority costs relatively little when compared to some agronomic research and would provide immediate benefits to many producers.

3.3 Pest control issues are ranked as the third priority because of the benefit that control of specific pests would provide to certain sectors. While the benefits are not as widespread as the first two priorities, the financial returns from the recovery of lost

production are considerable. The majority of identified pests come from the tree fruit sector.

3.4 Marketplace development issues were mentioned by many producers, although they had a wide variety of needs within this category. Issues of market protection (for those producers who have established their own markets) and market development (on a local or regional basis) ranked high for many producers. Additionally, market information (current prices, trends, opportunities) and wholesaler and distributor information were needed. This issue ranks fourth because of the potential benefits to producers across the province that this research would provide. There is some overlap with priority two. The currently funded market development plan phase 2 (see above) may address some of these needs; others likely belong inside the business planning function of individual farms or enterprises, i.e. they would likely not qualify for OSDP funding, while needs particular to certain regions may need to be addressed in that region by focused interest groups (i.e. low spread of benefits).

3.5 Weed management, cover cropping, and green manures were actually identified a number of times as high priority items, but there is currently a good deal of on-going and published research on the topics. The category also overlaps with priority one, soil management and fertility, and was therefore ranked fifth. Projects in this category should cover soil fertility and management criteria as well as just weed control and should be filling knowledge gaps in existing research. It will be important for proponents of projects in this area to do specific literature searches to assure funders of the novelty of the proposed research.

3.6 Infrastructure development includes things such as cold storage, trucking and shipping access, livestock slaughter facilities, and retail development in particular regions across the province. A combination of research dollars and entrepreneurial investment will be required to improve infrastructure in certain areas. This issue ranks sixth because of the limited efficacy of funding many projects for infrastructure development, but the need exists to research specific areas (e.g. options for livestock facility certification, low-cost or cooperative cold storage options).

3.7 Livestock management needs were generally not a high priority, in terms of research, because much information is readily available. Management techniques and strategies generally come from outside the realm of organic agriculture and much research has been conducted.

Management seminars on a variety of topics are conducted in many regions of B.C. and are well attended by producers. There were some research needs identified around issues of parasite control techniques. Much more important to livestock producers is the whole issue of the policy and regulatory environment in which they must operate. Advocacy and representation, while not precisely research needs, are critical to the ability of these producers to 'build production capacity'.

3.8 Seed production and distribution are not currently high priority issues, but may become so in the near future with changing certification standards. Research around issues of seed production and handling techniques, specific to organic production in the various geographic regions, would be appropriate in those areas where available research and information is lacking.

Results by Region

Region 1: South Okanagan / Similkameen / Kootenay-Boundary

The South Okanagan / Similkameen / Kootenay-Boundary research region extends from the Penticton region south through the Similkameen Valley and then east through Grand Forks into the Kootenay region. Oscar Somasco, based in Nelson, conducted the interviews and workshops in this region and was the key point of contact for producers during the course of the study.

The South Okanagan and Similkameen region contains most of the certified organic tree fruit (apples, pears, cherries, peaches, nectarines) growers in the province, a large number of ground crop growers, and some

herb and grape producers. The Kootenay-Boundary region is comprised of a more dispersed number of greenhouse, ground crop, and livestock producers. The tree fruit sector in the South Okanagan / Similkameen region is relatively well established and there are several producers who have spent considerable time in marketplace development. The professional capacity of key producers in this region has also been instrumental in the development of organic tree fruit production in B.C. The ground crop producers in this region are similarly established, although with less market penetration and cash flow. More importantly, the relative organization of ground crop producers here is significant. There are both transitional and well established organic producers, generating a good diversity of skill sets and ideas. There are also producers with a mix of conventional and organic production.

The Kootenay-Boundary area includes a number of smaller producers (by their own categorization), who have a diversity of production focus. Many growers have between one and ten acres of ground crop production, each producing several hundred pounds of different crops seasonally. Greenhouse production is also on a small to moderate scale with some producers providing local markets year-round. There is one significant dairy operation and several other smaller producers with certified livestock sales.

The main challenges identified by the producers in this research region center around access to affordable land, soil and weed management, marketplace development (especially in the Kootenay region) and increasing production volume to fill established markets (mainly in the Similkameen region). These broad challenges are reflected in the following research needs identified by producers.

Table 4: Research needs; South Okanagan / Similkameen / Kootenay-Boundary (unranked)

Note	Research need identified		Relative cost of conducting research	Relative return on investment	Availability of research or information	Expected spread of research benefits	Priority (unranked)
1a.	Pest and fungus control	Cherry fruit fly	High	High	Some, with on-going conventional research	Few producers initially	Low (cost)
1b.		Peach twig borer	High	High	Available sprays, some IPM work	Some producers	Medium
1c.		Nectarine thrips, Leaf hoppers	High	High	Very little	Some producers	Medium
1d.		Powdery mildew	Medium	High	Yes, different information sources around North America, some new treatments available	Many producers	Medium (some field trials of existing controls)
1e.	Biennial bearing in apples		Medium	High	Very little,	Many producers	High
1f.	Soil fertility and management		Medium	Very high	On-going OSDP funded project, little regionally specific information, many North American research sources	Many producers	Medium (on-going project)
1g.	Information needs	Variety identification	Low	Medium	Yes, access issues (see note)	Many producers	High
		Black plastic alternatives	Low	Medium	Yes, access issues (see note)	Many producers	High
		Polyculture systems	Low	High	Yes, access issues (see note)	Many producers	High
1h.	Weed management, cover crop management		Medium	High	Yes, many North American and European research sources; very little regionally specific information; on-going OSDP funded project	Many producers	Medium (on-going project)
1i.	Marketplace development		Low-medium	High	Some information available, very little detailed sectoral information for BC; on-going OSDP funded project (see note)	Many producers	High
1j.	Compost		Low	Medium	Yes	Many producers	Low information available
1k.	Alternatives to regulated materials		Low	Low	Yes	Some producers	Low information need overlap; see note
1l.	Infrastructure development		Low	High	Yes, requires investment and information sharing; see note	Potentially many producers (many in specific sectors)	Medium
1m.	Seed production		Low	Medium	Some information availble; information access issues	Some producers (all see specialists)	Medium
1n.	Treated post alternatives		Low	Low	Yes	Few	Low

1a. Several interview participants discussed cherry fruit fly control at each of the tree fruit workshops. There has been a large increase in cherry acreage in the Similkameen valley and currently there are only conventional sprays available to control the cherry fruit fly. The chemicals in use are being banned in some countries. Conventional growers are supporting current on-going research into less harmful sprays and other pest management techniques. *Spinosad,* a product derived from the fermentation of a naturally occurring bacterium holds some potential. *Success*™ (the trademark name) has not yet been approved because of some inert ingredients.

Almost every treefruit grower participating in this study considered this issue to be a high priority, but there was not much hope that anything will be developed in the near future. A researcher from the Agriculture Canada research centre in Summerland, B.C., has a proposal not yet funded to study this issue. *The OSDP fund cannot fund research on this issue alone, but could consider involvement in appropriate and cooperative initiatives*.

1b. Peach twig borer control was considered a major pest and a high research priority. Some growers felt that *Dipel* works well and others felt that it was too costly and many applications are needed. There is a possibility that parasitic wasps would provide a management solution. Again, this is an issue that requires a lot of research funding and whose main goal would be cost reduction for crop management. Some growers mentioned that it was simply more affordable and made more sense to grow something else instead. *It would be a strategic move for the OSDP fund to support a large scale and cooperative project as a minor funding partner, but cannot research peach twig borer control solely with OSDP funding.*

1c. Nectarine thrip control poses the biggest challenge to some producers and prevents good quality production of nectarines. Participant D stated that "…thrips posed the biggest challenge to [their] farm" and that they would not continue growing nectarines in favour of other tree fruits. Although organic control methods would encourage nectarine production, participants were not aware of any on-going research and it would be costly to initiate. *OSDP funding could support a cooperative research project, but cannot provide sole funding because of the high cost.*

Leafhoppers were identified as a major pest for grape growers. Some research is underway by the B.C. wine industry. *There is perhaps an opportunity for OSDP to participate in this ongoing research as a minor funding partner.*

1d. Powdery mildew of apples is a common problem for growers in the area and there are a few products available that may eliminate the need for primary research. *Kumulus* was discussed in one workshop and determined to be largely ineffective. Horsetail extract provides some promise as an effective control although a reliable product is not yet available. Participant H stated that they had done tests for different allowed products and had that data. Compost tea was also discussed as a new and very promising alternative. The development of compost tea mixtures and equipment is well advanced and there was an expressed interest in purchasing a compost maker and doing regional trials. Concerns about product contamination were expressed and there was some confusion about the difference between prepared mixtures and homemade live bacterium mixtures. More information is needed for producers interested in this product, and it is widely available. *OSDP funding could fund farm-level trials for testing of mixture efficacy on a variety of crops (apples, grapes, etc.).*

1e. Biennial bearing in apples is a large problem for high-density orchards. There was a good deal of discussion in the workshops and personal interviews about the need for research on sprays for blossom thinning. Currently, a mixture of lime sulphur and fish oil has been tried but it causes stress on trees. Calcium chloride is also being used with mixed results. It is likely that alternatives to labour intensive hand thinning can be found with relatively low cost field trials. This would provide a

high expected return on investment for apple producers in the Okanagan and Similkameen valleys. *The OSDP fund could sponsor farm level field trials proposed by individuals or groups of producers. In addition, cooperative ventures with research institutions could work on spray development, or other management techniques.*

1f. Soil fertility and management issues were discussed often and are probably the highest priority for this region, both in the short and long term. Soil health assessment is an important and neglected component of crop establishment and succession planting. It was felt that many pest and soil borne disease problems could be avoided with proper soil nutrition and management. Importantly, research on this issue would lead to problem avoidance rather than problem management. Soil testing could be widely utilized and more made more easily accessible, while organic soil additives and their impacts/effects should be well studied. Increased salinization of soil as a result of irrigation over extended periods of time is a long-term problem in this region and needs to be addressed.

While there are available research data on different soil additives, much of it is not regionally specific and the synergistic effects are not well known. *Current OSDP funded research includes a graduate student (University of British Columbia) examining soil quality indicators. OSDP funding should support both farm level, individual and group projects that examine soil additives and their synergistic effects, and projects by research institutions in the province that investigate soil health assessment. (See also Recommendations, Section 6)*

1g. Information needs were highlighted as a significant research priority, especially by producers in the Kootenay-Boundary region. There are a wide variety of information needs, all of which would help producers increase production capacity. Research would mainly take the form of secondary information gathering and dissemination, although an important component would be extension or outreach work. Research participants stated that the availability of information wasn't enough for it to be useful; it had to be in an accessible and understandable form and often 'pushed' to producers. One workshop discussed the need for an organic extensionist or professional researcher for the Kootenays. This area is comprised of many, small diversified farms with a broad range of crops: the extensionist could develop an 'information basket' with locally-specific information and talk to 'old timers' to obtain information that will soon be lost. Specific needs included variety identification (most suited) for particular regions, alternatives to black plastic mulch, and polyculture management information for particular microclimates and cash crops. Agronomic, technical, and marketplace research for B.C. and beyond can be packaged and made available to those without the research time or skills, high speed internet access, or points of contact in the research community. *This research would be relatively low cost and OSDP funding could support a regional research and resource project, complement current CyberHelp efforts, or look at professional development options province wide.*

1h. Cover crop management and weed management techniques were highlighted in both the interviews and workshop discussions. The OSDP fund is currently sponsoring a project on cover crop management in the Kootenays. There was still call for additional research, regionally specific, on their allelopathic properties, interplanting effects on the main crop, and the potential for living mulches.

Weed control is a perpetual problem, for both tree fruit and ground crop producers, and a continuing research need. Vegetation management that reduces vole habitat and competition with trees was discussed by treefruit growers. Quack grass control is also a common problem in all sectors. Whole systems weed management is the best problem avoidance solution and so research on cover crops, companion planting, succession planting, crop rotations, and soil health would fall under this approach. *The OSDP fund could co-sponsor (with conventional agriculture research*

project funders) farm level projects that test new cover crop varieties or crop rotation effects on weed management. Additionally, current research on these issues, from around the world, should be made more accessible; this can be done as described in note 1g.

1i. Research into and the development of appropriate market strategies were discussed by several participants. Marketplace development is often done by individual effort at this point and those producers who have developed their own market generally felt that this was the appropriate strategy. Others stated that an organic organization (e.g. COABC) should be a better advocate for local market development strategies and for protection of established market and distribution channels from imported organic products. This effort would require some research funding and funding for salaries of those involved; volunteer burnout is high with an on-going need such as this. The OSDP fund is already contributing cash toward a market research project (see Table 2). *This project should make an effort to include the participation of small producers who supply only local markets and examine practical strategies for market resilience in all sectors (i.e. local markets, local producer loyalty, protecting those markets established by B.C. organic producers).*

1j. The correct use of compost material was discussed in one of the workshops. The timing of application and volumes required are important information needs. The availability and types of additives to enhance the quality and response rate by crops may be a research need on a regional level. It was noted that some of this work has been done by the Soil Foodweb organization, biodynamic farmers around the world, and others. This would be a lower priority research need.

1k. The availability of alternatives to regulated materials was discussed by some of the participants. This stems from the desire to reduce or discontinue the use of these products. The list includes Boron, Calcium Chloride, Magnesium, Zinc Sulphate, Lime Sulphur, Sulphur, Copper products, and a few others. There are feed and additive suppliers who are working on alternative products in the region and they were able to participate in one workshop. Since the private sector is working on this issue, this would be considered a lower priority research need.

1l. Participants in the Kootenay-Boundary region discussed the need for infrastructure development and sourcing information, especially considering small machinery and greenhouse operations. Extending the shoulder season in this region requires affordable and sustainable heating solutions. Harvesting, planting, and processing machinery for small farms (mainly ground crops) would help reduce the labour requirements. Both of these issues could benefit from both research into and the provision of technical information and equipment sourcing. Some producers expressed an interest in the development of co-ops that could be involved in shared equipment or facilities. This would be a lower priority research need, but would complement the information needs issue identified in note 1g.

1m. The availability and sourcing of seed for organic production was discussed by several research participants. There are some producers in the province who are seed specialists and there is some untreated seed available from existing conventional seed catalogues, although price and the availability of certain varieties and quantities varies. Depending on the sector and region, this issue varied in importance. Certification standards may become more stringent and it would be beneficial for the *OSDP fund to support existing seed growers with farm level research and production information.*

1n. There was some discussion about the need for alternatives to treated posts as these may potentially be a certification issue. Cedar posts are an expensive option at the moment. This seems to be more of a sourcing problem than a research need and would be considered a low research priority.

Region 2: Fraser Valley/ Vancouver Island / Gulf Islands

Backgound information

Regional profile:

The Fraser Valley / Vancouver Island research area is comprised of a large number of organic producers in many different agricultural sectors. The area extends from Hope, B.C., on the eastern edge of the Fraser Valley through the increasingly urbanized outskirts of Chilliwack, Abbotsford, Vancouver to the Sechelt peninsula. The Vancouver Island region has producers from almost all parts of the island, mainly concentrated in the southern half. The Gulf Islands include Saltspring Island, Pender Island, Denman Island, Quadra Island and Cortez Island, with most certified organic producers and political activity occurring on Saltspring Island. Sarah Davidson was the researcher in this region and the key point of contact for producers and other research participants.

Most of the research participants considered themselves 'medium'-sized farms for the entire region, although what would be considered 'medium' varies from the Fraser Valley to the islands. Most organic ground crop farms in the Fraser Valley and on Vancouver Island are between two and ten acres in size, although there are quite a few larger operations, the largest in the Fraser Valley is 1000 acres. Operations on the Sechelt peninsula and the Gulf Islands are smaller than this on average. The majority of producers, especially those with the small- to average-sized operations had generally been practicing organic production methods for many years (at least ten) and often did so before they were certified as organic. There are now more transitional and recently certified farms that were conventional operations that converted to organic methods. These operations are often larger and have quite a different market focus than the small- to medium-sized farms that have previously been the norm, although some of them have also expanded. The competition in some market channels has increased considerably as a result of this.

Regulated marketing

The production of both livestock products and most vegetable produce is regulated under the Natural Products Marketing (B.C.) Act.

It is the position of COABC in its submission to the Lower Mainland Vegetable Distributors Inc. "…that organic production methods are distinct and different from conventionally grown produce, although there have been court rulings otherwise."

The majority of organic ground crop producers are offered an exemption from marketing through the British Columbia Vegetable Marketing Commission. Recently, Fraserland Organics Inc., has become the designated agency for certified organic potato marketing (in District 1), as they already have Certified Organic Handling status (through Oregon Tilth) and market smaller producer's products through their label. COABC has conceded that it cannot, at this time, certify a producer like Fraserland Organics Inc. (because the B.C. accreditation program is not yet recognized by the United States) and supported its application for marketing agency designation.

Some organic poultry (egg and meat) production has had on-going conflict with their B.C. Marketing Boards over exemptions from the purchase of quota and use of marketing channels. At dispute is the distinction of organic production methods from conventional production methods, and the volume of unregulated production entering a regulated market. Recently, organic poultry production has been influenced by 'new entrants' with quota, and conventional producers with quota converting to organic methods.

B.C. produced certified organic milk and other dairy products are sold in the Lower Mainland by distributors who also market conventional dairy products. The majority of this production is from conventional farms recently converted to organic methods. Imported organic dairy products (Canadian and U.S.) make up the supply deficit in this market segment.

Trends

It was noted by several of the research participants that there is consolidation happening within the organic sectors of this region, both in production and marketing. It appears that several large producers, who are working either with or in opposition to the provincial marketing boards, may be in a position to direct the production and marketing strategy for different organic sectors in the future. This consolidation mirrors what is happening elsewhere in the world, (especially in California vegetable production, the primary source of competition for B.C. growers). Depending on perspective, this trend can be seen as quite proactive, or as creating division between 'have' and 'have not' producers. Of importance to this study, COABC is the official umbrella organization representing all certification bodies in the province, but is not necessarily seen by some producers as being effective in representing the interests of large producers or protecting the existing markets of small- to medium-sized producers from this consolidation. These challenges are reflected in the following research needs identified through the research process.

Table 5: Research needs; Fraser Valley / Vancouver Island / Gulf Islands region (unranked)

Note	Research need identified	Relative cost	Relative return on investment	Availability of research or information	Expected spread of benefits	Priority (unranked)
2a	Soil fertility and management	Medium	Very high	Very little regionally specific and organic production specific, some on-going projects	Many producers	High
2b	Pest and fungal control -flea beetles -late blight -club root -downy mildew -sclertoni -grey mold -root maggots -wireworms -symphylans -seed rot -scorch virus -rodents	High	High	On-going research projects in B.C. and North America. Some information available	Many producers	High
2c	Cover crop and companion planting	Low	Medium	Some available, need for regionally focused research	Some producers, others have trial and error experience	Medium
2d	Seed availability	Low	Medium	Some sources, need for local seed production	Many producers in long term; some short term as it is not yet a certification issue	Medium
2e	Marketplace development	Medium, on-going	High	On-going projects, need for advocacy	Many producers	High
2f	Information needs -sourcing of equipment / seed -compost / soil management techniques -organic sector information (volumes/prices, etc.) -best management practices -potential regulatory issues	Low – medium	Medium	Most information is available; access is a problem	Many producers	High
2g	Organic animal health practices	Low	Medium	Need for more research/information on nutritional effects of organic management.	All livestock producers	Low
2h	Infrastructure development	High	High	Sourcing of appropriate planting, harvesting, processing equipment; cooperative development needed.	Many small ground crop producers	Low
2i	Compost tea research	Medium	Medium	Contradictory results Many ongoing projects	Many producers	Medium
2j	Regulatory	Low	High	Information available, needs to be presented appropriately, and supported.	Many producers	High

2a. Soil fertility and management was a ubiquitous theme in all of the research interviews and the workshops held throughout the region. As in the previous results from the South Okanagan/Kootenay-Boundary region, the discussion covered many issues surrounding soil management as a problem avoidance strategy. For example, soil nutrition has an important impact upon variety selection, succession planting, and weed control. At the workshops in the Fraser Valley there was an expressed interest in no-till methods for organic production and participants questioned whether organic farmers over-tilled their soil. Participants were interested in information or research in proper green manuring methods for their region and about the benefits of green manuring versus animal manuring. Growers of organic transplants expressed interest in nutritional management of seedlings. Soil improvements by using natural products such as slow release fertilizers such as zeolite, or locally available rock dust were mentioned and there were some questions about their efficacy. Additionally, the availability of relatively quick soil testing for organic producers in the region was mentioned at workshops in the Fraser Valley and the Gulf Islands. It was felt that the provision of this service would benefit many producers.

The OSDP fund should fund on-farm projects that examine different and justified[9] *aspects of soil fertility and soil management (this includes composting techniques, different and new green manuring techniques, and the impact of soil fertility and management on weed and pest control). Many small projects or a cooperative effort among many producers would provide a benefit for many certified organic producers of the region.*

2b. Pest and fungal problems were identified in most of the interviews and all of the workshops. The degree of concern about each identified problem varied from producer to producer and according to their familiarity (or lack of) with control methods. In general, the pest control strategy used by producers who had a very diversified cropping system was to discontinue growing the problem crop. Flea beetles, wireworms, and downy mildew were the most frequently mentioned issues. Root maggot, club root and other fungal diseases including late blight on potatoes are also common problems in the region. Since certification standards were changed to disallow the use of treated seeds, some growers have been interested in looking for a biological control alternative.

Symphylans (a small nematode) are a limiting factor in establishing seedling stands in grass and vegetable (ground crop) species. Symphylan infestations are considered to be a soil management issue and the only currently available organic control is proper aeration and moisture control in soil. Organic controls other than soil tillage need to be identified.

Research is ongoing in many of these areas by ESCrop Consultants and Fraserland Farms.[10] Wireworm control is being studied by the Agassiz Research Station, which has made good progress on a biological control. Some organic producers are working on various projects under the auspices of the Organic Farming Research Foundation in California.

Primary research on these problems is expensive; perhaps a first step as suggested by one participant might be to collect information from experienced producers across the country.

Rodent control was mentioned by some producers. Hazelnut producers have noticed European squirrels in the Aldergrove area and fear that they may move up the valley into large hazelnut plantings. Rabbit infestations cause a problem with tree girdling and there are few natural deterrent

[9] Justified by literature review to fill information gaps or prove regional adaptation of existing research or production techniques.

[10] "...Fraserland conducts approximately $100,000 worth of research annually." Quote from Shelly Harris in Agency Designation Application…Natural Products Marketing Act … BC Vegetable Marketing Commission, April 30, 2003.

products. Voles are a consistent problem in perennial and annual crops; rats can be a problem stored potatoes and greenhouses. In general most participants favoured using repellents instead of lethal pesticides for control and there was little information about natural deterrents. *This is largely an information need, but on-farm research projects that examine the use of potential organic deterrent products could be sponsored by the OSDP fund.*

2c. There was an interest in cover crop management and selection and companion planting expressed by the research participants. The timing and alleleopathic effects of cover crop planting, and the most beneficial companion planting options, all specific to the microclimate and soils of the region, were determined to be the most pressing needs for research and information gathering. *There is companion planting and cover cropping information available from a variety of sources, and it was suggested that a useful project could gather this information, appropriate to the Fraser Valley or Island regions, and present it in different growers manuals. The OSDP is currently funding cover crop research in the Kootenay region and the results of this research may be pertinent to the needs of producers in this region. The OSDP fund could fund the development of grower manuals, in conjunction with the soil management research (note 2a) and information needs issue (note 2f).*

2d. The availability of locally sourced organic seed is mentioned by many participants as a pressing concern and one that will likely increase if it is mandated under certification regulations. Sourcing quality seeds of favoured varieties from a reliable source is currently an issue and some large seed companies have discontinued untreated seed lines. Much information on breeding and saving seed is available, for example from John Navazio of Abundant Life in Washington State. *It would be a strategic move for the OSDP fund to invest in research and capacity building of local producers interested in seed collection for distribution.*

2e. Almost every participant expressed marketplace development concerns. These relate to the issues discussed in the introduction section for this region, and those in note 1i. Generally, it was felt that more needed to be done to provide exposure for the COABC 'checkmark' label and to push for product recognition. Locally or provincially grown and raised organic products have to compete with imported products. *The OSDP fund could sponsor on-farm or professional development projects that promote local producers. Again, the continuing market research project funded by the OSDP should include components relating to small producers and future marketplace conditions and strategies.*

2f. The information needs of the research participants were varied and cut across all of the research needs identified. The sourcing of small scale equipment, grower manuals for different crops, soil management and fertility information, crops and varieties that work best for specific microclimates, best management practices, and potential regulatory issues, were all mentioned on several occasions as information needs. These would not require agronomic research, but would require information gathering, collection, and dissemination. Most producers knew that this information was 'out there' but did not have time or skills to do web or library research. *Additionally, most felt that having the information in hand was not necessarily enough. Being able to filter the appropriate information with some professional resource would be very beneficial.*

2g. Several participants mentioned animal health practices as a potential research project. Topics such as parasite control, homeopathic remedies, winter production, poultry stocking rates, and poultry nutrition were the most common. Nutritional quality and its relationship to feeding regimes, processing practices, breeds and varying management practices is a potential area of interest. *There is much information available and substantial research has been done on these topics, so it is a low priority for OSDP funding.*

2h. The availability of capital is a fundamental challenge for all producers; many producers lamented the lack of affordable small scale planting and harvesting equipment, lack of processing facilities and the lack of affordable cold storage options. While this is not a research need per se, it is a need for many producers who participated in this research and signals that there are cooperative development needs. The joint purchase of equipment or the availability of low cost or blueprints for self-built equipment would benefit many (especially small) producers. The OSDP fund could support a cooperative development effort or the information gathering of affordable equipment sources; additionally this could fall under a larger professional development rubric (see section 6).

2i. Compost tea research is a hot topic for a lot of producers. Apparently it has potential as a nutritional supplement for both soil and plants, and as a fungal suppressant. There are, however, some safety concerns. A research project originating in the Similkameen is currently being proposed to the OSDP fund. Substantial research has been done with compost teas in the United States.

2j. Some growers identified two linked but separate regulatory issues:

- organically allowed or regulated pesticides that are already registered for use in Canada, but not for use in a particular crop where it is needed. This can be accomplished by a 'minor registration' or label extension. Evidently this is not an expensive task, requiring administration more than research.

OSDP funding could support the hiring of a consultant to expedite a broad range of such applications on behalf of interested growers.

- organically allowed or regulated pesticides that do not have a Canadian PCP number (registration). This is an expensive process for companies seeking the registration; as a result many products are available to U.S. growers that are not available to Canadian growers.

Canadian government acceptance of EPA approved materials[11] *is obviously the solution, but who will pay the costs and who will promote products? This is an issue that an industry professional development organization could assist with in cooperation with manufacturers and importers.*

Region 3: North Okanagan / Thompson / Cariboo

The North Okanagan / Thompson / Cariboo research region is comprised of a diverse group of certified organic producers. Most of the producers have small farms, and consider themselves small for this region. The exception is the presence of some apple and tree fruit growers in the North Okanagan region. Their needs are quite similar to those in the South Okanagan. The more northern parts of the Okanagan valley have fewer heat units than those farther south and provide better growing conditions for ground crops. The Thompson and Cariboo regions have many small ground crop producers and some livestock producers (beef, lamb, goat, poultry). Elaine Spearing was the researcher and key point of contact for research participants in this region and was based out of Quesnel.

At the workshops, many attendees spoke about the value of bringing people together, as was done with this study. Information and informal exchange was allowed to happen without the onus of certification meetings, etcetera. Most participants expressed a desire for improved networking and exchange of information among producers in their sector, both in their local area and across the province. Some of the ground crop producers, who produce mainly for local markets, stated that they felt relatively isolated from other ground crop producers in the province and that some organization based on sectoral interest would benefit them, and probably other

[11] (http://www.epa.gov/PR_Notices/pr2000-6.pdf)

sectors. Research projects could provide a focus for groupings of farmers to meet and discuss production issues, host farm trials and compare notes, and begin this sectoral networking.

An important point was brought up by some of the research participants: evaluation of the benefits of research. There was some consternation about who was going to get OSDP funding and who would receive the benefits from the research. The general feeling was that the research benefits should be spread as widely as possible and involve as many producers in each sector as possible. One proposed idea was to consult organized groups of producers for comment and evaluation at the mid and end points of each project. This would benefit the research process, but also foster involvement and discussion around key issues. There was little awareness of the current status of the OSDP fund, and producers did not know who was eligible to apply or receive funding.

The following research priorities are similar to those from other regions and reflect the diverse nature of organic production in the region. Since most producers considered themselves to be small to average sized farms and had a diversity of production on each farm, their needs generally focused on other capacity building issues such as marketing, information accessibility, education, and barriers to people entering farming. The specific agronomic research issues that were discussed were soil fertility and management, weed management techniques, and some pest control problems. Table 6 summarizes these issues and a discussion of each follows.

Table 6: Research needs; North Okanagan / Thompson / Cariboo region (unranked)

Note	Research need identified	Relative cost of conducting research	Relative return on investment	Availability of research or information	Expected spread of research benefits	Priority (unranked)
3a.	Soil fertility and management	Medium	Very high	Some information available; a variety of research sources; little regionally specific information	Many producers in all sectors	High
3b.	Information needs -a directory with small machinery sources -a survey to identify commonly grown ground crop varieties -sector profiles (financial, production volumes) -best management practices -barriers to new farmers	Low	High	Information is available from a wide variety of sources for machinery, technical information; little organic sector profiling is available for BC; few best management practices and case studies available	Many producers	High
3c.	Cover cropping, green manure	Medium	Medium	On-going research projects through OSDP; on-going projects in North America	Many producers	Medium
3d.	Weed management techniques	Low	Medium	Research available widely on different techniques; information distribution and access is an issue; complements point 3b.	Some producers, mainly ground crops	Low
3e.	Pest control -flea beetle -root maggot -carrot rust fly -potato beetle	High	Medium	On-going projects in BC and North America (see discussion in other regions); little regionally specific research available	Some producers (mainly ground crops)	Low
3f.	Seeds	Medium	High	Little research being done; regional sources of seeds needs development	Many producers	High
3g.	Livestock needs -parasite management -pig and chicken breeds for extensive production -integrated systems	Medium	Medium	Technical information is available from across North America; management models available from across North America	Some producers	Low
3h.	Infrastructure development	High	High	Information for development of cold storage, processing facilities for livestock and ground crops is available from across North America; is a capitalization and development issue	Many producers	Medium

3i.	Marketplace development	Medium	High	Marketplace information for small producers is needed; regional information needs research; on-going OSDP market research project; other information from across North America is available	Many producers	High

3a. Soil fertility and management issues recurred throughout the research in this region. Many of the discussions centered on information needs: how to manage crop rotations, compost applications, green manuring, the timing of cultivation etc. Producers had a strong interest in how these processes affect soil fertility, and how soil fertility is related to plant health, growth rates, pest control. Many producers were not sure whether they were over-fertilizing their soils, or whether they were applying the most appropriate type of fertilizer. Short term interests and needs were mainly nitrogen management on shorter time scales with the use of green manures or animal manures, and long term interests were mainly the (soil) sustainability of different types of production systems, especially stockless systems.

Interest was expressed in the current OSDP funded soil indicators project through the University of British Columbia. One grower identified a need for information that summarizes and simplifies information on soil fertility in order to better to make decisions for the short and long term health of his soil. While some of this information is available from a number of sources it is not accessible, or being accessed, by many producers; other producers were looking for a more in-depth and sophisticated understanding of soil fertility. *There is a need to develop 'easy-to-use' references for soil management; including soil structure principles and nutrient budgeting and cycling. Additionally, monitoring and evaluation tools and knowledge are an important part of maintaining soil health. More information and more research on indicator species in the different microclimates of the province would be a useful project. There are several soil manager tools available (e.g. University of Minnesota's 'Soil Manager') and these should be professionally developed, through a research project, in combination with soil testing at the farm level in the different microclimates of the region.*

In the discussion, specific soil building needs were stated. It would be very useful for a soil manager reference or toolkit to include tables for various weights and measures of compliant inputs needed (e.g. pounds of nitrogen, phosphorus, or potassium) and the correct balance between essential soil nutrients. It would also be useful for estimates of nutrients in certain types of compost, manures and crop off-takes (e.g. nutrient off-take per crate of broccoli). It would be beneficial to include information on various units of weights/volumes/areas and soil building options for different scales of production and infrastructure.

A common theme was the need for whole systems research and information so that producers can make decisions about integrated cropping systems and understand the synergistic effects of soil fertility, in both stock and stockless systems.

3b. This region's producers discussed their information needs under the following general headings:

• a directory of small machinery sources, blueprints, manufacturers.

• a survey to identify commonly grown ground crop varieties in the research region. Many producers use trial and error techniques and felt that they could learn more and save time with improved sharing of information across the sector.

• the need to know more about the individual organic sectors and the aggregate

of sectors across the provinces. *Organic sector profiles* would provide valuable information for new and transitional producers and those still undecided about organic production, as well as current growers. A clear idea of the number of producers, the volume of production, where product is being sold, the range of prices at farm gate, wholesale, distribution, and retail levels, the varieties being grown, and the transportation and distribution options being utilized across the province would help many producers make decisions about farm management. This information could be made public and organized by sector, while more specific information would be proprietary and could be available for a fee. This could be handled by a professional development organization (see Section 6) or research could be done by individual producers in conjunction with interested professional researchers. *The OSDP should fund sector profiling projects which would benefit all of the organic producers in the province and inform those interested in future regulation and the trends within the industry*.

• a more general information concern was the barriers for new entrants to organic production. In order to 'make the case' for organic production and facilitate the start up of new and young producers, the availability of information for business planning and production planning is critical. Participants in the region were also particularly interested in best management practices (BMPs) for their type and size of operation. It is recognized that BMPs are becoming a national agricultural issue and the organic sectors should consider BMPs specific to organic production at different scales of operations. *Potential research projects could develop a compendium of these, in consultation with producers in all regions.*

3c. There is a strong interest in regional information on the performance and use of green manures and cover cropping, including suitable green manures for the dry interior. Several growers were very interested in more information about the integration of green manures with cash crops, and many are currently experimenting themselves, albeit much of it informally. This issue is linked to the soil management and fertility issues and to weed management; *the OSDP fund should sponsor projects that have an integrated scope and combine different needs in more whole systems oriented research.*

3d. Weed management is a pervasive challenge for organic producers in the region, although specific research needs were not identified. Information requests for the effect of cultivations on weed populations, the use of green manures, and new or potential organic control methods were noted. *One suggestion was to conduct a survey of the most efficient weed management techniques and systems, document these, and make the information publicly available, at the regional level. This would take the form of case studies or best management practices (BMPs) and could be included with projects that focused on BMPs. Weed management research would be considered a low priority for this region.*

3e. Most participants discussed pest control issues. Many of the smaller ground crop producers indicated that they were less concerned with pest control issues; they used trial and error methods and generally didn't grow one particular crop if pest infestation was a significant problem. The major pests mentioned were flea beetle, root maggot, and carrot rust fly. There was also some interest in investigating the economics of using different types of netting material as an insect barrier.

3f. The availability of locally sourced and untreated seed was considered to be an increasingly pressing need. At present there is a lack of organic seed for nitrogen-fixing green manures and bulk quantities of organic vegetable seed are often difficult to get. The production of certified organic seed could be an opportunity for some growers to diversify and incorporate seeds into their enterprise. A best practices manual including information on tools, harvesting, and cleaning is needed as a resource for non-specialist growers. This would involve some investigation as there is varying information available about

isolation distances and other management practices.

An identified need among seed producers was improved information on maintaining quality, especially maintaining varietal purity. It is critical to manage the quality of seed to gain and keep the trust of commercial growers. *Comparative research examining local organic seeds with conventional seeds for vigor, germination rates, and disease resistance would be a useful marketing tool. In addition, there was an expressed need for a survey among seed growers in the province to catalogue the varieties being grown and the quantities produced to demonstrate the potential for an organic seed market. This would fall under a sector profiling study, and can be included with an information needs project (note 3b.).*

3g. The livestock growers of the region stated that three emerging issues were the most important with respect to research needs:

• systems for parasite management and alternative medications for parasites,

• appropriate pig and chicken breeds for extensive production,

• management practices for the integration of livestock and crops.

While the latter two issues have been well studied and documented in other parts of North America, new approaches to parasite management are only recently being studied. Possible projects could examine different integrated farming systems in different parts of the province. *A compendium of best practices for small livestock producers would be very beneficial to new and existing producers (e.g. improved pasture poultry techniques, rotational grazing strategies for beef, etc.).*

The need for improved access to slaughtering facilities exists for many beef producers. There are inspected and certifiable facilities in this region and other parts of the province, and with increased marketing success, there is an opportunity for expansion within the organic beef and poultry sectors. There is a trade off between direct marketing in local areas and working to gain access to retail distribution because of the variability in supply. There is also a need for producers to reach out to other markets, beyond certified organic, and cooperative development projects could link producers and slaughter facilities with established but alternative markets in North America and Europe; moving beyond the local direct marketing or large retail supply chain tradeoff.

3h. Infrastructure development is a major limiting factor for both livestock and ground crop growers in the region. Certified slaughter facilities for livestock production, cold storage for ground crop production, and distribution and transportation infrastructure were the commonly mentioned issues. There was some discussion about whether the critical mass necessary to sustain and develop more infrastructure existed. On the other hand, existing infrastructure in the region has been developed by individual entrepreneurs who source product from outside the region. The success of existing producers, with respect to infrastructure development, has been largely a result of individual effort and capital expenditure. It was suggested that an organization that represented producers, distributors, slaughter facilities, etc., directly would improve communication, product recognition, and marketplace development, as a start. *The OSDP fund could fund a project that initiated a profile of the organic livestock sector, for example, including producers, processors, and distributors; this project would also fall under the information needs category (see note 3b).*

3i. Marketplace development is a category of research needs comprising issues of processing, distribution, current market competitiveness and growth, and future market potentials and challenges. There was a lot of discussion about imported organic products, and concern that B.C. producers cannot supply their own market, and must compete in the local marketplace with California (generally) production. Participants questioned why this was happening, and stated a need to identify whether it was prices, or infrastructure, or distribution chains, or a combination of these. Different viewpoints were expressed

about the conversion of conventional farms to organic production; it was generally seen as a good source of new production to supply the Vancouver market, but another viewpoint saw this trend as a threat, with organic farming becoming industrial.

The point was made in different discussions that the availability of organic produce in supermarkets has had and will continue to have an effect on direct sales and small organic-only outlets. The promotion of local produce, in this context, is becoming increasingly important. The economic benefits of small-scale growers selling locally are numerous because of the spin-off effects in the local community and the provision of environmental and social benefits occurs where the product is grown. *The OSDP fund could promote more awareness and educational campaigns to support local growers*. One producer commented that a good example was the old Buy B.C. program; this type of program could be applied to organic production in B.C., for B.C. Another information need related to marketing:

• seasonal information on market gaps,

• the results combined into a database of crops needed and market and supply gaps according to region.

Region 4: Prince George / Peace River / North West

The geography of this region of the province is the primary determinant of the ordering of priorities for the 'research' needs identified by producers. There are few organic producers spread over great distances, involving significantly different climate zones. Commodity choices (low margin or high labour requirement), seasonal and climatic limitations, and distance to large markets limit the ability of organic operations in this region to participate fully in the growth of the larger organic marketplace. With few exceptions, income from off-farm sources is a significant supplement to income earned from farm production. The time required to earn the off-farm income further restricts 'capacity building'.

In the northeast, grain and livestock operations, most of a small- to medium-sized scale compared to conventional farms, have production and marketing information needs best answered outside the region or outside the province. The area is more similar in climate, crops and marketing infrastructure needs to Alberta than to any other region of B.C. A few groundcrop producers contribute to local markets.

In the north-centre region surrounding Prince George, livestock, berries and groundcrops operations predominate. Organic farms are on the smaller end of the scale compared to conventional farms. Similarily in the northwest, organic farms in the Bulkley Valley/Smithers area produce groundcrops, livestock (primarily beef), herbs and berries. Markets and community support in this area is significantly greater than in the other two sub-regions of the north.

Potatoes, beef and grains move as commodities from the north of the province to markets in Vancouver, Alberta and the U.S. These 'export' markets have been developed over time by individual producers. A significant proportion of organic commodities produced in the north are sold through conventional markets. Local markets are important to all producers, and most of the current efforts of individuals and groups are directed there.

This region does not appear to have the same growth rate of organic production or producers that other B.C. regions experience. The regional certification-focused organizations that served this area have either disbanded or diminished. All producers interviewed expressed concern over 'isolation' and 'lack of communication'.

Thus the first challenges facing producers in this research region depend on the form in which their product leaves the farm, as a commodity or as a food product, although both involve marketing infrastructure needs. For commodity producers, maintaining existing markets and profitability in the face of increased competition and resultant falling margins is of primary importance. Direct marketers of food products to

regional consumers face the challenge of identification and attraction of, and venue creation for, potential customers. The consistent supply of organic product (sourced out of area) by specialty and now major chain stores in the region further challenges local growers. Competition on price with conventional products is a significant marketing concern. 'Local and fresh' is as important in some markets as organic growing practices.

All of these concerns are in reality competitive issues, and might be best dealt with inside the business planning functions of individual producers or groups of producers. When funding proposals in this area, OSDP decision makers will face the challenge of supporting initiatives of general benefit to some producers, adhering to their own guidelines, and not interfering with ongoing entrepreneurial efforts in the same area of interest. Certainly there is an advantage for the few producers in each sub -region (northeast, north centre, northwest) to work together to develop particular markets. The OSDP has funded such a project (Root Sellar) in the northeast. As previously explained in 2e. (p. 20) the current OSDP funded market development project (see Table 2) should include elements that will benefit producers and consumers who are outside the reach of the concentrated focus of supply and market of the southwest region of the province.

When questioned as to where they currently get their research information, some producers have stated that they review research arising from conventional agricultural research projects in the region and adapt the information to their own situation (esp. variety trials). *Given that organic producers are few in number in this region, it would be in their interest to have their perspective included in ongoing work by other organizations. There is an opportunity here for OSDP to participate as a minor funding partner in some of these research initiatives to encourage the inclusion of an organic component.*

Table 7: Research needs: Prince George, Peace River, Bulkley Valley (unranked)

Note	Research need identified	Relative cost of conducting research	Relative return on investment	Availability of research or information	Expected spread of research benefits	Priority (unranked)
4a.	Soil fertility and management	Medium	Very high	Some information available; a variety of research sources; little regionally specific information relating in particular to organics	Many producers in all sectors	High
4b.	Information needs -accumulation of existing knowledge -marketing -sector profiles (financial, production volumes) -best management practices -food safety	Low	High	Information is available from a wide variety of sources for machinery, technical information; little organic sector profiling is available for BC; few best management practices and case studies available	Many producers	High
4c.	Weed management techniques	Low	Medium	Research available widely on different techniques; information distribution and access is an issue; complements point 4b.	Some producers, mainly cereal crops	Low
4d.	Pest control -flea beetle -grasshoppers -lygus bugs -wireworm	High	Medium	On-going projects in B.C. and North America (see discussion in other regions); little regionally specific research available	Some producers (mainly ground crops, cereal crops and berries	Low
4e.	Livestock needs -regulatory and other infrastructure needs 'outside the farm gate' -parasite management	Medium	Medium	Technical information is available from across North America; management models available from across North America; Ongoing entrepreneurial efforts developing genetics. Public representation on regulatory issues is weak.	Some producers	Medium
4f.	Infrastructure development	High	High	Information for development of cold storage, processing facilities for livestock and ground crops is available from across North America; is a capitalization and entrepreneurial development issue	Many producers	Medium

4g.	Marketplace development -information for customers -point of sale information	Medium	High	Marketplace information for small producers is needed; regional information needs research; on-going OSDP market research project; other information from across North America is available	Many producers, or could be seen as a personal business planning need	High
4h.	Communications -isolation from same sectors in other areas -local groups absent	Low	High	Many sources, websites, periodicals, but little focused & relevant production information	Many producers	High

4a. As in other regions, soil fertility and management issues were common among all producers, although not a particularly high priority in this particular study region. All of the long time organic farmers (livestock, cereal crops) felt that they were comfortable with their achievements regarding soil fertility, and had adjusted their production expectations to reflect their soils capacity. Tillage is used extensively by forage and cereal crop growers, and may become an issue in the future. No producers identified zero till organic production as a research need, although considerable research is underway. *It would benefit the organic industry generally if this research were brought forward, 'ahead of the curve', by OSDP sponsored projects*.

4b. Information needs are also similar to other regions, with more emphasis placed on the need for communications with producers in the same sector in different regions. The former organizational model for organic organizations in the region (regional certification focus) did not foster these kinds of communications. Several producers suggested that the accumulation of existing knowledge from experienced growers across the country would be very useful. *There is an opportunity here for institutions to develop case studies in the various sectors, like Ann Clark's work in Ontario, that could become both a learning tool and a baseline for the further development of best management practices in the industry. Funding sources other than OSDP, for example the probable funding that will result from the implementation of the Agricultural Policy Framework (APF), may be more appropriate for this work.*

4c.Weed management issues were not a high priority in this region. Cultural control practices in cereal and forage crops are well documented, and are accepted and relatively effective coping strategies. Yield reduction in cereal crops due to weed competition is well documented by conventional agricultural research, and seems to be an 'accepted fact of life' for most producers. Labour or time shortages for the necessary cultural control in ground crops and small fruit orchards is an ongoing concern. *Any research on covercropping and zero till would also be useful for this issue.*

4d. Pest control concerns were very specific to individual producers. Experienced growers had their own solutions, often avoidance of the problem by not growing the susceptible crop. Persistent large-scale infestations of pests such as grasshoppers have some solutions in system design, but remain a threat for organic producers.

A few producers mentioned wireworm problems. This a low priority issue for 'de novo' research for this region, although one that would become a component of actions taken to address information needs (4b. above).

4e. Livestock producers did not identify any pressing needs for research that relate specifically to organic production. Since many issues in livestock production have solutions in management practices that

address problem prevention, this should come as no surprise. Parasites present ongoing problem for all species – severe enough in some cases to prevent the inclusion of that species in an organic production program (sheep). Vaccines are being developed by the conventional industry (VIDO –Veterinary Infectious Diseases Organization) that will address some issues for some species. Livestock producers interviewed subsequent to the BSE incident have stated that any 'research' needs that address production issues 'behind the farm gate' are minor compared to the urgent need to properly represent the interests of organic livestock producers 'outside the farm gate'. As one producer stated "…if we don't take the lead in the impending regulatory decision making, we will lose (our ability to process and market our products)."

There is a pressing need for the development of a strong 'livestock caucus' within a 'professional development organization' (see Sec. 6 Recommendations) that can aggressively represent the interests of organic livestock producers at many levels within the larger agricultural industry. This representation falls outside the realm of certification, where much of the current activity is centered, and is currently more important to 'capacity building' in this sector than any agronomic research topic.

4f. Infrastructure needs have been much researched in the Peace region under various headings – community kitchen, value-added processing, mobile slaughter facility, etc. In all cases current and foreseeable volumes have been judged insufficient to warrant the large expenditures necessary for 'general use' facility development. However, more focused facilities have been established or are in the planning stages in northern and central B.C. and Alberta. These are without exception the result of entrepreneurial effort and will likely be able to benefit this region's primary organic producers in the future. Since this is principally a capitalization and business planning issue, with limited benefit to the industry as a whole, it should have a low priority for OSDP funding. (See 3h.)

4g. *It is important for this region's producers that their market information and support needs be included in the broader on-going OSDP market research project. To accomplish this, project developers will need to proactively engage this group. Commercial intelligence gathering, point of sale information, general process communication tools are some of the needs that have been mentioned. This issue is the highest priority for producers in this region.*

4h. A few producers have direct contact with COABC because of certification or directorship roles and so have less concern with communication issues than do others who expressed 'isolation' as a common theme. See 4b. above. Organizational changes by sector or production interest across regions, accompanied by active communication tools, could address these concerns. This is not a research need, but definitely a description of a tool that would help 'build production capacity'.

5. Research Resources

This research needs study is unique in the British Columbia context: to date there have been no other research needs studies specific to organic agriculture in B.C. Similar research needs studies have been done in other parts of Canada, the United States and Europe. Four major research needs studies (Clark, 2003, Walz, 1999, DARCOF, 2002, Padel, Powel and Lampkin, 2001) provided direction and corroboration for this study.

As well, we reviewed two other Canadian research needs studies and two unpublished meeting results (Canadian) addressing the same topic:

• Organic Industry Needs Assessment, March 2001, Saskatchewan Agriculture and Food

• Research Priorities Meeting, July 10, 2002, Ontario, chaired by Hugh Martin (unpublished)

• Organic Farming Research in Atlantic Canada, March 2001, AgriNova Consulting for Atlantic Canadian Organic Regional Network

• Notes from Organic Conference, March 11/12, 2002, Red Deer, Alberta (unpublished)

In addition to the three organizations discussed in the AgriNova report, we also mention, as further examples, seven other organizations that are involved in research or information dissemination directed towards sustainable and organic agriculture:

• Organic Agriculture Centre of Canada (OACC)

• Appropriate Technology Transfer for Rural Areas (ATTRA)

• Sustainable Agriculture Research and Education (SARE)

• Organic Farming Research Foundation (OFRF)

• CyberHelp (B.C. based web information service)

• Canadian Organic Growers (COG)

• CABI Publishing – organic-research.com

5.l Other Research Needs Studies

The results of the B.C. research align roughly with those of the previous studies. It appears that the general research and development needs of organic producers are quite similar in different regions of the world, although the ordering of priorities varies. This B.C. research complements and adds to the limited body of knowledge about organic research needs, at the producer level, found in North America and Europe.

Clark (2003)

Ann Clark's (2003) study of the research needs of Ontario's organic farmers is quite broad in scope. Its initial objectives were to improve competitiveness and develop integrated crop management systems.

The study details the following priorities:

• problem avoidance issues

• policy constraints within the organic industry

• the need to collect existing wisdom

• the importance of site specificity

• on-farm research.

• resource management

• food quality/safety

• livestock for organic farming

• plant breeding and seed production

• protection from genetic pollution

Problem avoidance issues are comprised of many different specific research needs: crop rotation practices, soil fertility and management issues, weed management, winter soil cover, and livestock confinement and feed substitution issues. Clark suggests that research on these topics is top priority for Ontario organic producers, affirming some of the results from this B.C. research study. Clark further states that an immediate action should be the development of a compendium of niche determinants for each major pest species (weed, insect, and disease), synthesized from the scientific literature. Research on problem avoidance

issues addresses the *cause* of the problem, because the visible problem – whatever it is – is just a *symptom* of a larger system dysfunction (Clark, 2003).

Policy constraint concerns exist in two broad areas: first, subsidies, and secondly, existing, proposed, or new policies which impact upon organic agriculture (Clark, 2003). The growth of organic agriculture in Europe has benefited from government subsidies, not necessarily specific to organic but directed toward environmental stewardship in general. Under the Common Agriculture Policy, many European nations heavily subsidized environmental stewardship and conservation programs in an attempt to limit agriculture production and stimulate rural regions. While conventional agriculture received the most funding support, organic agriculture has been cheaper to subsidize and thus has been encouraged.

This is seemingly at odds with the focus of international trade organizations and the North American rhetoric about subsidies and their removal. While all countries continue to support agriculture with large subsidies (Canada is the least subsidized for cereal, oilseeds, pulse crops, and beef, with the exception of New Zealand) there is some effort to have these removed. It is hoped that the Canadian organic industry will not be dependant on sustained government support in order to remain financially viable (Clark, 2003). Clark's study suggests that there is a need for research on the correlation between subsidies and environmental quality, specific to organic agriculture. While these studies have been done extensively for conventional industries (see Bradshaw and Smit, 1997, Bowler, 1992, Smit and Smither,1993), and link environmental degradation to increased subsidy levels, there has been little done in organic agriculture sectors.

Clark discusses some specific policy tools: crop insurance schemes for which the organic farmers in some regions are ineligible, workers compensation programs that overcharge organic growers, the Ontario Land Stewardship assistance program that was unavailable to organic growers, the Seeds Act that precludes the selling of open pollinated corn varieties favoured by organic farmers, and nutrient management planning in Ontario that requires composting to occur only on concrete floors, posing a burden on organic farms that may rely solely on compost nutrition.

There are no doubt similar policies, specific to the British Columbia context, and national policies, such as those contained in the Agricultural Policy Framework, which impact organic growers. Funding should be allocated to study these policies and their potential impact on B.C.'s organic industry. As well, active lobbying efforts will be necessary to ensure that the interests of organic agriculture are included as regulation is developed from these policies.

Clark's (2003) research needs study also identifies the need to compile and disseminate existing knowledge and conduct site specific and on-farm research. Many regions of Ontario have a long history of agricultural production and there are many individuals and historic printed materials that are recently becoming more useful, especially to organic farmers who are using more holistic systems of farming. Her study also found a lack of research on organic agriculture that was specific to southern Ontario and that was conducted on farms in the region. There was a good deal of research by higher education institutions on educational farms and research from other parts of the world. Clark recommends that organic research focus on regional contexts and microclimate conditions.

These needs echo what was found in this B.C. research study: the need to compile and make available existing knowledge and information and to have research conducted by and for those in the province who are organic growers.

Padel, Powel and Lampkin (2001)

This report details results of a survey of farmers and researchers done in the U.K. by the Instituite of Rural Studies, University of Wales. Of particular note in this report is the amount of research done or underway in the U.K. (and amount of funding committed) focusing on organic agriculture, and the

interest in and emphasis on the livestock sector. This suggests both a more mature organic industry and possibly as a result, significantly more 'official' support than in Canada.

The responses from producers are however still very similar to the responses by B.C. producers to this B.C. study.

The report uses thirteen categories to summarize the survey results, but gives no weighting as to priorities. The categories themselves are informative as to the broad range of issues facing decision makers regarding the allocation of resources for research and education. We have listed the categories below and have added notes highlighting some of the report content:

1. General points; priorities, funding and research organization
    a. need to ensure integration of programmes and research at the highest level
    b. need to include other players in the value chain, e.g. processors
    c. need for system based research, with regional and national variations considered
    d. importance of the interrelationship of organic and conventional agriculture
    e. need for new research to build on previous work.
2. Dissemination and technology transfer
    a. need for more effort to be put into communication, especially workshops, seminars, conferences, trade journals, manuals, farmer self-help groups, etc.
    b. need for case study work accumulated into benchmarks for various industry sectors.
3. Research methodology
    a. participatory and interdisciplinary.
4. Whole farm systems
    a. need for research into understanding of whole farm systems, including which farms are most suitable for conversion to organic production, inter farm linkages, energy use analysis, climate change impacts, multi-enterprise effects, agroforestry, long term effects of crop rotation, etc.
5. Soils and soil fertility
    a. importance of developing more reliable methods of monitoring soil fertility levels
    b. need to understand more about the effect of fertility on pest and disease control
    c. need for further research on manures and compost effects
    d. need to develop simple nutrient balancing methodology and understand how cropping sequences affect fertility levels.
6. Cropping systems and crops
    a. need for a broad range of work to be done on organic seed production
    b. need for continued research on varietal choices
    c. need to understand weed population dynamics
    d. need to understand pest and disease population dynamics.
7. Livestock and livestock systems
    a. need to do more research on breed, disease and pest

resistance and commercial trait relationships

b. need to investigate species-specific welfare and housing issues

c. need to further investigate health issues, especially alternative treatment and control strategies and products

d. need to continue research on many animal nutrition issues relating specifically to organic production.

8. Food quality and safety
    a. "definitive studies on the quality and safety of organic food".
9. Processing and storage
10. Marketing
11. Economics and rural development
12. Policy
13. Environment

There are references in this report to research projects affecting organic agriculture carried out under the auspices of the U.K. Ministry of Agriculture, Fisheries and Food (now the Department of Environment, Food and Rural Affairs), available at www.defra.gov.uk

Walz (1999)

Walz (1999) conducted a national organic farmers survey in 1997 and 1998 that was mailed to 4638 certified organic farmers throughout the United States and asked information about a variety of topics corresponding to their farms and their 1997 production year. The significance of this research needs study is that the information obtained is quantitative and provides a standardized response to a detailed set of questions. Although the results are not claimed as statistically significant of all organic producers, they are able to provide percentages and proportions to assertions of need.

The respondents ranked weed management as their number one research priority. Second and third priority were the relationship between soil fertility and crop health, pest and disease resistance and the relationship of organic growing practices to nutritional value of product. Soil biology, crop rotations, and cover cropping ranked fourth, fifth and sixth, respectively. Among the lowest ranked items were livestock production issues; alternative animal production systems, breed selection and genetics, and alternative animal shelter systems.

A section of the Walz report asks specific questions related to organic management strategies, asking farmers to list soil and crop management concerns. Foxtail, pigweed and quackgrass were the most frequently listed weed problems and bermuda grass, Johnson grass and bindweed were identified as the most difficult weeds to manage. Insect pests were discussed: cucumber beetles were listed as the most difficult pest to manage, followed by flea beetles, aphids, Colorado potato beetle, codling moth, leafhoppers, symphylans, and grasshoppers. A variety of animal pests were listed. The most frequently listed diseases were powdery mildew, blight (late and early), bacterial wilt, and mosaic viruses. A number of different management strategies were correlated with these weed, pest, and disease issues. Frequently, respondents stated that crop rotations, proper soil fertility and management, and appropriate growing conditions were some of the best ways to avoid these issues.

Walz (1999) also identifies the usefulness of a variety of information that organic farmers utilize. Among the most useful sources for organic production information were personal contacts, field consultants, supplier and grower associations, farming and gardening books, conferences and seminars, and other periodicals. Among the least useful sources were university research departments, government funded research institutes, email groups and subscriptions, and radio and television programs (Walz 1999). For organic marketing information, respondents indicated that buyers, other farmers, and individual consumers and their

customers where the best and most reliable sources of information. Non-government market information sources, state and federal agencies, and websites were ranked as the least useful sources of market information. Respondents stated that there was a need for more market information: organic prices and pricing, buyer lists, consumer demand trends, and the location of new markets were the most pressing research needs.

The Walz report, funded by the Organic Farming Research Foundation, affirms some of the findings from this study, although its scope is much wider. Weed management and soil fertility issues rank quite high, and management strategies such as crop rotations and proper soil building and soil fertility were identified as research needs to solve specific pest problems (evidence of the need for whole systems research). Additional information in the report, referring to marketing needs, information needs, certification needs, and existing markets are valuable reference material for any organic grower or researcher.

DARCOF (2002)

The Danish Research Centre for Organic Farming (DARCOF) conducted a review of their organic research priorities in 2000. The program was started in 1996 and has an estimated budget of Cdn. $21.6 million allocated between 1996 and 2001. The evaluation found that many of the projects funded were primarily focused on 'single crop, single field' scenarios and ignored rotation history or spatial effects. There was a call for a more comprehensive systems approach to nutrient management, encompassing plant-animal-man-environment, not just individual segments, with a renewed focus not just on N (nitrogen) but also P,K,S (phosphorus, potassium, and sulphur), and micronutrients (DARCOF 2002).

The evaluation also recommended that future research dollars be allocated through a shared conceptual framework that would unite the various specializations and interests within the organic research community. They found that existing results do not link well and are not in a form to support practical agriculture (i.e. the results are not immediately useful to organic growers).

The evaluation also found that medium and long-term research is needed to examine the effects and responses of growers to different research results. The benefits of research were determined to be an important issue; the spread of benefits and impact upon the organic sector(s) should be a determining factor when establishing projects and awarding funding. The evaluation also determined that future attention be paid to food quality issues, for both plant and animal products, from production to processing. Finally, the study found technology development, from farm machinery to information technology is needed to support the organic industry. More emphasis should be placed on graduate education, specifically to generate researchers able to handle complex systems and interdisciplinary research.

Specific recommendations found in the evaluation include identified research topics for future funding. These are of interest to this research study (COABC) and affirm the research results presented in this report. The recommendations are:

1. Emphasis on P, K, and S in supply, mobility, and soil depletion
2. Recycling of industrial and municipal residues, to complete the loop
3. More integrated studies, focusing specifically on on-farm studies and plant/animal interactions
4. Plant breeding to increase genetic variation and reduce pest damage, increase plant health, and improve feed and food quality – with a particular emphasis on secondary metabolites
5. Mixed species grazing, as of cows and sows, to enhance nutrient cycling and achieve related benefits, such as worm control in cattle
6. Screening of various breeds of cattle, pigs, and poultry for suitability to organic systems, and possible additional production systems, such as trout farming

7. Stockless production systems need to receive special attention
8. On-farm studies should be a more significant element in future research
9. Develop more operational parameters to study nature and environmental impacts, to develop both environmental impact statements and farmer decision tools
10. Develop new technologies, for tillage and hoeing, animal welfare, and IT
11. More fully integrate economic studies

Organic Industry Needs Assessment, Saskatchewan Agriculture and Food, 2001

"The top three priorities identified for production research and development were:

1. managing soil fertility and quality
2. studying crop rotations in relation to soil, weeds, insects and diseases
3. managing weeds," (p.3 of report)

The report suggests a systems approach for organic production research, but does not elaborate. It also identifies other producer concerns that correlate with the B.C. study findings:

• importance of on-farm research

• need to document practices of experienced growers

• preference for producer-directed, expert-assisted research

• communication needs

• marketing information needs

Research Priorities Meeting – July 10, 2002 – Ontario, chaired by Hugh Martin

Hugh Martin summarized the priorities identified by meeting participants into nine categories:

• whole farm planning systems

• plant breeding and genetics

• soil management systems

• livestock management

• dissemination of information

• application of existing research to Ontario conditions

• independent evaluation of products

• pest management

• market research

No analysis is provided, but the primary areas of interest are similar to other reports.

Organic Farming Research in Atlantic Canada – March 2001 – AgriNova Consulting for Atlantic Canadian Organic Regional Network

This discusses the possible roles for the Atlantic Canadian Organic Regional Network (ACORN) in developing and implementing organic research in Atlantic Canada. Shortly after this report was issued, the Organic Agriculture Centre of Canada (OACC) was established, and assumed most of the functions suggested for ACORN (see discussion of OACC below).

Of particular note in this report is the listing of research and casework that has been done by individuals, organizations and institutions in the region. That this research is not generally available underscores the importance of one of the recommendations in this report (and the others discussed above), that is, the need for an information 'accumulation' and dissemination service, tool or function. The report lists 'research needs' under the following general headings:

• Literature review, information collection,

• Crop production (weed and pest control)

• Livestock production

• Engineering

• Soil fertility

• Food quality

• Economics

It suggests that priority be given to work with immediate and very visible benefit to producers, and describes three existing organizational models that provide this function to their members:

1. The Practical Farmers of Iowa (http://www.pfi.iastate.edu/)

This non-profit organization ("farmers helping farmers make better decisions") is centered at Iowa State University and provides its members with an information network, basic on farm research, marketing information, workshops and field days, and access to farmer and institutional expertise in many fields.

Well established and highly successful, this is one of the best examples of the practical application of the 'producer-led, expert-assisted' approach to professional development for farmers.

2. Quebec Agronome model

These farmers' clubs hire agronomists to work with groups of farmers with similar production and information needs.

This model may be useful to B.C. organic producers as they prepare to organize around sectoral production and business interests beyond certification.

3. REAP Canada (Resource Efficient Agricultural Production) (http://www.reap-canada.com)

This independent, non-profit, research, consulting and international development organization based at McGill University conducts both on-farm and research facility-based programs. This organization has been working since 1986 with farmers and rural communities, both in Canada and internationally, "...to promote environmentally sound development to address society's need for food, fuel and fibre." (REAP Canada home page). They emphasize participatory on-farm research and plant breeding programs.

Many of the projects they have undertaken (see Reading List – Appendix 3) directly address some of the issues identified by B.C. producers. This organization may be a valuable partner/source of expertise for some of the work now called for in B.C.

5.2 Research and Information Organizations

In addition to the resources listed in the above (AgriNova) report, there are many others whose express purpose is to provide research and information for the organic farming community. We discuss six organizations below:

Organic Agriculture Centre of Canada (http://www.organicagcentre.ca)

This organization was formed in 2001 at Nova Scotia Agricultural College under the direction of Dr. Ralph Martin. Initially funded by the Canadian Adaptation and Rural Development (CARD) program and additionally by National Sciences and Engineering Research Council (NSERC) strategic grant, OACC intends to "…provide broad support, in Canada, for organic farmers and those in transition, through the development of new research programs, courses and deployment of effective methods of disseminating information." (OACC home page)

They have recently added a Prairie Coordinator (situated at University of Saskatchewan, Saskatoon) to their staff, who has been very active in collecting widely-dispersed research information of interest to prairie organic producers.

OACC has an ongoing research needs assessment project, as well as major projects in web course development, transition strategies, on-farm research, web based information resources, and market information. They have developed strategic links with many universities and Agriculture Canada Research Centres.

(See Appendix 3 for listing of information from the OACC web site on Canadian research projects)

This organization will no doubt become an important collaborator, source of information and source of expertise for B.C. organic producers. The role that OACC will play will be determined by the decisions B.C. organic producers take to meet their professional development needs in the near future.

Appropriate Technology Transfer for Rural Areas (ATTRA) http://attra.ncat.org

"The ATTRA Project is operated by the National Center for Appropriate Technology under a grant from the Rural Business - Cooperative Service, U.S. Department of Agriculture." (ATTRA home page)

This government funded project has available through its website, publications and extension services a massive amount of information relating to sustainable agriculture and some of the expressed research interests of B.C. organic producers.

We include this organization both as an important source of valuable information and as an example of the results that are possible if sufficient public (government) resources are focused on particular needs in agriculture 'ahead of the curve'.

Sustainable Agriculture Research and Education (SARE) http://www.sare.org

"SARE is a U.S. Department of Agriculture funded initiative that sponsors competitive grants for sustainable agriculture research and education in a regional process nationwide." (SARE website)

This organization has been operating since 1988 and has funded about 1800 projects. It has a searchable database of projects they have sponsored, an extensive publications list and online resources applicable to topics of interest to B.C. producers. SARE has three categories of grant programs:

- Research and education grants for scientists, producers and others in an interdisciplinary approach.
- Professional development grants for extension educators and other professionals to take advantage of learning opportunities.
- Producer (farmer/rancher) grants for on-farm work.

They have indicated that they would be willing to open a dialogue with potential Canadian partners, and have offered to share the benefit of their expertise. The contact person is Jill Auburn (JAUBURN@CSREES.USDA.GOV).

Organic Farming Research Foundation (OFRF) http://www.ofrf.org/research

The Organic Farming Research Foundation, headquartered in California, has been active for more than 10 years and in that time "has awarded over $1,000,000 in support of organic farming research and educational projects." (OFRF website)

"The purpose of the Organic Farming Research Foundation is to foster the improvement and widespread adoption of organic farming practices. To achieve this goal, we've defined our mission as: to sponsor research related to organic farming, to disseminate research results to organic farmers and to growers interested in adopting organic production systems, and to educate the public and decision-makers about organic farming issues." (OFRF website)

Several B.C. producers and affiliated groups have received funding from the OFRF. For example, the wireworm control research underway at Pacific Agri-Food Research Centre in Agassiz, B.C. has been partially funded by OFRF for the past three years.

This very successful organization will be an important collaborating partner for the work that the OSDP decides to undertake, not only as a funding partner, but also as a reference for previous work and as potential assistance in assessing the efficacy of proposed undertakings.

CABI Publishing http://www.organic-research.com

This online resource is a private database subscription service that, according to the website homepage, "…provides unlimited access to 120,000 abstracted research articles from 1973 onward…and is fully searchable."

Canadian information services targeted to organic producers:

In addition to OACC mentioned above, we would like to mention two other organizations in Canada that offer information services for organic producers:

CyberHelp
http://www.certifiedorganic.bc.ca/rcbtoa

This B.C.-based web service is partially funded by COABC and in spite of the fact that it is relatively new, provides an increasingly diverse and thorough selection of information links on topics of interest to organic producers and consumers. For example the current soils 'reference page' (http://www.certifiedorganic.bc.ca/rcbtoa/training/soil.htm) contains a selection of information resources on the topic of 'soil quality', the number one research interest of B.C. producers.

Unfortunately, it is limited to internet-based information. In the feedback received during this research, some producers commented that it was the passive nature of CyberHelp, along with technological barriers (lack of high speed internet), that made it less useful to many people.

Potentially, CyberHelp could be a valuable part of a total communications strategy, perhaps as an independent organization contracted to provide focused services to B.C. organic producers. It could be especially useful if it could participate in some aspect of the contextual research recommended for major research projects (see Recommendations, below)

Canadian Organic Growers (COG)
http://www.cog.ca

The senior Canadian organization focusing on organic issues, COG maintains a lending library, publishes a magazine and newsletter and supports information and data collection on the Canadian organic industry. B.C. COG members are active in the organic community.

This organization should be a valuable partner for B.C. organic producers and should be included in their discussions concerning professional development.

As well, there are many university, university extension agents, U.S. land grant universities and colleges, government affiliated institutions such as research stations, non-profit and non-governmental organizations, and for-profit private businesses around the world that conduct research on organic agriculture. To date, the majority of the research results have been in the public domain; anything conducted by government funded or affiliated organizations and the university or college system is generally available to anyone. While the results are published primarily in scientific journals and thus not always in an accessible form, and the research process is not always reciprocal, the results can be found or requested.

Research that has application to organic agriculture will not be found only in searches containing the word 'organic', since much important work is interwoven throughout the immense body of research and knowledge on the whole of agriculture. For example, in the organic livestock sector, pasture management and manure management issues often arise. Excellent work on these topics has been done recently at the Lethbridge Research Centre by Dr. Walter Willms and others (http://res2.agr.ca/lethbridge). This work does not refer to organic agriculture *per se*, but answers questions important to organic livestock producers.

Increasingly, private business has been conducting its own proprietary research. Many large farms, including some in British Columbia, conduct their own research in livestock, field crop, greenhouse, and ground crop sectors. This research is usually site specific and privately funded. It is also not usually available for public use, although occasionally research results can be accessed for a fee. Because of the flexibility provided by private funding, this research is often leading edge and forward thinking; gaining market advantage is a driver.

A significant amount of organic agriculture research has been conducted in western Europe and much of this research is difficult although possible to access from available resources here.

We have directed our review of published work to other research needs studies and also have included some specific information sources and research organizations. (See above)

Future projects supported by the OSDP fund need to take into account existing knowledge and research results. OSDP decision makers will want to avoid not only the 'nice to know' type of project, but also the 'nice to know again' projects. A critical component of this effort should be a review of pertinent literature for a specific proposed project or hypothesis for investigation. Proposed projects should be trying to fill a knowledge gap and not duplicate previous work. For example, a proposed project on compost tea should include a review of available research on compost tea (this information is publicly available) and an identification of a gap or need with this research. Another example would be a proposed project for research on downy mildew; a review of available literature on downy mildew and different organic methods of control or prevention is an essential part of the proposal. Producers proposing research on seed production would be interested to know that the Northeast Region SARE group has funded (US$62,925) research and the development of a handbook on just that topic – Project #LNE03-186. Those interested in reduced tillage systems for vegetable production would be informed by Project #LNE03-189 funded by the same group in the amount of US$150,000. Dairy producers considering the investigation of alternative mastitis prevention strategies could review a study done in Great Britain by U.K. Ministry of Agriculture, Fisheries and Food, #OF0124T, between 1996 and 1999. Organic grain growers interested in a research project on infrastructure and marketplace development should conduct a review of literature from both organic and conventional sources as there is a good deal of overlap. (In fact, this type of research may be better conducted within the framework of a private business plan.) Similarly, research on different tree fruit pests should be justified with a review of both conventional and organic research sources. The important point, again, is that future research needs to fill a knowledge gap; the search for available information will inform both the funding grantors and grantees.

There are obviously many more sources of information than those listed above, but this list provides a starting point and can be expanded by proponents of future research projects.

Appendix 3 contains a table of web site resources.

6. Recommendations and Conclusions

A summary of the priorities for research for B.C. organic agriculture is presented in Table 3 and the accompanying text. This table ranks the research priorities, as per this research June 2003, and this is based on analyses from each region. The feedback and discussion from the research participants provided valuable information about the political and economic context(s) within each region. The rankings are based upon this discussion and feedback, the interviews and workshops, and upon the knowledge, experience, and judgment of the research team.

The following recommendations further these results and provide more qualitative discussion about research procedures and sectoral development. These recommendations do not fall under specific research priorities, rather they represent issues larger in scope that support the priorities in Table 3. The recommendations fall under the following categories:

• project evaluation and monitoring,

• organizational and professional development,

• the role of entrepreneurs,

• the role for institutions,

• research type,

• communications,

• procedural recommendations,

• first steps towards a research strategy.

6.1 Project Evaluation and Monitoring

Project evaluation and monitoring is critically important to the OSDP and the current OSDP funding. As with any research program, the ultimate measure of its success will be the benefits to the grower community, now and in the future. There must be some consistent and reliable method to compare projects, to determine if they achieved their initial goals, and to disseminate the results of the research.

Project evaluation should occur at two points in a funding cycle: first, the evaluation of project proposals, and secondly, the evaluation of completed projects. A common sentiment heard throughout this research was that money (referring to agricultural research generally) is given out and seems to disappear, and that there is no follow-up or advertisement of the finished projects. Appropriate project evaluation and monitoring should mitigate this for OSDP funded work.

Project evaluation at the proposal stage currently includes a list of qualifying factors (see COABC website). These factors are based on the original grantors' (AFFF) criteria. Additionally, this study recommends the following criteria:

• *Spread of research benefits* (Who will benefit from this research i.e. the number of potential producers and in which sectors?)

• *Identification of knowledge or information gap* (Research projects should identify the specific knowledge or information gap that they intend to address.)

• *Review of available literature* (It is imperative that each project application identify the context within which it is being proposed i.e. a literature review to determine how this issue has been addressed elsewhere.)

• *Research process* (Many participants in this research called for increased transparency and participation, and that emphasis be placed on on-farm research projects. Each application should identify how the research process will handle these issues.)

• *Dissemination of results* (A clear plan for disseminating the results to the intended audience and methods for reaching audiences beyond this needs to be in place. There needs to be a practical and achievable plan for 'pushing' the information to producers.)

Project monitoring and completion evaluation is also a necessary component in the funding cycle. At completion of the project, an evaluation based on the original proposal can be done based on final reporting and documentation. Additionally, it would be invaluable to develop monitoring processes post-completion.

Monitoring would specifically examine the spread of research benefits, i.e. the dissemination and implementation processes. This sort of monitoring does not necessarily have to be project specific; COABC could conduct follow-up monitoring on a regional or sectoral basis and examine the impacts and effects of a number of projects at once. Currently COABC does not seem to have allocated resources to this function.

6.2 Organizational Development and Professional Development

An important point heard on several occasions in different regions of the province was the need for more organizational development and communication. Specifically, many participants felt relatively isolated from other certified producers within their own sector, possibly because the current certification organizations are based on regions, not on sectors.

For example, many ground crop producers in the North Okanagan have very little knowledge or communication with their counterparts in the Fraser Valley. Similarly the certified livestock producers in the province are scattered in different regions and have little communication with each other.

Our researchers were told that the research process for this study was valuable to many participants because of the opportunity to meet for purposes other than general meetings or certification meetings; and that they were able to discuss with other growers particular production and marketing concerns. We believe that these sentiments describe the rising need for a continuing forum for expression of professional development interests. This forum may be most appropriately organized around sectoral interests, for example sector caucuses within a larger professional development organization.

A large number of the research needs identified require a combination of agronomic research, information gathering, packaging, dissemination, and service provision. There is an opportunity for the development of an organization that would provide this service to organic growers. For example, soil fertility and management issues, including soil testing and the determination of appropriate soil amendments require this combination of research, information, and service provision. Additionally, grower manuals, pricing information and market information (gaps, niches, regional opportunities) could be provided by such a professional organization.

The justification for recommending the development of a professional development organization comes from observing the work of similar groups and the discussions heard throughout this study. The research needs (and other professional development needs) of B.C. organic producers are likely to increase and evolve substantially in the future. The OSDP fund has both a limited lifespan and financial resources; and is directed and managed for the most part by volunteers. A professional development organization could provide information packaging and delivery, a research resource for growers, and a project monitoring and evaluation service for exogenous projects.[12]

6.3 The role of entrepreneurs

There is a critical role to be played by entrepreneurs in the different organic sectors throughout the province. Entrepreneurial skills and development play an important role in community development, especially in rural regions (see Pierce and Dale, 2000, Roseland et al, 2000, Pierce, Prager, and Smith, 2001, Wallace Centre, 2003). In the organic agriculture sectors in British Columbia there are some ground crop, tree fruit, and livestock producers, as well as developers of livestock slaughtering and other processing facilities that would be considered leading-edge entrepreneurs because of the direction they are providing to the industry as a whole. The development of organic agriculture can be driven by *both*

[12] This proposed organization could generate a revenue stream by developing from the research it directs, promotes or funds a distinct suite of knowledge that could be formed into a service for its members.

organizational impetus and entrepreneurial innovation.

A cursory overview of the B.C. organic scene for the last twenty years reveals that the industry has been driven by entrepreneurs of various types, from worker co-ops and individual business people in the distribution business, to manufacturers, to growers and retail outlets. Only very recently has government funding been directed toward organics. This independence is one of the great strengths of the organic food production and distribution system.

Individuals who decide to invest their effort and resources into projects such as livestock slaughtering facilities, seed handling and packaging facilities, feed processing facilities, or research services and the like will likely play a major role in the future trends of organic agriculture in B.C. It is important that public organizations such as COABC not deflect this process inadvertently, but instead encourage entrepreneurs, influencing their investment decisions if need be (and if possible) for strategic reasons, and facilitate access to a broad range of industry specific information for new entrepreneurs. Research funding dollars should be directed at skill and knowledge building activities that will benefit the individual efforts of all producers and encourage the entrepreneurial culture that has served the industry well to date. Given the funding criteria established by the AFFF, the challenge for OSDP decision makers will be to support activities of general benefit, while avoiding interference with or providing undue benefit to business efforts already in process.

6.4 Role for Institutions

At the onset of this study, it was assumed by the project developers that institutions, represented primarily by university or college based researchers, would play a significant role in delineating the 'research needs' of B.C. organic producers. Both the response from producers, and review of the literature, suggest that a more appropriate role for institutions is as 'service providers' for the industry, i.e. that research projects be producer-led and expert-supported, not the other way round.

However, there are significant support functions that can be provided by these institutions quite apart from their potential role as research service providers. In collaboration with industry, there are several specific issues upon which institutional expertise could be focused:

• multidisciplinary/interdisciplinary case studies of existing organic operations. A body of work describing farming operations in various sectors would be extremely valuable for students of organic agriculture, for entrepreneurs preparing business plans, for industry leaders developing larger strategies, and for sector decision-making. A possible approach might include a collaborative effort to develop a 'whole systems' based model for assessing, analyzing and reporting on individual farming businesses. Once this model was developed and tested, perhaps graduate students could be engaged to conduct the field work.

This collection of case studies would also be valuable in the development of industry benchmarks and best management practices, a goal set out in Agriculture Canada's Agricultural Policy Framework. Funding flowing from the APF might be available for much of this work.

• industry and sector data collection – during this study, it became apparent that little reliable data was available to describe organic agriculture in the province. Knowing only the number of certified farms or acreage in the province is of little use for industry leaders, and especially for individual entrepreneurs preparing business plans for participation in the organic marketplace. While several attempts have been made by the B.C. organic community to collect more data, results have not been complete or comprehensive.

Many institutions have the expertise to do this kind of research, and could no doubt do it more objectively and thoroughly than could the industry itself. A Request For Proposals (RFP) to selected institutions by OSDP decision makers might be an appropriate approach.

• Ann Clark, in her assessment of Ontario Organic Industry research needs has suggested that one important first step would be the preparation of a "compendium of niche determinants for each major pest species (weed, insect, disease)" (Clark, 2003). This work may be best done by a collaborative effort of institutions since literature review and data collection from a wide range of sources would be an important component. An organization like OACC may be interested in coordination of this type of project that has far reaching benefits. OSDP decision makers may want to fund or partially fund a B.C. component of a larger project.

• This report suggests organizational changes as part of the answer to the needs expressed to us by B.C. organic producers. COABC, the organization sponsoring this project, is itself in the process of reviewing its structure and practices. The business faculties of B.C. universities have expertise that could be brought to bear on these issues. The objectivity and range of experience of individuals within these institutions would benefit the industry as it undergoes an important growth phase.

• An idea brought forward by Art Bomke of UBC included the development of focused (rapid) response flexible teams whose purpose would be to respond quickly to issues raised by producers (Personal communication, Whiterock, B.C., February 2003). While the original intent was to deal primarily with agricultural production issues, this model could work equally as well for some of the other concerns (e.g. economic) brought forward by producers and discussed earlier in this report.

• Institutions could contribute significantly to agriculture in general and the organic industry in particular by promoting graduate education specifically to generate researchers able to handle complex systems and interdisciplinary research (DARCOF, 2002).

6.5 Research Methods

The participants in this study have indicated that their preference is for on-farm and participatory research work. This preference is echoed throughout the research needs studies we have reviewed.

There is also a preference for a 'producer-led, expert(university)- supported' approach to the choice of topics for any research work that is undertaken. This approach is supported by many research and development institutions, and by governments through their funding criteria. (Clancy, Grow, 2003, p. 19)

The authors of this report envision a broad range of on-farm and participatory research projects.

Valuable information could be obtained inexpensively from very simple on-farm trials comparing practices or treatments [see Practical Farmers Of Iowa website for a concise explanation of the "Paired Comparison" trial methodology]. The possible costs involved would be for technical assistance to properly set up the trials and perhaps review the results, and for write up and publication costs. This report recommends a 'small projects discretionary fund' for projects such as these.

At the other end of the cost spectrum could be large projects doing whole systems work involving interdisciplinary research teams and multiple farm units in various regions. Such large projects would likely require cooperative funding from multiple sources, not solely OSDP funding.

For these larger projects, and for some of the smaller ones as well, many professionals involved with research are recommending a multidisciplinary and/or interdisciplinary approach. If it is important to organic agriculture that production research be systems oriented and "examine both the biophysical and socioeconomic effects of alternative farming systems" (Stevenson, Posner, Hall, Cunningham, and Harrison, p.1), and that it is participatory (includes farmers and others affected by farmer decisions, such as suppliers and processors), and that this work be communicated to a much wider audience than just those immediately involved, then it will be necessary to have an overarching framework in which to make critical decisions. A model addressing these issues is described in

Radially organized teams by Stevenson *et al* and is included in this report as Appendix 4. This approach will be especially important to the development of a model for the preparation of case studies as suggested in '6.4 Role for Institutions' above. And most important to producers, this research approach will address, by design, issues of viability in the dynamic situation that all of agriculture finds itself today. This multidisciplinary/interdisciplinary approach may not be practical for each and every project undertaken, but could form the context in which each project is considered, so that the effect of the whole body of work is cumulative and purposeful, and most important, relevant to producers.

6.6 Communications

The common request from producers that information be 'pushed' (actively delivered) to them, likely means that the listing of information or research results on a website will not be sufficient to meet their needs. More active communication tools are available, including subscription-based tailored information packaging, both electronic and print media. 'Pushing' has a cost that will have to be borne by producers. *CyberHelp* and *The Grower*, the two current media offering information services to B.C. organic producers, may be able to extend their services in the direction of a customized 'trade journal' directed at sectors within their readership.

Certainly the results of research projects funded by the OSDP will need to be circulated within the B.C. organic industry as the first priority, and secondly, made available to a wider audience.

Conferences, workshops, seminars, focused discussion groups, sector caucuses, farm field days, farm tours, and the like, are some of the more active means of information collection and dissemination. Partnership funding from many government agencies and private sources are available for this work.

The Organic Advisory Service already in place is considered valuable and should be strengthened. Production manuals that have been initiated but not completed need to be reactivated.

Resources spent on these activities to spread existing knowledge may prove more beneficial than 'de novo' research projects.

6.7 Procedural Recommendations

6.7.1. Establish a small projects discretionary fund, offering quick turnaround on projects under $2000, with a 50% cash-matched funding criteria. This would require a block of funds in the hands of the decision makers, to avoid the lengthy approval, administration and cash flow process now in place.

6.7.2. Set up a pre-proposal research fund to be accessed by producer groups proposing projects. This would be used for hiring professional researchers to compile a focused literature review on the topic of interest. Results of the literature review should go to a database for future reference (OACC, CyberHelp, university based or in-house). As in the small projects discretionary fund, this should have a 50% cash-matched criteria, maximum $3000, from funds in the control of industry decision makers.

6.7.3. Establish a 'decision makers fund' that would allow the current OSDP decision makers and their successors to hire expert assistance to review the merits of larger proposals. This assistance would be able to assess the adequacy and analysis of literature reviews and the efficacy of the proposed work. This fund could also be accessed to hire expertise to assess the spread of benefits of activities initiated by the OSDP decision makers.

6.7.4. The OSDP committee, which is now appointed, should be elected, as an interim measure, to approve research projects that are in the strategic interests of B.C. organic producers. (This group could become the steering committee for the formation of the professional development organization recommended in 6.2 above.) The process of review should be transparent and decisions should be published. Information regarding all proposals submitted, approved and/or rejected should be public information, except in those very specific instances where

proprietary information needs to be protected.

6.7.5. COABC should facilitate the formation of a professional development organization (6.2 above), either inside COABC as an independent subsidiary, or preferably, outside the COABC organizational structure. In either case, it is important that this organization be representative and operate at arms length in order that producers have the opportunity to discuss and express a perspective and take actions independent of the quasi-governmental regulatory and enforcement function that is the core business of COABC.

6.7.6. The work initiated by this project is ongoing and incremental. The professional development agency suggested above needs an executive director who will take the work presented in this report and add to it and focus it under the direction of a new constituency.

6.8 First steps towards developing a research strategy

6.8.1 *The first need for the B.C. organic industry is data collection on the industry itself* and its place within the larger food and agriculture industry. This has to be reliable and comprehensive data, from which strategic decisions can be made. It must be inclusive, i.e. not restricted to COABC and its affiliated organizations on the production side, and also include a critical analysis of markets and trends. It is important that surveys and other methodologies used for data collection, and the data collection, collation and analysis, be designed and implemented with independent professional assistance. One way to accomplish this would be for the OSDP decision makers to send out a request for proposals to institutions and/or professionals. It should be possible to find funding partners or cooperating institutions to assist with this important (and expensive) work, for example APF funding.

6.8.2 *OSDP decision makers must search for opportunities to partner* with other agricultural research activities in the province and elsewhere in order to participate in larger projects, encourage the inclusion of an 'organic' component in conventional research and have greater benefits flow from limited resources.

6.8.3 OSDP decision makers will want to initiate a *communications plan* directed to all organic producers in the province in order to implement any actions resulting from this study.

Conclusions

We have spoken with a cross section of organic producers throughout the province and prepared a summary of their priorities for research and information as of the spring of 2003 (Table 3).

During the initial stages of this project, we attempted to understand the differences in responses from the participating B.C. producers by describing 'organics as industry' and 'organics as movement', and further as 'product driven' versus 'process driven'.

This dynamic surfaces again in the development of a strategic approach to research and education by characterizing the choices facing decision makers as between investing in projects, or investing in human resources.

In the conclusion of the Walz report, under the heading 'Towards An Organic Farming Research Agenda', the author states, "The relative ranking of research priorities… provides an initial guide for targeting research and extension resources. The broad general quality of these priority areas begs many immediate questions…The next step is to assemble specific hypotheses and problem statements within each priority area."

Similarly for this B.C. study, much work remains to be done to focus resources accurately towards issues of importance to B.C. producers.

We have suggested an organizational response that would allow B.C. organic growers to further discuss these issues and gather additional pertinent information and expert assistance, with a view to the formulation of a professional development

strategy that would further their interests. While this organizational process is underway, it should be possible for OSDP decision makers operating within the current program to allocate resources to projects that address the priorities identified in Table 3, keeping in mind that *producer input*, *producer oversight* and *producer impact* are key decision making criteria.

This is the 'project' approach.

Don Macke, Co-director of the Center for Rural Entrepreneurship in Lincoln, NE, presented a paper to a workshop entitled 'Agriculture as a Tool for Rural Development' in April 2003. Speaking about rural development and the policy and program support needed to assist developing agricultural businesses, he stated, "This is a human resources development game requiring us to invest in people who can then create more successful ventures."

At the same workshop, Anthony Smith, Executive Director of the Lightstone Foundation and Community Development Corporation in Moyers, WV, stated, "...[we should]…support entrepreneurial communities, not projects."

One of our grower participants put it this way, "…Support the farmer...include more than organic farmers' interests when considering needs in the regions, for example, conventional small farmers, customers and other regional sustainable agriculture interests."

Since it is most likely that the 'increase in production capacity' goal identified by the COABC's strategic plan will be met by entrepreneurial effort, as it has in the past, it will be necessary for COABC to invest its time and resources to enhance the skills and abilities of existing and future organic growers in the province.

Investing in organic industry human resources requires a different strategic approach than investing in 'projects'.

Finally, as one producer stated during the interview process, "…if the B.C. organic industry is to thrive, not just survive...it will be important that its collective resources be focused…to anticipate and research, not the needs of the past, but the needs of the future."

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Appendix 1: Semi-structured interview questions

Introduction
We'd like to talk to you about research for organic agriculture in B.C., and will use your suggestions and answers to some interview questions to complete our 'research needs study'. This study is going to determine the direction of future research funded through COABC. The answers to these questions and results from subsequent workshops will result in a report that will help guide decisions on production related research proposals that are received by the Organic Sector Initiative Advisory Committee. Any input you can give is important and the following list of questions will be the focus of an informal and confidential interview. If you would be willing to participate in this study, please take a minute to think about the following questions and indicate a convenient time to contact you, preferably by phone, between the dates of March 12 and 31.

Part I
1. What is the primary production focus from your farm? Secondary/other production focus?

2. How many acres do you have in organic production this year? Relative to other organic producers in your region or sector, would you consider your operation small, medium or large? Are you satisfied with your production levels?

3. How long have you been growing organic crops or livestock? How long have you been selling what you grow?

4. Where do you see your farm heading over the next 20 years/generation/for your kids? What would you like to see happen with your farm to achieve this?

Part II
This section asks some questions about your previous and current experiences with farm-related research and where you think it should be heading in the future. We want you to think beyond your own operation and speculate on the sectors of organic agriculture with which you're most familiar. (i.e. What will be good for the entire sector/industry? Where should the sector/industry be heading in the future?)

5. What have you found to be the major challenges to achieving the production level of the major products on your farm? What have you found to be the major challenges in achieving the kind of production system that you want? (if different than the first part of the question). For example, do you have problems maintaining target production levels? Why? Are there crops that you'd like to grow or have tried previously but don't grow now? What stands in your way? Is maintaining product quality a challenge in your operation?

6. What do you find consistently costs you the most or requires the most labour, or more than expected, to maintain production levels?

7. Looking at your operation – where do you see the most pressing need for research and improved information in the following components: *(Be specific where you can – particular crop, particular weeds, diseases, harvesting techniques, quality control techniques, etc.)*
– planting/growing?
– harvesting?
– post-harvest handling?
– marketing?
-quality control throughout?

8. What kinds of experimentation do you do on your farm? Do you keep formal records of the

results? Do you discuss or compare your experiments with other producers?

9. Is there previous collaborative research (on-farm/off-farm) that you've been involved in that has or hasn't worked out? Please list and describe these briefly. What research agencies or funding sources were involved?

10. Would you be willing to be involved in on-farm research again? Under what conditions? What would you be willing to contribute – cash, land, equipment, technical skills, planning and design, etc.?

11. In your experience, what style or method of researching in agriculture is most useful to producers like yourself? *(Is it field trials, on-farm research, university/farmer partnerships, research done by community organizations, research done by informal farm groups, or some other arrangement?)*

12. Do you think that the research needs of the B.C. organic farming community could best be served by:

12.1 many small projects in all regions and sectors
12.2 larger projects in each sector
12.3 a single large initiative benefiting all producers

13. Do you feel that the research needs on your farm are representative of most of the other producers in your area? Are there other producers who would have different needs because of size, niche markets, etc?

14. If you had to choose a single important research interest, what would it be:

14.1 for your farm?
14.2 for your sector?
14.3 for the province?

15. Do you feel that your sector *(e.g. organic potato industry, organic vegetable sector, organic beef sector, organic apple growers, organic broiler sector, etc.)* in B.C. faces the most pressing challenge with achieving increased production levels, or with marketing abilities, or quality control, or processing, or other issues beyond the farm gate, etc.?

16. We're trying to come up with some research priorities your sector *(e.g. organic potato industry, organic vegetable sector, organic beef sector, organic apple growers, organic broiler sector, etc.)* in B.C. – what would you recommend from your experience? Please be specific if you can. Rank your choices.
Do you know if the research you are suggesting has been done elsewhere?
If yes, where? What results? Why do you think it should be repeated?

17. What are your information-source preferences for learning about recent studies or innovations in your industry:
- Books?
- Newspapers/magazines?
- The internet?
- Farm tours?
- Field days to see results of research activities?
- Demonstration projects?
- Word of mouth?
- E-mail discussion lists?
- Meetings and conferences
- Classes or workshops

Appendix 2: Workshop Guide

Handout 1- Specific research priorities

Objective:

To determine the most important and immediate priorities for future research in the organic agriculture sector.

Instructions:

Please use the following questions as a guide throughout the discussion. Space has been left for you to add points for discussion or for inclusion in the meeting notes.

1. From your experience, where do you see the most pressing need for research and or improved information? *(Be specific where you can – particular crop, particular weeds, diseases, harvesting techniques, quality control techniques, etc.)*
    a. planting/growing?
    b. harvesting?
    c. post-harvest handling?
    d. marketing?
    e. quality control throughout?
2. Can you think of particular research and or extension projects (on-farm, with an organization, etc.) that you would like to see happen?
3. In your experience, what style or method of researching in agriculture is most useful to producers like yourself? *(e.g. field trials, on-farm research, university/farmer partnerships, research done by community organizations, research done by informal farm groups, or some other arrangement?)*

Handout 2 - General research directions

Objective:

To examine the long-term goals of the organic sector in B.C. with respect to research and development.

Instructions:

Please use the following questions as a guide throughout the discussion. Space has been left for you to add points for discussion or for inclusion in the meeting notes.

1. Where do you feel most emphasis should be placed for research and future development of the organic sector – production, harvesting, marketing, quality control, etc.?

2. What are the benefits to research that is oriented toward increasing production within the organic sector?

3. The drawbacks?

4. What do you think the role of membership organizations should be regarding research in the organic sector?

5. What do you think are the biggest challenges to the organic sector in B.C. in the coming years?

Appendix 3: Reference Web Sites (a place to start)

http://www.ipmalmanac.com/	Integrated Pest Management
http://www.oekoforum.de/english/index.html	Environmental Research Network - Germany
http://www.oeko-institut.org/index.html	Institute for Applied Ecology - Germany
http://www.oel.fal.de/	Institute for Environmental Agriculture
www.organicagcentre.ca	Organic Agriculture Centre of Canada
http://www.organic-research.com/	International info - Searchable abstracts
http://www.organic-research.org/	International info
http://www.pmac.net/ge.htm	Pest Management At The Crossroads
http://www.rachel.org/home_eng.htm	Environmental Research Foundation
http://www.sare.org/	Sustainable Ag Research & Education Network
http://www.sarep.ucdavis.edu/	Sustainable Ag Research & Education, UC Davis
http://www.attra.org/	Alternative Technology Transfer for Rural Areas
http://www.epa.gov	US Environmental Protection Agency
http://www.certifiedorganic.bc.ca/rcbtoa	CyberHelp (B.C.)
http://www.cog.ca	Canadian Organic Growers (COG)
http://www.reap-canada.com	REAP Canada (Resource Efficient Agricultural Production)
http://www.pfi.iastate.edu/	The Practical Farmers of Iowa
http://www.ofrf.org/research	Organic Farming Research Foundation (Calif.)
www.defra.gov.uk	U.K. Ministry of Agriculture, Fisheries and Food (now the Department of Environment, Food and Rural Affairs),
http://www.nal.usda.gov/ag98/	Agricola (Agricultural OnLine Access USDA)
http://www.infobasket.gov.bc.ca	BCMAFF InfoBasket
http://www.fptt.gc.ca/agri.html	Federal Research Facilities (including Agassiz Research Centre/Summerland Research Stn. Centre)
http://www.fptt-pftt.gc.ca/bc.html#agassiz	Pacific AgriFood Research Centre in Agassiz, and in Summerland
http://www.carc-crac.ca/english/index.htm.	Canadian Agricultural Food Research Council

Appendix 4: Radially organized teams

Addressing the challenges of sustainable agriculture research and extension at land-grant universities

by Steve Stevenson, Joshua Posner, John Hall, Lee Cunningham, and Jan Harrison
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Abstract
Researchers at land-grant universities are under pressure to widen their research objectives, which requires them to expand their inquiry from a disciplinary base to a systems level, to include farmers and nonuniversity organizations as research collaborators, and to communicate with broader sectors of the public, such as consumers and policy makers. However, there are few rewards for scientists who undertake long-term, systems-based research. An approach that brings together multidisciplinary, multiprofession teams using a radial model of organization has successfully addressed these challenges in Wisconsin. A small "hub" manages the team, with the remaining participants linked to component task forces or "satellite" projects. This enables research to be done on both multidisciplinary and related singlediscipline questions. Radially organized teams can attract diverse people with different time commitments and reward incentives. The research meets the criteria of public and academic audiences alike. For innovative research and extension efforts like radial teams to reach their full potential, larger institutional changes are needed within the landgrant system and professional agricultural societies.

Key Words: multidisciplinary team research, land-grant universities, alternative agriculture, integrated cropping systems

Introduction
In applied agricultural research, the landgrant universities face several major challenges through the 1990s and beyond:

Challenge I: To adopt systems oriented, agroecological approaches that examine both the biophysical and socioeconomic effects of alternative farming systems.

Voices inside and outside the land-grant system increasingly are calling on agricultural researchers to expand their inquiry from a discipline base to a systems level (Schuh, 1986; Buttel and Busch, 1988; National Research Council, 1989). Behind these calls is the need to identify, evaluate, and implement agricultural systems that are "economically sound, socially acceptable, and environmentally compatible" (Lacy, 1993, p. 41). Some writers have focused on systems analyses in the biophysical areas (Duvick, 1990; Francis et al., 1990), others on the connections between the biological and the social sciences (Heberlein, 1988; Lacy, 1992), and still others on matters of social justice (Allen et al., 1991).

Challenge II: To expand the circle of research and extension collaborators to include farmers and representatives of nonuniversity organizations.

Suggested additional participants include producers, and where applicable, suppliers, processors,

nonprofit environmental and consumer organizations, and representatives of government agencies (Busch and Lacy, 1983; Schaller, 1991). Such calls have several bases: the historical citizen/university dialogue envisioned under the Morrow, Hatch, and SmithLever Acts (Danbom, 1986); a growing awareness among private U.S. corporations that listening to customers is crucial (Deming, 1982; Peters and Waterman, 1982); and the success of farmer involvement in applied research in international agriculture (Chambers et al., 1989). Reasons for expanding the circle of research and extension collaborators range from raising the quality and relevance of the knowledge generated (Suppe, 1987; Stevenson and Klemme, 1992), to restoring the image of the land-grant system (Buttel and Busch, 1988).

Challenge III: To communicate research results to broader audiences, including consumers and policy makers.

The range of citizen groups who are actual or potential constituencies for the land-grant university system has changed significantly since the system began in the late nineteenth century (Buttel and Busch, 1988). Consequently, landgrant scientists and educators should establish communication with these new groups (Debertin, 1992). Particularly important are consumers and policy makers (National Research Council, 1989; Clancy, 1992), two groups with whom land-grant institutions historically have not communicated well (Buttel and Busch, 1988; Lacy, 1993). Not giving attention to these communication channels will prove increasingly costly as the public becomes more concerned about agriculture's impact on the nation's natural resource base and the food system (National Research Council, 1989; Gussow, 1991).

Multidisciplinary, multiprofessional, radially organized teams can attract diverse groups of people to undertake various types of systems research and extension. In the next section, we outline the radial model of team organization, an approach that offers particular advantages for addressing the three challenges listed above. Next, we describe two team projects in Wisconsin that use this model. One is a case study; the other uses a traditional replicated research design to compare alternative production strategies. We then assess the radial model after three years of experience, and conclude by offering some thoughts on what else the land-grant universities must do to meet the challenges of the next decades.

Radially organized teams: the model

Little attention has been paid to the organizational dynamics of effective multidisciplinary, multiprofessional teams in university-based agricultural research. The radial approach to structuring applied research and extension teams was inspired by the work of several organizational theorists who emphasize participatory leadership and goal-setting (Deming, 1982; Wright and Morley, 1989; Miller et al., 1990), adaptive divisions of labor (Perrow, 1979; Kanter, 1983; MacRae et al., 1992), and multiple reward structures (Weisbord, 1976; Peters and Waterman, 1982). Many organizations, including research institutions, traditionally have divided labor either by specialty (discipline-based departments) or by multiskilled units (task forces) (Weisbord,1976). Radially organized teams allow both.

This model is so named because when viewed schematically it resembles a spoked wheel. The center or "hub" consists of a few systems-oriented collaborators. They are connected to "satellite" researchers who focus on specific, discipline-oriented problems. Within the hub is the "axle," the administrative center.

The responsibilities of the team's hub include focusing on overall project objectives, particularly the interdisciplinary or systems-level investigations, and helping the axle with day-to-day management. To accomplish these tasks, hub members must meet frequently to discuss developing situations. They also initiate new satellite activities, integrate the findings of the completed research, and direct the outreach components.

Other team members involved in satellite research have more narrowly defined objectives that fit comfortably into existing disciplinary approaches, such as monitoring weed management strategies, arthropod dynamics or farm economics. These activities can be either long- or shortterm.

The "spokes" or means of communication that connect the hub with the satellites include field visits, team meetings, progress reports, and telephone. The axle in this model consists of the principal investigators, who are responsible for helping the teams to function effectively and for dealing with external agencies, such as by soliciting funding and writing reports.

In summary, radially organized teams do the following:
· They foster effective coordination of research and extension activities on multidisciplinary and related single discipline questions on a wide range of topics.
· They enable research coordinators to attract a wide range of university and nonuniversity participants with differing motivations, time commitments, and reward requirements.
· They allow satellite studies related to the core scientific explorations to be done according to different schedules.

Projects that illustrate the radial model
Two Wisconsin projects currently employing the radial model of team organization are described in Tables 1 and 2. One project, the Krusenbaum study, is a whole-farm case study. Its objective is to monitor and assist a young farm couple as they convert a newly leased dairy farm from conventional to organic management. The other project, the Wisconsin Integrated Cropping Systems Trial, is a field-sized, replicated study that compares the productivity, profitability and environmental impact of six agricultural systems at two locations. Both projects began in 1989.

Forming teams and resolving conflicts over research design
With a general research hypothesis in mind (Tables 1 and 2), the principal investigators or axis members of each project began forming teams through ad hoc meetings to which they invited many potential team members. The primary tasks of these early meetings were to gauge people's interests and to choose the general research methods for each project (Tables 1 and 2).

Issues associated with alternative agricultural systems had been heavily politicized in recent years (National Resource Council, 1989; Council for Agricultural Science and Technology, 1990; Potash and Phosphate Institute, 1990). Therefore, both projects gave high priority to insuring that the teams represented a range of philosophies so that future audiences would consider them "honest brokers." As Table 3 shows, the result was that the teams included a significant range of university scientists and other agricultural professionals. Because of the applied nature of the research, the scientific cores of both projects were recruited from university extension researchers drawn from the biological, physical, and social sciences. Farmer members of the Krusenbaum case study were selected because of their experience with systems that use reduced levels of purchased inputs. Farmer members of the Cropping Systems Trial, on the other hand, were chosen to represent a range of production strategies that paralleled the cropping systems being evaluated in the field-sized experiment.

About half the scientists invited to the initial meetings joined one of the projects. The primary reasons of those who did not were lack of time or objections to the research methods. These objections involved three methodological issues. First, several scientists discounted the Krusenbaum project because confounding phenomena are inevitable when an entire farming system is being studied, and because it is difficult to generalize from a case study. Second, a serious debate erupted in the early meetings of the Cropping Systems Trial between ecologists and production scientists. Expressing boredom with the simplicity of most agricultural systems, the ecologists argued for including a wide diversity of crops in the trials. The production scientists, on the other hand, wanted to limit the comparisons to economically reasonable

alternatives. The project's hub developed a compromise consisting of six rotations, all potentially competitive economically, but ranging in complexity from continuous corn to controlled livestock grazing.

The last conflict was over farmers' power within the teams. The university scientists all accepted the principle of farmer participation in decision making, but several objected strenuously to the principal investigator's commitment to submit all research protocols to farmer evaluation, with the possibility of farmer veto. Scientists who felt most strongly about this withdrew.

A related disagreement was over how fast to release information from the research projects. Farmers and extension agents were concerned about the slow publication timetables of the university scientists. This conflict was resolved by scientists agreeing to present preliminary results at field days and through university departmental papers.

Involving a wide range of university and nonuniversity participants in the design phase resulted in a team of self-selected people for each project who felt comfortable working together and who agreed upon a common set of objectives (Tables 1 and 2). However, it quickly became clear that few participants in either project had the time to administer or coordinate the proposed research and outreach. The radial model of organization helped to resolve this impasse by accommodating team members' varying time commitments and research preferences. Table 3 describes the axle, hub, and satellite structures that eventually emerged for the two projects.

Using the radial model

Although the two projects have very different designs, their objectives are similar (Tables 1 and 2). Both emphasize understanding the biophysical and socioeconomic dynamics of the farming systems under study. Identifying and evaluating alternative production strategies figure strongly in both projects, and each team has made substantial commitments to educational and outreach activities.

As a result, there are many parallels between the two projects' hub activities (Tables 1 and 2). The first task of both hubs was to design the basic crop rotations. Other tasks included establishing data collection and measurement protocols for the performance of the crops and livestock and for economic and management indicators. Both projects hold winter meetings at which all members review plans for the coming season. Hub members meet regularly in the spring and early summer to implement timely changes in cropping plans. Additional hub activities include organizing field days, site visits and other educational programs, and annual team meetings to review project and team performance. Less coordinated effort is required for the satellite activities, which are component-specific and often shorter term. As described in Tables 1 and 2, these parallel explorations include agronomic, animal, physical, and farm management studies.

An assessment of the radial model

Three years' of experience with the two Wisconsin projects is enough to allow an initial assessment of the radial team model. The assessment focuses first on how well these radial teams have addressed the three challenges to the land-grant system posed earlier, and second on how well radially structured teams solve organizational problems generic to all team efforts.

The three land-grant challenges:

· To adopt systems level research

Both Wisconsin projects meet this challenge, with qualifications. Each focuses on an important system--an entire farm in one case, and a series of alternative cropping systems in the other. However, nearly all the analyses so far have been done in parallel rather than interactively. Agronomists compare nutrient cycling or weed ecology in the various cropping systems. Soil

scientists focus on the systems' impacts on soil erosion or groundwater quality. Social scientists monitor the farms' labor use, management decisions, and profit margins. Helped by hub members and team meetings, such investigations result in important multidisciplinary as distinct from interdisciplinary research.

Some systems-level problem solving of an interdisciplinary nature has been undertaken in each project. The Krusenbaum team has worked interactively to generate dairy forage systems that comply with environmental standards, meet the herd's nutrient needs, and are suited to the farm family's labor and financial resources. As the literature suggests, truly interdisciplinary analysis is both required and facilitated by systems level problem solving (Birnbaum, 1982). Interdisciplinary efforts, however, require commitments of time and resources that only a few participants could make.

· To expand the circle of research and extension collaborators
Both Wisconsin teams have done well in responding to this challenge. As Table 3 reveals, both have farmers, county extension agents, scientists from non-profit organizations, and professional agricultural consultants as active members. Also, the Cropping Systems Trial includes a high school teacher and the superintendents of the institutional farms hosting the investigations.
A greater challenge than recruiting these nontraditional research participants has been to obtain more than token involvement. As indicated above, the issue of farmers' power drove several prospective university scientists away when the teams were being formed. Both proactive and reactive organizational mechanisms have been used to give the nonscientists on the teams a sense that they are "owners" of the projects and exert real authority. First, the farmers, extension agents and research station superintendents were involved from the outset in setting the objectives and designs of both projects. This resulted in placing high priority on farmers' concerns regarding the financial, labor, and management implications of the farming systems being studied and on the extension agents' concerns about the educational components. Second, nonscientists in both teams are empowered to veto project ideas that they collectively judge to be off the target.

· To communicate results to broader audiences, including consumers and policy makers
As with the other two challenges, the Wisconsin teams have had qualified success in meeting this outreach challenge. A large number and good variety of people attended traditional field days sponsored by the two projects. Also encouraging has been the response to several innovative outreach activities generated by team members. These include elementary and high school curriculum units developed by the teams' county extension agents and public school teachers (Cunningham, 1992) and twilight meetings, cohosted with the Audubon Society, on the interactions between agriculture and wildlife. Attempts to communicate with state policy makers, on the other hand, have been only partially successful.

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Organizational evaluation
Besides having to meet these three challenges facing land-grant universities, the radial teams at Wisconsin had to address organizational challenges that are generic to all team efforts, but are particularly important to these teams because of the mix of disciplines, professions, and political outlooks. To function well, radial teams must develop effective leadership and goal setting procedures, foster successful communication and conflict resolution, and insure that the necessary

resources are obtained to reward and motivate team members (Weisbord, 1976).

· **Leadership**
Effective leadership is critical in managing the varied activities of multiprofession radial teams. It requires the teams' axle and hub members to make a substantial commitment and to be competent both in scientific judgment and human relations skills (Anbar, 1973; Rossini and Porter, 1979). Commitment is required because leadership and coordinating duties often are frustrating and time consuming (Heberlein, 1988). As shown in Table 1, radial teams need substantial monitoring and adjusting. This attention is particularly necessary in agriculture, where participating professionals like university scientists and family farmers are accustomed to working independently.

Pivotal to the successes of both Wisconsin teams has been the leadership of an axle person who not only has a background in farming systems research but also has a mandate from the college to facilitate applied, multidisciplinary projects. Such job descriptions are rare in landgrant institutions. Also, both teams have profited from the inclusion of a social scientist interested in small group dynamics, another nontraditional area for agricultural researchers.

· **Internal communication and conflict resolution**
These areas clearly show the importance of leadership and a center of team accountability. After experimenting unsuccessfully with more complex communication structures, both teams decided to transmit all significant information through one axle faculty person. Agendas for planning and communication are prepared by this team leader and carried out in several ways. The hub of the Cropping Systems Trial meets four times a year, while the Krusenbaum team hub has averaged over six meetings per year. The full teams meet twice a year, once before planting and once after harvest. Annual reports summarizing the various satellite studies also are important in communication.

Conflict resolution also is handled in various ways. Whenever possible, compromises are forged at team meetings, such as the compromise mentioned earlier between the ecological and production groups in the Cropping Systems Trial. When such resolution is not possible, the satellite studies and onfarm trials offer opportunities for conflicting sides to try out their preferences, such as testing the effectiveness of various soil additives.

As mentioned, veto power is important for both projects. An agreement was reached early in the Krusenbaum project that whenever the farm couple chose not to follow advice offered by the team, they would tell the hub why in writing. The Krusenbaums kept a decision diary that shows such veto power was exercised primarily when the couple believed that following the advice would require too much labor or would significantly set back the farm's transition to organic certification (Stevenson, 1993). The veto power exercised by the county committees of the Cropping Systems Trial was less aggressive, and usually involved recommending modifications of the satellite research experiments proposed by university scientists.

· **Obtaining resources**
The marginal status of long-term, systems research is revealed by the difficulties that both teams have had in securing funding. One problem has to do with the research objectives. Since neither study focuses primarily on agricultural inputs, it is difficult to go to some traditional sources that fund applied research. On the other hand, neither study is sufficiently process-oriented to have access to funding sources for basic biological research. Timing is another problem. Neither longterm rotations nor farms in transition are in equilibrium during the early years, so that few conclusions can be drawn with short-term funding.

Finally, academic prejudices appear to play a role. The Research Committee of the Graduate School at the University of Wisconsin, for example, rejected funding for the Cropping Systems

Trial with the justification that the school "should not fund projects that do not potentially help faculty to develop research programs fundable by federal agencies like NIH, USDA, NSF, etc." The committee twisted the knife deeper by commenting to the principal investigator that its funds "should go to projects with clearly stated hypotheses and methodologies used in creative ways" (!) (memo to Joshua Posner, December 12, 1991).

On the positive side, support for the two projects has been secured from nontraditional funding sources, including the University of Wisconsin's Center for Integrated Agricultural Systems (Stevenson and Klemme, 1992), the Wisconsin Department of Agriculture, Trade, and Consumer Protection, the Wisconsin Department of Natural Resources, USDA's Sustainable Agriculture Research and Education program, and the Kellogg Foundation.

Summary
Our experience shows that radially organized teams of scientists, farmers, and other agricultural professionals can make important contributions to sustainable agriculture research and extension. Areas identified for further work and development include:

· Doing truly interdisciplinary research to complement multidisciplinary and single discipline investigations.

· Broadening the acceptance of the contributions that nonscientists make to multiprofessional research teams.

· Developing creative outreach strategies to communicate with wider sectors of the agricultural community, particularly policy makers.

· Generating new sources of funding and support for long-term, systems-oriented agroecological studies.

To address these challenges successfully, significant institutional changes will be needed within the landgrant system and professional agricultural societies. These changes include:

· Broadening the public research agenda beyond the traditional orientation toward agricultural production issues and the recent emphasis on the molecular and cellular levels (Bonnen, 1986; Buttel and Busch, 1988). This will mean seriously upgrading the attention given to such topics as ecological systems, whole farm and community analyses, and matters of class, race, gender, and intergenerational equity in agricultural and food systems (Allen et al., 1991).

· Modifying institutional structures to give a clear mandate for integrating high quality science with systems-oriented applied research and outreach programs. Encouraging efforts to do so are occurring at centers of integrated or sustainable agricultural systems on several land-grant campuses across the country (Lacy, 1992). Such efforts, however, need to be institutionally structured at higher levels of organizational authority and integration (Weiss and Robb, 1989; Beattie, 1991).

· Altering the flow of resources and rewards to create incentives for interdisciplinary research and outreach efforts. Examples include devising ways to credit multiple authorship fully (Friedhoff, 1988), securing space in prestigious journals for reporting high quality, systems oriented research (Heberlein, 1988), and revising job descriptions and tenure evaluations for new faculty hired to provide leadership to effective multidisciplinary and multiprofession teams.

Table 1. The Krusenbaum Farm: a case study and model in the establishment of an organic dairy
Hypothesis: A low-input, sustainable agriculture approach is suitable for entry-level dairy

farmers.
Research methods: A multidisciplinary case study of a family farm and its transition to organic farming.
Research objectives:
1. To describe the biological, physical, and financial effects of adopting low-input production practices.
2. To chronicle the evolution of a set of coherent farm strategies to deal with issues of animal husbandry, debt management, and labor use.
3. To develop tools that will permit generalizing from a case study to help others evaluate alternative production strategies.
Hub activities: Conceptualize and evaluate an overall transition plan
1. Design crop rotations to meet economic and organic objectives
2. Develop and annually review the dairy herd feeding strategy
3. Annually review compliance with ASCS and SCS regulations
4. Annually review nutrient management and weed control program
5. Maintain farm records (e.g. agronomic, climatic, sales and purchases)
6. Organize field days
Satellite activities: Redesign field boundaries to minimize erosion
1. Weed monitoring and control strategies
2. Evaluate milk production and herd health
3. Analyze financial records
4. Maintain decision diary
5. Analyze building and machinery needs
6. Monitor soil biological and physical characteristics
6. Maintain labor diary

Table 2: The Wisconsin Integrated Cropping Systems Trial Hypothesis: Increasing crop rotation diversity can maintain system productivity and profitability while reducing the need for chemical inputs.
Research methods: A randomized complete block design comparing six rotations at two locations. Individual plots are approximately 0.75 acres
Research objectives:
1. To describe the biological, chemical, and physical impact of alternative crop rotations at the field level. This work will help promote an agroecological focus on farming.
2. To quantify the short- and long-term economic implications of adopting alternative crop rotations.
3. To expand the range of alternative technologies being presented to farmers.
4. To build functioning "learning centers" that will involve diverse groups in community learning about agriculture.
Hub Activities: Design the initial set of treatments
1. Supervise the agronomic activities on the plots
2. Modify treatments as the growing season progresses
3. Develop the Learning Centers educational programs and field days
4. Conduct site visits
5. Edit an annual technical report
Satellite activities: Monitor earthworm numbers
1. Study the evolution of weed seed numbers
2. Build phosphorous and potassium nutrient budgets
3. Measure fall soil nitrate levels
4. Describe changes in soil health
5. Screen litter dwelling arthropods
6. Take census of nematode populations
7. Characterize corn root health
7. Conduct economic analysis

Table 3. Team make-up of two Wisconsin projects employing the Radial Model of Organization.

Krusenbaum Project

· **Axle:** Host farmer, MFAI agronomist, UW agronomist
· **Hub:** Host farmer, MFAI agronomist, crop consultant, UW-agronomist, UW-sociologist, UW-economist
· **Satellite activities:** 2 farmers crop consultant, MFAI agronomist, 8 UW-Ext. Specialists, 2 UW-researchers

WICST Project

· **Axle:** 2 extension agents, 2 farm superintendents, MFAI agronomist, 2 UW agronomists
· **Hub:** 6 farmers, 2 vo ag instructors, 2 extension agents, 2 farm superintendents, MFAI agronomist, 2 UW-agronomists
· **Satellite activities:** 2 farmers, 2 MFAI agronomists, master gardener, land conservationist, SCS soil scientist, 9 UW-ext. specialists, 7 UW-researchers

MFAI = Michael Fields Agricultural Institute
UW = University of Wisconsin-Madison Staff
VoAg = High School Vocational Instructors in Agriculture

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