The BC Ecological and Organic Seed Sector and the Role of the UBC Farm Seed Hub

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Introduction

"…the seed has indeed become a prominent symbol of the struggle against the neoliberal project of restructuring the social and natural worlds around the narrow logic of the market. More than a symbol, however, the seed is also the very object and substance of that contest. As both foodstuff and means of production, seed sits at a critical nexus where contemporary battles over the technical, social, and environmental conditions of production and consumption converge and are made manifest. Who controls the seed gains a substantial measure of control over the shape of the entire food system." – Jack Kloppenburg, 2008

Whether they are planted or consumed, seed is at the origin of our agricultural and food systems. Seeds carry the essence of the agricultural biodiversity responsible for food system resilience. Despite the importance of agrobiodiversity, 90% of the agricultural crop varieties have disappeared over the last century due to the increase of the industrial-type corporations' control over seed systems (FAO, 2015). In response to this decline, there has been increasing efforts to build a strong global seed sovereignty movement with organizations such as Via Campesina (viacampesina.org) and Navdanya (navdanya.org) encouraging seed preservation and fighting to protect farmers' rights to the millennium-old practice of seed saving (Shiva, 2012). For local seed producers, this fight for seed sovereignty translates into producing quality seed in quantities large enough to support the local food system, maintaining cultivar performance in their respective regions, and encouraging other farmers to practice seed saving.

Support beyond the political realm of seed saving is needed to sustain seed production practices. Organizations and networks across the world such as the Organic Seed Alliance in the United States have been developing programs to directly support seed producers' needs. Closer to home in British Columbia, seed producers have been connected through either loosely-formed networks or more official organizations such as BC Seeds (bcseeds.org) to increase seed production capacity. Every year, new seed producers and stakeholders emerge in BC. Among them, a project based at UBC Farm called the Seed Hub was created in 2012.

The Seed Hub is unique in its capacity to go beyond seed production. The project has developed educational activities and research opportunities as part of its programming. The ultimate goal of the Seed Hub is to maintain a program fostering the needs of BC seed producers. Having been developed in 2012, its time for the Seed Hub reassesses its focus and current

activities. To make meaningful recommendations for the UBC Farm Seed Hub's future, it is essential to understand the context of BC seed producers and the interests of all stakeholders. It is also essential to understand the details of the Seed Hub's current activities and potential. This document aspires to be a guide to support the UBC Farm Seed Hub in becoming a valuable member of the BC seed producer community. Although recommendations for the Seed Hub are only one tool in a dynamic toolbox needed to move towards local and global seed sovereignty, it is an important step in building seed production capacity in BC.

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Chapter 1 - The Context of the Organic Seed Sector in British Columbia

1.1 The Organic and Ecological Seed Market in British Columbia

The Canadian organic sector has been increasing in popularity since its beginning in the 1980's (Levert, 2014). From 2001 and 2011, the number of organic farms has increased by 66% while conventional farms have decreased by 17% (Levert, 2014). In Canada, in order to use the word 'organic', farmers have to follow the regulations of the Canadian Organic Standard, which includes acquiring organic seeds when available (CFIA, 2015). Although organic farms only account for 1.8% of number of farms in Canada, they cover approximately 1.67 million acres of land supporting an organic seed market valued at $3.5 billion CAD per year (Levert, 2014).

1.1.1 British Columbia Context

The organic seed market is composed of two main crop categories: agronomic or field/row crops (e.g., grains, forage, and grass) and horticultural or vegetable crops (e.g., squash, lettuce, broccoli). While BC has 10,000 acres in organic agronomic crops, it only accounts for 1.4% of the total organic agronomic crop production in the country (Macey, 2013). However, BC is the largest producer of organic vegetable crops with 2,305 acres in production (Levert, 2014). Therefore, the organic seed market opportunities in BC are primarily in the vegetable category of the organic seed sector.

1.1.2 Demand for Organic Vegetable Seed

Based on studies done by Eco-Resources Consultants (2011) in Ontario ON, organic vegetable farmers bought, on average, 65% of their seeds as organic. Organic verification officers, through a survey prepared by The Canadian Organic Trade Alliance, also confirmed 65% as being an accurate average of organic seed purchased by Canadian organic vegetables farmers. Given that the Canadian organic vegetable seed market is valued at $9 million CAD, the 35% of non-organic seeds used by organic farmers is valued at $3.2 million CAD and represents a significant opportunity for the organic seed production sector (Levert, 2014). Furthermore, the current $5.8 million CAD worth of vegetable organic seeds currently bought by Canadian farmers is in part, seeds internationally sourced and not grown in Canada. This provides Canadian organic seed producers an additional market greater than $3.2 million CAD if it's

assumed that the preference of Canadian organic farmers is to buy domestically produced seed if all other factors are equal (i.e., price, quality, and availability).

1.1.3 Including Ecological Farms

Typically, statistics generated about the organic sector do not include farms following organic practices but remaining non-certified under the Canadian Organic Regime (COR) or other provincial authority. In Canada, while 1.67 million acres are listed as ‘organic’, a total of 4.5 million acres are included under the umbrella of "ecological farming" (Levert, 2014), which includes both organic and non-organic farms that follow the general regulations of the COR, or follow aligned practices such as biodynamic, permaculture, and agro-ecology. If it was assumed that ecological farms are using the same ratio of organic seeds as the certified organic farms, the unmet market for organic vegetable seeds in Canada would increase from $3.2 million CAD to $6.65 million CAD (Levert, 2014). In BC, there are 2337 acres of land growing certified organic vegetables and 4841 more acres of non-certified land, totalizing 7178 acres of ecological farms growing vegetables (Macey, 2013). The total market for ecological seed in BC is estimated to $7.9 million CAD.

1.1.4 Challenges to Increasing Organic Seed Production

Over recent years, organic seed producers have been hesitant to increase production despite the clear increase in demand. In the 2014 Canadian Organic Trade Alliance (COTA) report on the organic and ecological seed sector in Canada (Levert, 2014), challenges identified to increasing organic seed production included organic standard rule derogation for farmers, contamination risks from genetically engineered (GE) genes, and the lack of initiative to bred cultivars specifically for organic production. The COTA report also identified other challenges including that the government and large seed suppliers perceive the organic seed sector as marginal and the lack of reliable data describing the organic sector (i.e., no federally based survey on organic acres or regionally complied data on ecological and organic seed suppliers). Specific to the vegetable seed market, additional challenges identified included the lack of local market analysis, insufficient organizational structure to connect organic and ecological producers and stakeholders to the local value-added chains, and non-standard seed quality assurance programs. Moreover, breeding research and educational programs designed to improve organic

vegetable crops have been neglected and/or absent in Canada, directly affecting the growth of the regional and national organic seed markets.

1.1.5 Inadequate System for all Ecological Farms

The COTA report's findings on the challenges faced by the organic seed sector reveal various aspects of the inadequate organization and support for the sector, which not only affects organic seed producers but all ecological farmers. Often, ecological and organic farmers have to purchase non-organic seeds because of the lack of availability, low quality and/or low quantity. The quality issue is not only a local production issue but a systemic issue considering internationally sourced organic seeds are not normally bred for organic systems, just produced on a certified organic farm. This leaves organic and ecological farmers with seeds not necessarily performing well in their systems compared to other seed bred and produced for organic production. A solution to this wide range of challenges needs to come from meaningful engagement from multiple stakeholders (e.i., NGO's, government, associations, Universities) and be inclusive of the larger ecological farming movement.

1.1.6 Moving forward

From producers to food advocates, every member of the society has an important role to serve in helping to improve the organic and ecological seed sector. In BC, although the seed movement has been gathering momentum for over 20 years, it is only in the last 10 years that the movement has started to structure itself around various collectives and key organizations. Similar growth and momentum has been seen across the country, making the national seed community stronger in recent years. In order to understand the full potential and opportunity of the organic and ecological seed market in BC, an overview of the various stakeholders and their connections to the community is necessary.

1.2 Seed Movement and Seed Communities in British Columbia

Many stakeholders, including national groups and organizations, have the potential to support the organic and ecological seed market in BC. Among the largest Canadian stakeholders, the Canadian Seed Trade Association (CSTA) is one of the most influential bodies in the seed sector, with more than 130 member companies largely concentrated in the agronomic crop

sector. CSTA represents their members at the federal and national levels and is often perceived as the most influential member of the seed industry in Canada. Unfortunately, CSTA doesn't currently represent any ecological or organic interests and has no organic or ecological members. As an example of their lack of connection to the ecological or organic interest, a recent news release from CSTA (2014) urged the Ontario government to reconsider their decision to reduce the use of neonicotinoids, a common seed treatment for conventional seed, linked to bee death (Health Canada, 2014). Neonicotinoids are also prohibited by organic standards.

The Canadian Seed Growers' Association (CSGA) is another important stakeholder. They focus on providing seed certification and promoting pedigree seed use (CSGA, 2015). Although their members are largely conventional producers from the agronomic sector, they also represent organic growers. Four members, all in Quebec, are listed as pedigree organic seed producers for barley, soybeans, wheat, and oats. Although vegetable seed crops are included in the Regulation and Procedure Manual published by the CSGA, no vegetable seed crop growers are currently listed as members (CSGA, 2013).

Given the general lack of support and representation within the national seed industry, organic and ecological seed producers typically rely on various provincial bodies or non-profit organizations for support. In Canada, the recently-formed Bauta Family Initiative on Canadian Seed Security (BFICSS) along with multiple national partners, including Seeds of Diversity Canada, the University of Manitoba, USC Canada, the Canadian Organic Growers Association (COG), and the Canadian Organic Trade Association (COTA), are working towards a diverse and resilient ecological seed sector. They also partner with regional organizations such as the Atlantic Canadian Organic Regional Network (ACORN), Everdale in Ontario, Organic Alberta and FarmFolk/CityFolk (FFCF) in BC, to reach local small-scale producers in each region. BFICSS' objectives are: 1) to increase the quality, quantity and diversity of ecologically grown seeds in Canada; 2) to promote public access to seed; 3) to facilitate information-sharing and collaboration among individuals and organizations committed to advancing an ecological and diverse seed system in Canada; and 4) to respect, advance, and promote the knowledge of farmers in seed and food production (Bauta, 2015). Their approach is divided into three streams: training and networking, applied research, and public access to seeds. Impacts from the various

activities of the BFICSS have already been felt across the country since their official program launch in 2013.

In BC, the BFICSS programs are managed through FFCF which has already been fostering a local seed community since the creation of their BC Seeds project in 2006. The BC Seeds project was formed to support local organic and ecological seed producers through the creations of multiple seed-related activities and initiatives (See BOX #1 and #2). The first major activity carried out by BC Seeds was a seed survey designed to elucidate the BC seed sector. It was completed in 2006 with the financial support of the Organic Sector Development Program (OSDP). In the years following the survey, the project held regular meetings, organized workshops, and created networking space for seed producers. In 2012, participants of BC Seeds and other local seed producers met in Port Townsend, WA during the Organic Seed Alliance conference to discuss the idea of creating a seed co-op. A co-op was thought to be a solution to support the outreach efforts of local seed producers and increase the availability of locally produced seed to farmers by offering seed in larger quantities. Later that year, BC Seeds organized the first Seed Gathering, a 2 days event which brought together over 100 members of the community around a series of seed-related workshops and networking spaces. The intention of the gathering, beyond networking and learning, was to identifying the capacities and strategic areas of development for the movement. During 2013, BC Seeds held regular meetings to both formalize the co-op and maintain support to other seed-related activities across the province. Towards the beginning of 2014, a seed co-op

Box #1

BC Seeds Mandate (2006)

- To support BC farmers to grow more and better quality certified organic seeds
- To develop and promote seed growing methods that are economically viable, increase genetic diversity and thereby foster local sustainable agriculture.
- To educate seed growers and farmers about effective plant breeding and seed saving techniques
- To establish contacts with Canadian and bioregional organic seed growers
- To stay informed on issues and developments affecting seed democracy
- To build national and international partnerships with those furthering these goals
- To educate the public re: the importance of seed quality an democracy

Box #2

BC Seeds Strategy (2006)

- To foster a network of BC seed growers
- To develop a website
- To survey our exciting BC seed growing capacity, seed inventories and the needs of the BC organic farmers
- To develop a database serving BC seed growers and farmers
- To articulate best practices guidelines for certified organic seed production
- To support/develop seed distribution network(s)
- To develop cleaning strategies and equipment for collective post-harvest treatment and handling to organize workshops and distribute information (eg link with Canadian Organic Growers' research library)

committee started to meet independently in order to focus their efforts on building the co-op. At the same time, a survey was created by BC Seeds to gather information on the current seed production interests and seed consumption needs to both help inform the co-op feasibility plan and the general movement about the state of the BC organic and ecological seed sector (Goodall. 2015). The co-op was incorporated in October 2014, under the name of B.C. Eco Seed Co-op (BCESC).

The BCESC's mission is to "increase the quantity and improve the quality of ecological and certified organic seed grown in BC" (BC Seeds, 2015). This mission aligns perfectly with the mission of the BFICSS and for this reason, the BFICSS has been financially supporting the Co-op since 2014. The creation of the Co-op was a collective effort involving about 15 community members and representing about 10 local seed companies. As of March of 2015, the Co-op has 7 official members (individual and companies) and about 6 new applicants in review. The Co-op is currently in the process of developing its quality assurance program, membership policies, and general operating procedures in order to offer its first seeds for sale for the 2016 season. The mission of the Co-op goes beyond the sufficient production of high quality seeds. BCESC also wants to organize community resources (i.e., knowledge and infrastructure) for cleaning and marketing seeds, support on-going educational opportunities for its members, promote member farm businesses, and create networking opportunities for regional seed producers. For each producer member, the Co-op offers the opportunity to sell or trade seed through its system and minimize the producer's workload.

Beyond the members of the Co-op, BC is home to over 20 small seed companies and a multitude of seed saving enthusiasts. Regional organizations that can direct the energies of these smaller seed companies and individual seed savers are essential to support the organic seed sector. The Comox Valley Growers and Seed Savers and the Sunshine Coast Seed Saving Collective are two of those regional groups that are helping support seed savers and promoting seed saving. In addition, there are a great number of community groups supporting the seed movement through organizing 40 or so Seedy Saturdays or Seedy Sundays events across BC. Those events, usually held for one to two days, bring together local seed producers and retailers in one location to allow gardeners and farmers to buy or trade their seeds for the season.

Although the specific goals and interests of many of these groups are often focused on home gardeners and beginner farmers, they are nonetheless important members of the seed community and a springboard for many new seed producers.

Finally, a few post-secondary institutions participate in the seed movement through incorporating seed saving education into their curriculum. Kwantlen University and UBC are examples of institutions incorporating seed saving knowledge into their curriculum as well as offering other types of support to the seed community such as space for trials and access to equipment. Those institutions are key stakeholders for improving and developing the organic and ecological seed sector in BC.

1.3 Distinction between Hobby and Commercial Seed Saving

While both hobby seed savers and commercial seed producers grow seed, they have very distinct goals and requirements. Seed saving as a hobby is valuable and important for many reasons but their interests are typically narrowed to providing basic education and community-based activities. Conversely, the interests of commercial seed producers (defined as those with a seed production of more than 5000 ft^2 or 1/8 acre), are often focused on advanced breeding skills, marketing strategies, networking, and profit generating. Although hobby seed savers are working toward achieving greater seed security, they do not currently have an impact on the commercial organic and ecological seed market. Therefore, in order to address the challenges, barriers, and needs within the BC organic and ecological seed market, commercial seed producers need to be the focus of recommendations.

1.4 Summary

Opportunities for growth in the organic and ecological vegetable seed market in BC have been clearly identify through the 2014 COTA report. While some national support for the BC seed producers' community is available through advocacy groups such as the BFICSS, other national entities have yet to show support for the organic and ecological seed movement. Meanwhile, BC stakeholders who are active within the BC organic and ecological seed producers' community have repeatedly identified their primary goals as increasing the quality and quantity of ecologically grown seeds. Together, BC stakeholders are supporting these goals

through a variety of activities including education, promotion, and actual production. Several new structures within the national seed movement are supporting seed producers in developing a viable seed market. Within this context, the community of BC seed producers is now prepared to build a sustainable organic and ecological seed market in BC, if given the appropriate provincial support to move forward.

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Chapter 2: The Centre for Sustainable Food Systems-UBC Farm and the Seed Hub Project

2.1 UBC Farm History, Goals, and Interests

Located in Vancouver British Columbia, the Centre for Sustainable Food Systems-UBC Farm (CSFS) is a unique farming model initiated in 1999. Originally logged in early 1900's, UBC Farm location was cleared for agriculture in the mid-70's and fell abandoned through the 1990's.The site was re-discovered in 1999 by a group of students from the Faculty of Agricultural Sciences (now Land and Food Systems) with the intention of establishing a teaching farm. In 2000, a vision document entitled "Reinventing the UBC Farm" was created in partnership with the Faculty of Science and Forestry helping initiate a new vision for the Farm. The document outlined the Farm as a creative hub for education initiatives and practical skills development. Ten years later, a new academic plan was created entitled "Cultivating Place" (Riseman et al, 2010) which has been guiding all Farm projects and initiatives since 2010. The CSFS is today defined as a "research centre that aims to understand and fundamentally transform local and global food systems toward a more sustainable, food secure future" (UBC Farm, 2015). The CSFS serves as "living laboratory committed to finding solutions to both the local and global challenges facing food systems sustainability and translating solutions to improve personal, community and environment health" (UBC Farm, 2015). The physical farm encompasses a mosaic of cultivated annual fields, perennial crops, hedgerows, teaching gardens, and forest stands. Each year, the CSFS welcomes 55,000 visitors, 800 volunteers, 2000 children from local schools, hosts 60 different courses, 150 academic projects and more than 2500 UBC students. The UBC Farm grows more than 200 cultivars which translate into 80,000 pounds of food every year.

2.2 The Seed Hub Project

2.2.1 History

Since 2012, the UBC Farm's Seed Hub has evolved from an individual directed studies student project to become an integral part of the CSFS. However, the Seed Hub was not the first seed saving initiative at the UBC Farm. Since 1999, several seed saving initiatives were started but were primarily driven by farm staff's personal interest and curiosity; there was no integration

with the broader farm operations. Beans, peas, and other self-pollinated seed crops were most of the crops saved on-site from 1999 to 2011.

The UBC Farm Seed Hub was officially initiated in January 2012 by Melanie Sylvestre, a UBC Farm staff and Faculty of Land and Food Systems undergraduate student. Her intention was to create a seed production trial in order to evaluate the potential for integrating seed saving practices into the core UBC Farm production system. Melanie was introduced to seed saving in 2008 after realizing first-hand the precarious state of some specific crop varieties. Her interests quickly shifted towards supporting the production of sufficient quantities of high quality organic seed appropriate for local small-scale farmers.

The first year of the project resulted in 1) the production of seeds from over 30 varieties/cultivars of vegetables, flowers, herbs, and grasses, 2) the delivery of five seed saving workshops, and 3) engagement with of over 100 students and community members through lectures, workshops, and tours/visits. Community connections were also created through involvement with BC Seeds, as co-organizer of the first BC Seeds Gathering in November 2012, and attendance at the Organic Seed Alliance conference in February 2012.

During the winter of 2013, the project was assessed and restructured to take advantage of bulk seed contract opportunities and to offer improved educational experiences. An internship program was developed with three students receiving internship credits in 2013. By the end of 2013, the project had created new learning opportunities for interns and organized more than ten seed saving workshops connecting with over 100 students and community members. Bulk seed were sold to seed distributors while retail packets were sold through Seedy Saturday events. The project coordinator, Melanie Sylvestre, attended the 2nd Student Organic Seed Symposium in WA, organized by graduate students in plant breeding and participated in 4-days of workshops, presentations, and opportunities to meet public breeding and organic seed industry representatives (SOSS, 2015). This facilitated Melanie's broader connections with the organic plant breeding community in the USA. Furthermore, in 2013, the project collaborated on a specific research project. Organic Section Development Program (OSDP), a funding agency managed in collaboration with the government of Canada and COABC, funded an edamame

(*Glycine max* (L.) Merr.) cultivar trial led by the independent researcher, Mr. Khrisna Sharma. This collaboration elucidated a new opportunity for the project; a place for research and new crop development.

During the winter of 2014, the seed project went through major re-visioning and restructuring to create a more sustainable framework. It had become apparent that the project was focused on four main streams of activity: seed production, education programs, research projects, and community outreach. The project name changed to "UBC Farm Seed Hub" to acknowledge these distinct streams. The Seed Hub continued with most of the activities initiated in previous years while also preparing for an expansion of research opportunities. Farm-based research activities in plant breeding and cultivar trials, in collaboration with the Bauta Family Initiative of Canadian Seed Security (BFICSS), were initiated in order to assess the research capacity of the Seed Hub. A website was also developed to communicate with the community and stakeholders about the ongoing developments and activities of the project (lfs-seedhub.sites.olt.ubc.ca).

2.2.2 Financial

The Seed Hub project relies on student labour and external financial support to support most of its activities. During the first two years, the majority of hours spent on the project were associated with university credits towards the coordinator's degree in Applied Biology and not remunerated by the UBC Farm. During the third year of the project, the UBC Farm supported five hours per week of paid staff hours towards the project. The project also benefits from the Farm's volunteer program, practicum program, and the internship program. In total, an average of 500 hours of labour per year is devoted to the Seed Hub, half remunerated and the other half accounted for by unpaid interns and volunteers.

In 2012 and 2014, the Seed Hub received grants from the UBC Alma Matter Student (AMS) Sustainability Projects Fund. The money was used to acquire new seed cleaning equipment to increase production and processing efficiency as well as to help enhance the education activities. About $8500 CAD was donated over those two years by AMS

Sustainability. In 2014, the Seed Hub also received $3500 from The Bauta Family Initiative on Canadian Seed Security to create a seed bank. The money was used primarily to cover the wage of the project coordinator. In 2015, new grant of $8000 CAD from The Bauta Family Initiative on Canadian Seed Security has been allocated to support the various initiatives of the Seed Hub. These grants together with revenues from seed sales have covered all the project costs to date (Appendix 1 - Seed Hub Financial Summary 2012-2014).

2.2.3 Activities

The UBC Farm Seed Hub's four streams of activity are: production, education, research, and community engagement. All four include distinct activities and bring a foundational strength to the project. They are individually described below with the acknowledgment of the strengths and limitations for each.

A. Seed Production:

A.1 Crop Rationales and Production Systems

Seed production is the primary and most essential component of the Seed Hub. Without seed production, most educational aspects of the project would become irrelevant. The selection of seed crops to be grown at UBC Farm is based on a series of five criteria:

1- Is the crop well suited to the region? Coastal Vancouver is not an ideal climate for seed saving but does have advantages such as minor frosts over winter and mild summers.

2- Is the crop valuable to the Farm's production system? The seed crops selected for the project are preferably crops that are used for food production on-site.

3- Does the crop have potential for commercial sales? Many of the seed crops grown will produce more seeds than what the Farm needs for production and therefore, the extra seeds are available for sale. The sale of seeds is also essential to the financial sustainability of the project.

4- Is the crop commercially available as organic? Although the Farm won't be certified organic until 2016, it has been following organic practices and needs to acquire organically grown seeds when possible. The purpose of this criterion is to increase the availability and diversity of organic seeds in BC.

The physical organization of the seed crop production at the Farm has changed since 2012. Originally, the seed crops were grown in rows following the Farm's normal production practices which allows for standardized seeding, cultivation, and irrigation. Unfortunately, this single row arrangement was thought to not be ideal for space efficiency and for the promotion of cross-pollination within plant populations. Therefore, the physical organization of the seed crops was reviewed. Block production systems were created in 2014 allowing for better cross-pollination and weed management (Appendix 2 – UBC Farm Field Layouts 2012-2014). Most blocks were between 300 ft^2 and 500 ft^2. Some seed crops, such as beans, peas, edamame, tomatoes, and peppers, are sometimes integrated within the Farm's production fields. These crops being self-pollinators, it is acceptable and more practical for the Seed Hub to have them in rows and integrated into field production.

Seed crop establishment and maintenance practices are diligently planned before the beginning of the season. Following the normal Farm practices, the seed field is plowed and harrowed, and compost or other minerals are added in March and April. The crops are seeded between March and May, some direct seeded while others are transplanted from the greenhouse. Weeding on most crops is done manually by staff and interns starting in May until September. Drip irrigation is installed on all crops in May to irrigate during dry periods, typically from July to September. A drip system was selected over overhead irrigation system to help decrease disease pressure and improve water use efficiency. Some crops require trellising to keep the fruit from touching the ground and to promote better air circulation for decreasing diseasing pressures. Individual plant selections for each crop are performed throughout the growing season based on defined selection criteria. Records of germination, seeding and transplanting dates, selection practices, and harvest dates are maintained throughout the season (Appendix 4 – Seed Hub Record Keeping Systems). Harvest and processing is primarily done by the project coordinator and the interns from August to October. Additional students participate in harvesting and processing for educational/curricular purposes. Bulk seed sales occur from November to January while retail sales start in January through the summer.

Seed processing demands the greatest amount of labour, infrastructure, and knowledge. In early 2013, the UBC Farm repurposed one unproductive hoophouse into a permanent seed centre focused on seed sowing, drying and processing. The hoophouse is used from February to July for seeding, followed in July by garlic storage overlapping in August with the first seed crop harvest and drying. By September, at least half of the hoophouse is filled with drying seeds. As soon as a cultivar's seeds are dry and processed, they are stored in a room in the Farm Centre to prevent damage from temperature and humidity fluctuations. The seed cleaning equipment at UBC Farm includes a collection of equipment including an antique seed cleaner (i.e., 1940's Office Clipper), manual winnower, fans of various sizes, column winnower, heaters, air compressor, many screens of various sizes and shapes, totes, fabric bags, and other various items to help with the cleaning of various seeds. The hoophouse is spacious enough to have all equipment set up and ready to be used at any time starting in August. This is ideal given that many students and groups come to experience seed cleaning on-site. Permanent access to the hoophouse also saves significant time in equipment set up and protection from inclement weather.

A.2 Outlets and Distribution

Seeds grown by the Seed Hub are distributed through various outlets including bulk contracts with commercial seed distributors, retail sales, and Farm use. Seeds needed for Farm production for the following two to three years are generally set aside after processing. Between 5 - 30% of the seed produced at the Farm are set aside for Farm production. Bulk seed contracts with seed distributors are one of the simplest outlets available to the Farm. Seed crops are sometimes contracted before the season for a specific distributor while other seed crops are offered for sale once harvested. Bulk seed orders are shipped to the distributor all at once by the end of the year. Seed sold in retail typically requires a marketing strategy and detailed records for distribution. It is by far the most time-consuming distribution system. In 2013 and 2014, the Seed Hub sold seeds retail at only periodic events such as Seedy Saturdays and the UBC Farm's market. New connections made at the beginning of 2015 with the Shop in the Garden at the UBC Botanical Garden allows upcoming retail sales in a widely accessible location. Seeds are also distributed as Farm donations/presents to various visitors, donors, and volunteers (Appendix 1 - Seed Hub Financial Summary 2012-2014).

A.3 Strengths and Limitations of the Seed Hub Production Stream

1. Location and Isolation Distances

UBC Farm is isolated from other commercial farms, which offers a great opportunity for producing true-to-type cross-pollinating crops. The only known risks to undesired cross pollination is from the small community garden less than a few meters north-east of the Farm perimeter, the Botanical Garden's food garden less than half a kilometer away, and the Orchard Garden at Totem Field almost a kilometer away. Natural barriers such as the forested area between those locations and the Farm further reduce the need for strict adherence to recommended isolation distances; the Farm is functionally isolated for most crops. The main concern in terms of isolation resides within the Farm itself. The Farm grows a variety of crops in the production fields in order to meet the market demand. Although many crops are harvested or tilled under before flowering, cross-pollination is an issue for crops such as squash and cucumbers. To grow those crops in isolation would require specialized techniques and strict attention during production thereby significantly increasing their cost. Another risk for contamination within the Farm is the multitude of smaller programs and community projects. The Farm is the home to four indigenous gardens, a large children's garden, a caretaker garden and a practicum plot garden. All these sites need to be monitored on a regular basis to avoid undesired cross-pollination and regular communication with the participants.

2. Integrated Seed Production

Integration of seed production within the normal production system is a common practice by many seed producers. While a small amount of the UBC Farm seed crops are integrated with production, including members of the Fabaceae (beans and peas) and Solonaceae (tomatoes and peppers), the additional time required for fruit maturation is problematic for the Farm's fast rotations between crops. Crops such as peas, lettuce and various brassica are usually harvested and turned under before seed ripen. Additional issues including increased weed pressures and sowing cover crops often influence the decision to not leave crops in the field for seed harvest.

3. Facilities

The seed hoophouse has been an ideal place to dry and process the seed. Unfortunately, the hoophouse is not temperature or humidity regulated which means that all seed needs to move relatively quickly through the area. Once processed, the dry seed are usually stored in the classroom of the Farm Centre where the humidity is lower and temperature more stable. However, the classroom has limited capacity and not appropriate for the large number of bags and totes used for storage. Thankfully, the new Farm Centre, which is planned to be built in the next 5 years, includes a temperature and humidity controlled seed storage room as well as a controlled environment to dry fruit until processing. Until then, the project will continue with the available locations.

4. Climate

The lack of heat (above 25C) in the summer and the commonly wet and cool falls are the main barriers to growing particular seed crops at the UBC Farm. These conditions promote disease development and increase the risk of crop failure. The higher risk of late season rains can also damage seed crops reaching maturity. Conversely, a cool spring and summer can be advantageous to growing crops that prefer colder weather. Hot weather is also known to disrupt pollination in plants such as spinach, making the region's cooler weather one of the best areas for producing spinach seeds. Another advantage of the region's climate is the mild winters, which allow for overwintering biennial plants in fields saving significant time for seed crops such as kale, collard, and swiss chard. Typically in colder locations, biennials are harvested and stored in coldrooms over the winter.

5. Support and Community

The isolated location of the UBC Farm is a challenge to building community and support networks. Although the Seed Hub is part of an extensive network of seed producers that are willing to answer questions through e-mails and phone calls, this limits the interaction. Physical visits between farms are often the best way to share information. The UBC Farm is not located in a farming region, making it challenging to organize visits between farmers. Despite this lack of direct farmer's connection, important support for seed production is available through the

University. Dr. Andrew Riseman, Associate Professor in the Faculty of Land and Food Systems and supervisor for this project has supported the Seed Hub through sharing his expertise in plant breeding and bringing his classes for practical experience. He has always made himself available to help guide the project's activities. Other professionals that have been helpful with advice when needed include Dr. Lindsey Dutoit, Plant Pathologist, Washington State University (WSU), Dr. Zamir K. Punja, Professor, Plant Pathology/Biotechnology, Simon Fraser University (SFU), Micaela Colley, Director of the Organic Seed Alliance (OSA), and Ms. Laurie McKenzie, Research and Education Assistant, OSA.

6. Outlets and distribution

Although bulk sales offer the simplest way to sell the seed, the revenue is dramatically lower than from retail sales (Appendix 1 - Seed Hub Financial Summary 2012-2014). The advantages of bulk seed sales reside in growing many plants of fewer crops and developing expertise for these few crops. Retail sales provides the highest revenue but also requires the greatest expenses. In addition, retail sales require a greater diversity of seed crops to be grown and a well-managed marketing component. A combination of bulk and retail sales has been practiced since 2011. The future direction of the Seed Hub distribution system will be assessed following the outcomes of the 2015 seed sales. As bulk sales contracts increase, the retail sales activities may be reduced. However, if the 2015 retail sales generate profits, the possibility to have ongoing retail activities will be considered.

B. Education:

B.1 Internship

The Seed Hub has offered undergraduate internships (3 or 6 credits) in Seed Saving since 2013. The internships run from May to December with the students working directly with the project coordinator while a faculty member serves as the academic supervisor. Students are involved in all aspects of seed production and participate in some education and research activities. The students, with the help of the coordinator and academic supervisor, develop learning objectives and deliverables at the beginning of their internship. Past topics addressed by the interns have included elementary school seed curriculum development, variety trials, seed crop economic study, and seed production evaluation at UBC Farm. Feedback from students

collected at the end of the internship allows the project coordinator to adjust the curriculum for future years. Components already improved following interns' suggestions include creating a reading list related to the theory and philosophy of seed production (the readings are discussed during the in-field component of the internship) and assigning students a specific crop to care for throughout the year. The students then develop a management plan and harvest and processing methods for their crop.

B.2 Workshops, Classes and Tours

Seed saving workshops, classes, and tours are offered by the Seed Hub, both on and off site (Appendix 3 – 2014 Education and Outreach Activities). Each year, approximately 100 students and community members participate in Seed Hub activities. The UBC Applied Plant Breeding course (APBI 318) taught by Dr. Andrew Riseman, has been using the Seed Hub since 2012 to teach students the practices of seed saving. These students come to the Farm between September and October to experience seed harvesting and processing as well as to receive educational lectures on seed saving practices. The students enrolled in the Practicum in Sustainable Agriculture at UBC Farm also receive similar education from the Seed Hub. As their program is based at UBC Farm, the 10 to 12 student of the program can observe the seed crops all season. Near September, they receive two or three workshops involving harvesting, processing, and the theory of seed saving. UBC Farm is also the location of many other initiatives such as children's and indigenous programs. Nearly all of the programs have engaged and benefited from the presence of the Seed Hub, either from receiving free seeds for their projects, from consultation for practicing their own seed saving, or from education sessions.

In 2012, the Seed Hub hosted three Seed Saving Basics workshops to the general public, attracting about 50 community members in total. Starting in 2013 and into 2014, the Seed Hub shifted to delivering workshops off-site instead of on-site. This occurred because of consistent requests from community organizations to offer seed saving workshops in their community. Collaborating with local groups and having them be responsible for promotion and registration makes delivering off-site workshops more convenient to the Seed Hub and for the community. Offering on-site workshops are still possible but need to be evaluated in consideration of time, effort, and outcomes.

Requests for specific educational activities have also been received over the years. The Richmond Farm School students have been coming every year to receive a half-day introduction to the practice of seed saving. These students receive the theory in-class and complement their knowledge with their visit to the Seed Hub. In 2013, USC Canada brought a group of Cuban plant breeders and seed producers to the Seed Hub as part of their BC seed production tour. The participants spent two hours with the Seed Hub coordinator hearing about the specifics of the project, observing the production fields, and visiting the processing installations.

UBC Farm offers guided tours throughout the growing season for groups and the general public. The Seed Hub is often featured as part of the guided tours, highlighting the importance of seed security to food security. UBC Farm is open to the general public during operational hours, allowing visitors to see seed production on their own. Many members of the public stop by the Seed Hub production field inquiring about the activities and the various crops on display, allowing another opportunity for engagement.

B.3 Strengths and Limitations for the Seed Hub Education Stream

1. University connection

The Seed Hub benefits from being part of a community strongly focused on education. The CSFS and UBC offer valuable support and encouragement to the Seed Hub for its educational activities. Time and space are given by the CSFS to build and support the educational programming of the Seed Hub. The Seed Hub also benefits from being within a community of students with specific interests towards seed saving often seeking both theoretical and practical knowledge. However, most educational activities are for beginners seed saver and don't currently address the need of experience producers.

2. Visibility

The CSFS has been supporting the Seed Hub by allowing the project to have its own website connected directly to the CSFS website (lfs-seedhub.sites.olt.ubc.ca). The CSFS regularly post on social media about the activities of the Seed Hub, increasing the visibility

of the project. This support also allows the Seed Hub to offer educational resources online to the community not able to physically come to the Farm. The funders of the Seed Hub also increase the visibility though posts on their websites and social media accounts. The Seed Hub website needs regular update to keep the interest of the visitors. This requires time sometime challenging to carve out of busy periods of the year.

3. Experience

The Seed Hub is currently managed by a coordinator with 12 year's experiences in organic agriculture, 9 years experiences as a farm educator, and 5 years in seed production. This hands-on practical knowledge is essential to the Seed Hub education stream and complementary to the academic knowledge available through the University. Developing greater expertise in seed production would be an asset for the Seed Hub, as only a limited number of BC producers have this knowledge. The project relies on the coordinator's expertise and could be challenged in the future when the coordinator leaves the project.

C. Research:

C.1 Data Collection and Plant Breeding

The Seed Hub has been exploring the potential for research activities at UBC Farm. Since the beginning, extensive record and data collection systems have been developed to support inquiry-based projects (Appendix 4 – Seed Hub Record Keeping Systems). Information such as planting dates, germination rates, selection criteria, harvest yields, and disease pressure have been meticulously recorded for each crop and each year in production. The long-term data produced by the Seed Hub is valuable to understand the seed production system at UBC Farm and beyond. These data are often transferable to other locations and can, in the future, be used to inform other growers about seed production best practices.

Plant breeding activities at the UBC Farm have been minimal since the beginning of the project. In 2014, a program to produce a purple bush snap bean with a slender pod was initiated and is on-going. Also in 2014, some of the germplasm from the OSDP-supported edamame research project was donated to the Seed Hub in order to preserve and stabilize segregating lines.

This breeding project was a perfect opportunity for the Seed Hub to develop the skills to gather data on specific populations. Population maintenance and improvement are sometimes thought of as plant breeding by seed producers. All seed crops at the UBC Farm are maintained and improved when possible through observation and regular selection practices. However, the Seed Hub doesn't consider those practices as part of the research stream but rather as part of best production practices.

Variety trials for the BFICSS, in collaboration with Seeds of Diversity Canada, were performed in 2014. These trials consisted of producing populations and collecting data (template provided by SoD) on selected crops and reporting back to Seeds of Diversity Canada for inclusion in their data repository. A percentage of the seeds produced were donated to the Seeds of Diversity national seed bank. The variety trial was a great opportunity for the Seed Hub to connect with a national organization. Although the UBC Farm site is limited in size, more trials are possible in the future. The Seed Hub can provide a rigorous and robust trial environment given the close support of university instructors and students.

C.2 Strengths and Limitations for the Seed Hub Research Stream

1. University connection

The integration of the Seed Hub within the University community allows the project to host fundamental research projects as well as support more applied research. The Seed Hub is the perfect place to bridge the gap between the seed producing community and academia. The project can help improve seed production through knowledge generation and sharing. Dr. Andrew Riseman has demonstrated his support for the Seed Hub and its research on crop improvement and plant breeding. The interest towards research is still recent and need to be explored in more depth which will require time and commitment from the UBC Farm.

2. Community support

All research by the Seed Hub will be shared with the seed producer community. This extension-type service is essential to build trust between producers and the University and to ensure relevant research is conducted. Possible research activities include cultivar trials,

optimum production practices, and crop improvement breeding. Collaboration between the University and the community is and will be an important component of the Seed Hub research stream. The Seed Hub plays the role of a bridge between the University and the seed producers allowing collaboration and support towards improving BC seed production.

3. Visibility

All research from the Seed Hub will be shared through the UBC Farm's newsletters and social media updates. In addition, research has the potential to be featured on the website and in presentations across campus and beyond. The Seed Hub could develop set of materials such as newsletters and briefs to promote research and disseminate the results among seed producers acting as an extension service for the community. There are challenges working with the university while meeting the needs of the community. The type of language use in publications and the information delivery methods will need to be adapted to satisfy all stakeholders.

4. Sustainability

The CSFS is an integrated part of UBC and offers long-term stability essential for agricultural research such as plant breeding. Research is often expensive and requires financial support that is more likely to be accessible in connection with the University. The unique location of the Seed Hub allows it to access research funding and in-kind support otherwise not available to other seed producers. The CSFS would need to commit to integrating a position dedicated to the Seed Hub to its system beyond the presence of the current coordinator to offer stability for the research program.

D. Community Engagement

D.1 Seed Hub Community Connections

The Seed Hub has a strong record of community engagement. It engages with the broader seed producer and seed advocate community through the coordinator's volunteer participation in various projects and initiatives. Every event the Seed Hub coordinator participates in promotes the Seed Hub. The coordinator has been an active member of BC Seeds, a project of Farm Folk City Folk. BC Seeds coordinates various initiatives such as the 2009 and the 2014 seed surveys

and the 2012 and 2014 BC Seeds gatherings. BC Seeds has also been an essential supporting body to the formation of the BC Eco Seed Co-op at the end of 2014. The members of the co-op are active seed producers intending to provide seed to BC organic producers and offering services such as education and administrative support to its members. The coordinator of the Seed Hub is a founding member of the Co-op and is actively participating in its development.

In 2012, the Seed Hub coordinator was on the BFICSS advisory committee responsible for further developing their program after a one year pilot project. Following this participation, the coordinator presented with the director of the BFICSS program on 'Seed Security in Canada' at the annual Food Secure Canada conference in Edmonton in 2013. In 2014, the Seed Hub received funding from BFICSS for creating a seed bank while additional funds were approved for 2015 to support all four streams of the Seed Hub. The Seed Hub participated in the BFICSS variety trial project in 2014, as previously mentioned in the research section, and participated in the organization of the regional meeting held in November 2014.

The Seed Hub has connections beyond Canada to Washington State. The coordinator has participated in multiple Organic Seed Alliance (OSA) workshops and conferences over the last 3 years and created relationships with the director and researchers. This connection is valuable to the Seed Hub, given the work of the OSA in advancing organic seed production in a similar bio-region to UBC Farm. OSA is an incredible source for extension knowledge and services, which has been regularly used by the Seed Hub. In 2013, the Seed Hub coordinator participated in the second Student Organic Seed Symposium in Washington State. The symposium brought together graduate students interested in the organic plant breeding, instructors and professors working on organic plant breeding, and professionals from the industry. The symposium provided many educational opportunities as well as an incredible opportunity for networking among peers.

Finally, the Seed Hub is present beyond the various organizations mentioned simply as a seed producer in BC. The BC seed producer's community is small and through being active with various initiatives, the Seed Hub and the coordinator have earned the trust of the community.

D.2 Strengths and Limitations for the Seed Hub Community Stream

1. Commitment

The project has a certain degree of presence within the community simply by being a seed producer. However, the dedication and commitment of the Seed Hub coordinator since 2012 is responsible for raising the project's profile and respect within the community. This engagement has been demanding and time-consuming, although rewarding.

2. Geography

The Seed Hub's activities are limited to within the region. However, most organizations and groups allow involvement through webinars, phone conferences and meetings as well as e-mail communication, making the geography less an issue.

3. Continuity

Community connection and liaising of the Seed Hub relies heavily on the work and reputation of the coordinator. The longevity of the Seed Hub may also rely heavily on the presence of that coordinator at UBC Farm. The next Seed Hub coordinator will need to invest time to develop meaningful community relationships and to prove themselves as a respected seed producer.

2.3 Summary of the UBC Farm Seed Hub Strengths and Limitations

The four streams of the Seed Hub demonstrate a series of strengths and limitations as defined under each stream section. These important reflections on the Seed Hub can be summarized as follow:

A) The UBC Farm production system, location, and climate create a series of barriers affecting the project's seed crop production capacity but also give it unique advantages.

B) The Seed Hub benefits from university connections supporting rigorous educational activities and research initiatives. However, efforts need to be targeted towards improving the communication between the university and the seed producer

community to produce additional relevant educational opportunities and deliver relevant information to all the stakeholders.

C) The Seed Hub benefits from being integrated in the CSFS, which allows the project to be visible, accessible, and have potential for longevity. However, the CSFS needs to commit to keep the Seed Hub project coordinator position as part of UBC Farm system in the future.

D) The Seed Hub has a unique connection with the seed producer community, allowing the project to serve the community. This connection need to be maintained through involvement within the community outside of the Seed Hub project.

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Chapter 3: Current Needs Assessment of the BC Ecological Seed Producer Community

3.1 Introduction

To address the challenges of the organic and ecological seed market in BC, as identified in the 2014 COTA report and summarized in Chapter 1, it is essential to look closer at the specific needs of the BC seed community. First and foremost, it is important to acknowledge the diversity in the BC seed saving community that includes hobby seed savers, small-scale seed producers and dedicated seed companies. Unfortunately, addressing all needs of this diverse community is beyond the scope of this thesis. Therefore, this assessment will focus on small-scale seed producers and dedicated seed companies only. However, the contribution of hobby and amateur seed savers and non-commercial seed producers to provincial is important in working towards seed security.

3.2 Methods: Information Collection

Over the last decade, multiple efforts have been initiated to describe the ecological and organic seed systems in Canada. Organizations such as BC Seeds, a project of FarmFolk/CityFolk (FFCF), and the Bauta Family Initiative on Canadian Seed Security (BFICSS), have created surveys, summarized results, and produced reports intended to capture the essence of the seed movement in Canada and in BC. This chapter includes a review of the findings of those various organizations in BC and Canada with a focus on the needs of the commercial organic and ecological vegetable seed producers of BC.

3.3 Review of Reports and Surveys

3.3.1 Bauta Family Initiative on Canadian Seed Security (BFICSS) and Canadian Organic Trade Alliance (COTA) reports

In 2014, the BFICSS requested COTA to study the organic and ecological seed market in Canada. The report, “The Market of Organic and Ecological Seeds in Canada: Trends and Opportunities 2014”, was released at the end of 2014.

The objectives of the study were:

- Highlighting the current organic and ecological vegetable and field crop seed markets.
- Assessing potential markets for organic and ecological vegetable and field crop seed.
- Understanding operator-level requests for derogations for organic seeds by certified organic seed growers.
- Making recommendations to overcome obstacles that inhibit growth of the market for organic and ecological seed in Canada.
- Providing recommendations to internalize ongoing data collection in the organic sector, so as to provide an opportunity for performance benchmarking and longitudinal insights.

COTA's study focused on both field crops and vegetable crops. Organic field crops in BC represent only 1.4% of the Canadian market compared to organic vegetable crops in BC, which is closer to 30% of the Canadian organic market. In order to understand the main influence on the BC seed market, this review will focus on the vegetable component of the study.

COTA's report lists the various barriers to expanding the organic seed market. The systematic challenges identified were: 1) a disconnection between the producers, who are uncertain about the benefit of increasing production, and the buyers who find the supply insufficient, thereby creating a supply-demand paradox; 2) the derogation impasse within the organic standard; 3) the negative impacts of breeding efforts based on non-organic practices; 4) the general lack of data on the organic sector, and 5) the perception by the government and the seed industry that the organic sector is marginal. In terms of the vegetable seed market, COTA noted a few additional barriers including the lack of local market analysis and insufficient structures to connect organic and ecological producers and stakeholders to the local value-chains, as well as non-standard seed quality assurance programs and a lack of research and educational programs.

The COTA report (Levert, 2014) made a series of recommendations intended to strengthen the organic seed sector in Canada, The final key recommendations of the report were as follows:

- *Increase investment in organic seed research and development to increase availability of varieties that respond to the needs of organic producers.*
- *Support the scaling up of organic seed production to provide quality seed in the varieties and quantities producers need. Beginning with expansion of a selection of high-potential crops will build capacity readiness for future growth.*
- *Foster vertically integrated relationships. This will aid understanding local market and opportunities, but also carry through the value chain – having the right seeds for producers to grow the crop buyers need to meet the preferences of end-consumers.*
- *Develop a national communications and marketing strategy and identify key partners, stakeholder groups and opportunities for integration and collaboration with the broader organic sector.*
- *Develop a coordinated approach among certifying bodies with regards to data collection and approaches to seed derogations.*
- *Use data from certifying bodies to help quantify the economic contributions of local organic seeds, as a means to help build a case for support from producers and purchasers to invest in the sector over the long term.*
- *Foster relationships with relevant government officials, industry representatives and groups such as the Canadian Seed Growers Association to relay information and integrate the realities of the organic market with the broader seed sector.*
- *Ensure actions to support the development of the organic seed market in a manner that allows growers access to a wide diversity of varieties and that values the role of seed saving in the organic community.*
- *Support the development of the organic section in Canada as a whole, as a means to grow the market for organic seed.*

The BFICSS and COTA are not producer-based organizations but rather advocates and support organizations that represent their members and other interested people. Their analyses and recommendations are not a direct reflection of producers but are valuable in understanding the needs of the seed producer's community.

3.3.2 BC Seeds 2006 and 2014 Surveys

A survey report was released in 2006 describing the state of consumption and production of organic seeds in BC. The survey was conducted with the guidance of BC Seeds. The results were analyzed and reported in the report "Exploring Certified Organic Seed Production in British Columbia: Survey Summary and Report" (Wells, 2007). Eight years later, BC Seeds, in close alliance with BCESC, worked on a new survey to revisit the questions and compare some responses to those from 2006. This time, the survey also included 'ecological seeds'. The results of the 2014 survey were published in 2015 (Goodall, 2015).

Valuable information was collected through those two surveys, including topics producers' desire more advanced knowledge about, and identified barriers to increasing the quality and quantity of ecological seeds in BC, as identified by producers. The difference in participant numbers between the two surveys is attributed to the wording of the invitation document from 2014 with a focus on engaging mainly commercial seed producers. This difference in the targeted audience also influenced the results giving a more accurate portrait of small-scale seed producers from the 2014 survey.

Selected Survey Results

(Wells, 2007. Goodall, 2015)

	2006	**2014**
Portrait of the community		
Number of respondents	275	22 (small-scale producers only)
Less than 1 acre in seed production	88%	72.7%
Self-taught education	73.3%	81.8%
Quality		
Upholding minimum population for their seed crops	39.8%	40.1%
Practice selection on their seed crops	38.7%	18.2% very rigorous selection 40.1% rigorous selection
Trialed their seeds against other seeds of same variety	39.8%	50.0%
Networking		
Interested in collaborating with other growers to meet the seed demand	52.7%	86.4%
Interest in a centralized seed cleaning facility	27.5%	38.1%
Research		
Interested in a participatory plant breeding program	54.1%	77.3%
Interested in doing seed research on their farm	37.6%	50.0%
Already doing research on their own farm	7.2%	36.4%

Both surveys identified topics which producers desired more knowledge as well as identified barriers to increasing quality and quantity of seed grown in BC. In order to be as relevant as possible to current producers' needs, only the 2014 results are listed below.

Topics BC seed producers would like to learn more about include:

- Seed borne disease identification and management
- Selection and quality control practices
- Isolation practices and hand pollination
- Integrated seed production for market farmers
- Cleaning practices for specific crops
- Regional considerations for growing seeds
- Best practices for large scale production
- Seed cleaning equipment
- Seed storage practices
- Seed germination guidelines
- Advanced botany and genetics
- Trials and progeny testing
- Cross breeding

List of barriers to growing more crops:

- Lack of space for isolation distance (54%)
- Lack of growing space (54%)
- Lack of time (46%)
- Not economically viable (40%)
- Varieties not available (36%)
- Lack of appropriate equipment (36%)

List of barriers to practicing good crop selection:

- Lack of time (60%)
- Lack of space (50%)
- Staying above minimum population (50%)
- New to seed production (30%)

Surveys Conclusions

Although the 2014 survey participation was significantly lower than the 2006 survey, the 2014 survey response analysis is more relevant to the seed producer community in BC. However, both survey conclusions are rather similar.

Based on the findings of the 2006 survey, the author of the report concluded that in BC:

- Participatory plant breeding is needed and desired.
- More education and training is needed.
- Communication and trading could be improved between seed growers.
- There is a hesitation towards creating a centralized seed facility.

Conclusions from the 2014 survey include the following:

- Participatory plant breeding is still desired by seed producers.
- A centralized cleaning facility is still not highly desired but there is an interest in more accessible regional cleaning facilities (from survey comments).
- Networking between seed producers has increased and is still essential to most growers.
- More education and training is still needed to address the ongoing low rate of quality assurance practices performed.
- The same amounts of producers are still interested in research but more are already doing it.

Based on the results of both surveys, barriers to improving the quality and quantity of seed produced in BC were fundamentally limits in space, time, or knowledge. This is despite the increase over the last 8 years in networking efforts, collaborations among growers, and research activities.

3.4 BC Seeds gathering 2014

In the fall of 2014, BC Seeds organized a gathering in Richmond, BC, bringing together some of the key seed producers in the province. During the gathering, various discussions and activities were developed to gather information on the needs of the seed community as well guidance on the future direction of the BC seed movement. Two main activities were used to collect information: a regional advisory meeting led by the BFICSS and a "world café" led by BC Seeds allowing the community to list their needs and rank priorities.

On the first day of the three-day gathering, the participants invited by the BFICSS for the regional advisory meeting were asked to reflect on four aspects of the seed movement: 1) how to increase quality, 2) how to increase quantity, 3) how to increase diversity and 4) how to build the seed movement. They were then asked to list the successes and improvements associated with each category. The results were compiled and shared with the rest of the community on the last

day of the gathering. The community was invited to participate in a "world café" which consisted small groups of people brainstorming ideas series of topics. Groups were given five to seven minutes to discuss each topic before moving to the next topic. The topics included the same categories from the regional meeting plus four other topics: research, co-op, community access/Seedy Saturdays, and seed sovereignty/miscellaneous. Once the lists were completed, they were displayed for the community to review and prioritized through an activity called "hot dot". Each community member was given five coloured dots to vote on what they believed were the five most important items. Priority topics were identified by having more than four votes. Each category is summarized below (Howardson, 2015).

- *Increasing Quality*
    - *Extension services for seed producers*
    - *Quality assurance guidelines*
    - *Recording seed stories/bank of information*
- *Increasing Quantity*
    - *Regional seed equipment hub*
    - *Improving infrastructures for storage and cleaning*
    - *Marketing strategies to encourage sustainable businesses*
- *Increasing diversity*
    - *Indigenous-led seed initiatives*
    - *Strategies for farm successions*
- *Building the seed movement*
    - *Increasing desire and trust in regionally grown seeds*
    - *Building a culture around the seed movement*
- *Research*
    - *Connecting with university and farm programs*
    - *Knowing which varieties are dropped and missing and connecting with seed bank for stewardship*
- *Co-op*
    - *Producing and selling bulk seeds*
- *Community access*
    - *Promotion and education on the value of local seeds*
    - *Community-accessible seed cleaning equipment*
- *Wild table/Seed sovereignty*
    - *Supporting land trust systems*
    - *Developing "victory garden" kit with seeds included*

Compared with other information sources (i.e., surveys), these results are more inclusive of community members and therefore essential to capturing the essence and direction of the seed

community in BC. The summary of these activities and results also directly connects with the findings of the COTA report and the BC Seed surveys' results in that all support a stronger focus on practical actions.

3.5 Summary

The surveys and various other activities of BC Seeds/FFCF help describe the BC seed community with regards to the potential for growth. They also capture information on the community's needs in order for the sector to achieve its various goals. The results, in relation to the trends and opportunities of the Canadian organic seed market as per the 2014 COTA's report, draw a portrait of the community's current needs in order to address the challenges of expanding the organic seed market.

Based on the reviews available, the following needs were identified within the organic and ecological seed producer's community in BC.

Research

- Research to improve the quality, quantity, and diversity of seeds in BC.
- Research directly involving seed producers (Participatory Plant Breeding).
- Developing relationships with universities and other institutions in order to identify and support research goals.
- Extension services to support and foster advanced knowledge in the seed community.

Education

- Educational opportunities in advanced knowledge for seed producers to improve the quality, quantity, and diversity of seed crops grown in BC.

Quality assurance

- Quality assurance guidelines development.
- Maintaining biodiversity and access to diverse seed germplasm through well-supported seed bank systems.

Production

- Bulking up/increasing production of seed crops in BC.

Economic viability

- Understanding the local seed market and developing sustainable seed-based businesses.
- Working toward farm successions, land trust systems, and other initiatives to secure land for seed producers.

Community

- Supporting indigenous-led seed initiatives.

- Community building events and networking opportunities to build a culture around the seed movement.
- Building regional hubs to support producers in the region and create regional processing facilities.
- Regional seed hub.
- Increasing the desire and trust in regionally grown seeds.

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Chapter 4: Roles of the UBC Farm Seed Hub in Addressing the Needs of the BC Seed Producer Community

4.1 Current role of the Seed Hub within the BC seed producer community

The UBC Farm Seed Hub plays a valuable role within the BC seed producer community. The project, first and foremost, produces quality seeds primarily dedicated to the bulk seed market. The Seed Hub also participates in the creation of rigorous quality assurance guidelines through researching, developing, and sharing its own quality assurance processes with other seed producers. This directly addresses the need to increase the quality and quantity of seeds grown in the province. Moreover, the educational program of the Seed Hub participates in training the next generation of farmers in a sustainable model of seed production while also increasing seed quality and quantity across the province. This is even more important considering the aging farmer population and the need to preserve seed production knowledge.

Along with the production and educational activities, the Seed Hub focuses on collecting, creating, and sharing information on seed production and relevant quality assurance practices. Information collected by the Seed Hub ranges from production techniques to economic models and is intended to help create a more viable seed sector in BC. For example, the Seed Hub has developed a record-keeping system allowing seed producers to track their crops from establishment to sales. The system was presented at the 2015 COABC conference during the "Integrated Seed Production to Farm Business" workshop and is freely available to all seed producers.

The Seed Hub is unique in its capacity to disseminate information via the large UBC Farm network, allowing a higher visibility for the project. Dissemination of information is essential to building a strong community of knowledgeable seed producers and to foster the culture around the seed movement. Through its regular social media updates and general website presence, UBC Farm has been increasing the Seed Hub's visibility in the community. This capacity to effectively disseminate information has also benefited other initiatives such as the B.C. Eco Seed Co-op through social media posts. The UBC Farm's followers are diverse and go

beyond the agricultural movement to include a spectrum of environmentally and socially conscience people who appreciate learning more about seed security.

Finally, the Seed Hub has been creating space for research and supporting collaborations with other seed producers, organizations, and researchers, making it a new academic stakeholder in the province. The current research projects are small-scale and intended to explore the potential opportunities for larger-scale research.

4.2 Possible new roles of the Seed Hub within the BC seed producer community

Given the nature of the project and its youth, the UBC Farm Seed Hub still has the flexibility to evolve into an important provider of services and support for the BC seed producer community. Here is a list of possible new activities for the Seed Hub:

1) Increasing seed production in order to offer more quality seeds in BC. Although seed production at UBC Farm is somewhat limited by space, financially viable seed crops can be produce within the system.
2) Community support. The strong ties of the Seed Hub to various communities already allow the project to be an ally to many seed initiatives across the province. Those ties can grow to offer direct support, promotion, and advocacy to other initiatives working towards the same goals.
3) Developing advanced education. The educational capacity of the Seed Hub can be developed beyond the beginner curriculum currently offered to students and community members. Given the educational structure in place, the Seed Hub is the perfect location to offer an advanced curriculum in seed production.
4) Developing and supporting research. Given the project's recent efforts in developing its research capacity, the Seed Hub could become a central hub for seed-based research in BC. Variety trials, plant breeding, and participatory plant breeding are all activities that could be supported by the Seed Hub through offering space and technical support to researcher’s and farmer breeder’s initiatives.
5) Extension service. The project could expand its use of the available communication channels, networks and social media to share research findings and publications

across the community. With the participation of other organization and community members, the Seed Hub can help centralize information and be a pseudo extension service for information dissemination.

4.3 Strategy and Recommendations

The Seed Hub's potential for growth is great given its range of activities and interests. In order to move forward in developing the project, a strategic plan is needed. The recommendations below were developed to promote further discussions regarding the future of the Seed Hub project at UBC Farm.

1) Physical facility (Spring/Summer 2015)
    a. Promote research collaborations with local seed producers designed to improve the quality and quantity of seed production in BC through selection of regionally adapted crops. Consultations would help identify which crops are in-demand the BC market.
    b. Consultation with the CSFS Farm manager to assess the potential for the Seed Hub to be a regional hub with dedicated and accessible trial sites.
    c. Consultation with the Dr. Andrew Riseman, and other Faculty of Land and Food Systems stakeholders, to assess the laboratory capacities of UBC to support the research activities of the Seed Hub.
2) Support and Outreach (Summer/Fall 2015)
    a. Consultation with the CSFS academic program coordinator and Dr. Andrew Riseman to assess the capacity of the Seed Hub to develop a series of extension-style publications and a resource centre for seed producers.
    b. Consultation with the BFICSS-BC branch (FFCF) to assess their capacity to support an extension-style publication series and resource centre for seed producers.
    c. Consultation with the CSFS communication coordinator to assess and develop model of information dissemination able to reach the diversity of seed producers in BC.

d. Maintaining, reinforcing, and increasing the current Seed Hub community ties through ongoing participation in FFCF BC Seeds project and the BCESC in order to support BC seed producer initiatives.

3) Academic strategy (Winter 2015-2016)
    a. Consultation with the Faculty Land and Food Systems stakeholders for the Seed Hub and the academic director of the Centre for Sustainable Food Systems should be held to assess and define the capacity of the project to support on-site and off-site research.
    b. Consultation with Kwantlen Univeristy to assess the potential for collaboration between UBC and their institutions for education and research on organic and ecological seed.
    c. Consultation with the BFICSS and the OSA to assess their capacity to support the academic potential of the Seed Hub (research and curriculum) and connect with the other programs they support.
    d. Consultation with BFICSS-BC branch (FFCF) to assess the potential for collaboration and support on the current research initiatives in BC.
    e. Research financial support options and leverage when available to support the research activities of the Seed Hub (BFICSS, IAF)
4) Sustainability (2016)
    a. Research and consultation with the CSFS, LFS, and BFICSS to assess the long-term potential of the Seed Hub and develop a strategic plan in consultation with all stakeholders for the project's long-term goals.
    b. Consultation with the CSFS to assess the possibility to create a permanent position at UBC Farm to coordinate the Seed Hub, allowing longer-term projects and planning.

Conclusions

"With all our love we will protect our seeds" – Extract from Seed Freedom (2015)

Seed sovereignty will not be accomplished by the efforts one individual, but only with the help of an entire community. This is why strategic planning involving all stakeholders is needed for any project trying to work towards a sustainable seed system. Knowledge of the context in which seed producers operate, the stakeholders involved in the seed movement, and the needs of the seed community are essential to support and participate to the BC seed movement.

The context in which BC organic and ecological vegetable seed producers operate comes with a series of opportunities and challenges as defined in "The Market of Organic and Ecological Seeds in Canada. Trends and Opportunities 2014" (Levert, 2014). Every year, over $3.2 million CAD of the organic vegetable seed market is left unfulfilled. Meanwhile, seed producers encounter challenges such as the lack of initiatives to breed cultivars for organic systems, the lack of analysis of the local seed market, the insufficient structures to connect organic and ecological producers and stakeholders to the local value-chains, and the lack of consistent seed quality assurance programs. Some organizations, institutions, and networks are already supporting the work of seed producers, either through offering educational opportunities, networking spaces, or marketing support. However, the community's needs are not yet met to achieve its goals and to meet the market demand.

The UBC Farm Seed Hub, as one of the local stakeholders among the BC seed producers' community, brings a unique set of activities to the table while supporting the common goal of increasing the quality and quantity of seeds in BC. The project produces quality seeds, offers educational and research opportunities, and is an active member of the community in creating network and sharing spaces. Although the Seed Hub already supports the community through some of its current activities, new initiatives such as regionally-based research involving farmers, advanced education opportunities, extension-type services, and support to offer quality seeds, are being considered. For the Seed Hub to develop those new activities, consultations about the academic direction of the Seed Hub are recommended. Consultations with members of the

community and other stakeholders to develop the best educational opportunities and produce seed crops needed on the market are also recommended.

New needs will arise with time and organizations supporting seed producers need to be dynamic in how best to shape their programs. This document was meant to suggest a robust structure while allowing flexibility for the project to stay accountable to the community. This is not the beginning of the journey and it is far from the end; seed sovereignty is the only constant possible.

Reference

Levert, Marie-Eve. 2014. The Market of Organic and Ecological Seeds in Canada. Trend and Opportunities 2014. Canadian Organic Trade Association. Retrieved from https://payment.csfm.com/donations/usc/bauta/images/seedmarketstudy_EN_Oct27.pdf

Seed Freedom. 2015. Global Movement for Seed Freedom – Our resolve, our commitment. Retrieved April 18th, 2015 from http://seedfreedom.info/global-movement-for-seed-freedom-our-resolve-our-commitment/

APPENDIX 1 – 2012-2014 Seed Hub Financial Summary

The Seed Hub income projection for 2015 from seed production is $4500 (Table 1). This projection should be accurate for following years given similar crop production size and facility. The project has been relying on external funding (grants) to meet some specific goals such as research and education activities. Portion of those grants allocated to research and education activities allowed the purchase of equipment and material essential for efficient production systems as well as part of yearly labour cost. The first few years of financial support were important to build the capacity of the production system. The Seed Hub is currently capable to produce seed crops without encountering extra equipment expenses. Projection of production expenses without funding is approximated to $7700/year (Table 2). UBC Farm would have to financially support the Seed Hub project if no grants are secured for activities such as research and education (Table 2). No expenses projection with funding for research and education was developed as each grant has unique objectives and deliverables.

Table 1

INCOMES		**2012**	**2013**	**2014**	**2015**	**2015**	**2015**
					Expected	**Minimum**	**Maximum**
Sales Revenue							
	Retail	$365	$465	$1,253.80	$1,500	$800	$2,500
	Bulk	$248.50	$1,295	$1,878.05	$3,000	$1,000	$8,000
	Total	$614	$1,760	$3,132	$4,500	$1,800	$10,500
Grants Revenue							
	AMS	$3,500	$0	$4,940	$3,000	$0	$5,000
	BFICSS	$0	$0	$3,700	$8,000	$8,000	$8,000
	Total	$3,500	$0	$8,640	$11,000	$8,000	$13,000
TOTAL		**$4,114**	**$1,760**	**$11,772**	**$15,500**	**$9,800**	**$23,500**

Table 2

UBC Farm Seed Hub Budget Projection without Funding for Research and Education				
	Unit	**Cost/unit**	**Total**	**Details**
Labour				
Coordinator hours				
Field work	50	$18.00	$900	Field prep, seeding, weeding, irrigation, trellis. ~5hr/week May to Sept
Harvest and processing	150	$18.00	$2,700	Including germ test and packaging ~12hrs/week Sept and Oct + ~5hrs/week Nov to Jan
Sales and marketing	40	$18.00	$720	Contracts, catalog, promo. ~5hrs/week Dec and Jan
Report	5	$18.00	$90	
Teaching (Interns, course-based and practicum)	30	$18.00	$540	
Total	275		$4,950	
Volunteers/Interns hours				
Field work	40	$5.00	$200	
Harvest and processing	198	$5.00	$990	
Total	238		$1,190	
Material				
Material for seed distribution	misc.		$300	Envelops, shipping, stamps, catalogue, etc.
Compost			$100	
Tractor work	3	$95	$285	
Irrigation and t-post	misc.		$100	Re-used what's on site plus a few parts
Total			$785	
Office and administration				
Administration fees	1		$183.75	
Field space	500sqm	$1.26/sqm	$630	
Total			$813.75	
			TOTAL	
Project total			$7,738.75	

APPENDIX 2 – Seed Hub Field Layouts 2012-2015

2012

- One row per bed, beds 3.5’ apart.
- 100’ long beds.
- No legumes seed crops in seed field, all in production field.

3.5’	Phacelia		
3.5’	seed edamame	seed cilantro	seed Arugula
3.5’	seed Spinach		
3.5’	seed Radishes		
3.5’	Phacelia		

2013

- One row per bed, beds 3.5’ apart.
- 100’ long beds.
- Most legumes in production field, a few in seed field.

Flax	Lettuce		Chard	1	3.5’
Radish	Lentils	Chickpeas	Empty	2	3.5’
Spinach	Arugula			3	3.5’
Phacelia				4	3.5’
Quinoa trial				5	3.5’
UBC 2012 seed trial				6	3.5’
Beer Friends				7	3.5’

2014

- Most beds 7’ wide with 3.5 wide cover cropped pathway in between.
- All bed 100’ long.
- Most legumes in production field, a few in seed field.

1	3.5’								
2	3.5’	Leeks	Foxtail millet	Phacelia	Pearl grass				
3	3.5’								
4	3.5’								
5	3.5’	Quinoa		Arugula	Cilantro				
6	3.5’								
7	3.5’								
8	3.5’	Radish		Lettuce	Spinach				
9	3.5’								
10	3.5’								
11	3.5’	Comp 7 B1+2	SPS BL-1	MLB 3	Midori	Sayamusume TSC	SPS ISO	SPS BL-3	
12	3.5’		Teggia	Beer friend edamame		Aztec Kidney (Bauta)			

2015

- Mix of single beds and larger beds for cross-pollinators
- Most legumes in seed field
- 100’ long beds
- Multiple fields

Field 1

2	3.67’		Lettuce		Lettuce
3	3.67’				
4	3.67’				
5	3.67’				
6	3.67’				
7	3.67’				
8	3.67’				
9	3.67’				
10	3.67’				
11	3.67’				
12	3.67’				
13	3.67’				
14	3.67’				
15	3.67’				
16	3.67’				
17	3.67’				
18	3.67’				
19	3.67’				
20	3.67’				
21	3’				

Field 2

3’				3’
5’	Seeds- Raxe Radish		Seeds- Red Legion Shallot	5’
5’				5’
5’	Seeds- Black Magic Kale		Seeds- Red Russian Kale	5’
5’				5’
3’				3’

APPENDIX 3 - 2014 Seed Hub Education and Outreach Activities

2014 EDUCATION and OUTREACH ACTIVITIES		
Activities	**When**	**# people reached (approx.)**
On-site		
Introduction to Seed Saving workshop at UBC Farm	May	3
Practicum students in Sustainable Agriculture	3 x August, September and October	10
Richmond Farm School tour	September	7
UCS Canada Cuban tour	August	13
UBC APBI 318- Plant Breeding class	4 X lab sessions in September	25
Internship program	All season	2
TOTAL (approx.)		**60**
Off-site		
Introduction to Seed Saving- North shore Seedy Saturday	Feb	20
Richmond Food Secure- Introduction to Seed Saving	3 X in July, August, and September	45
Sustenance festival- City of Vancouver- Introduction to Seed Saving	October	15
BC Seed gathering	November	110
TOTAL (approx.)		**190**

APPENDIX 4 – Seed Hub Record Keeping Systems

A series of spreadsheets has been developed since 2012 to be able to record the metrics of the project over the years. The Seed Crop Log allows information including seeding dates, germination rate, planting dimensions, harvest dates, and notes to be recorded (Table 1). The Distribution Log tracks where the seed crops have been distributed and the amount distributed for each crop (Table 2). The Sales Log allows information about the sales to be recorded (Table 3). The Germination Log allows yearly germination test to be recorded (Table 4). Other spreadsheets were developed but are not included in this appendix. The tables are a snapshot and the displayed content is incomplete.

Table 1- Seed Crop Log

Harvest Year	Crop	Type	Cultivar/Variety name	Contracts	Initial seed source	Current seed source (if different from initital)	Seeding method	Seeding date	Seeding germination rate	Transplanting date	Grow out location	Dimensions of plantir
2014	Arugula		Surrey		Dam 11'	UBC 13, UBC 12, Dam 11' (North to South)	DS	05/02/2014	Good	-	C1-1	4 row per block (35')
2014	Cilantro		Calypso		Osborn 13'		DS	05/02/2014	Good	-	C1-1	4 row per block (35')
2014	Lettuces	Green leaf	Panisse				50-cell	05/26/14	Good	May 7th. 2014	C1-1	4 row per block (35')
2014	Peppers	small green hot	Padron	ST (1/4c)			cell				North tunnel	
2014	Radish		French Breakfast			UBC 13	DS	04/01/14 (in HH)	Good	May 7th. 2014	HH and C1-1	4 row per block (35')
2014	Spinach	Savoy	Bloomsdale savoy	ST 2lbs		UBC 13	DS	05/02/2014	Good	-	C1-1	4 row per block (35')
2014	Tomatoes		Black cherry				4" pot				HH	

Table 2 – Distribution Log

Year	Commercial seed lot number	Crop	Type	Cultivar/Variety name	Amount harvested/ available	Bulk outlet	Bulk amount sold	Revenue (bulk)	Packages #	Quantit
2014	51402	Arugula		Surrey			x		x	
2014	41401	Lettuces	Green leaf	Panisse	2lbs				70	1/2tsp
2014	81303	Peas	Snap	Super Sugar Snap	10oz				10	2tbsp
2014	81302	Peas	Snow	Avalanche	1lb				30	2tbsp
2014	81301	Peas	Shelling Peas	Green Arrow	3.6lbs				65	2tbsp
2014	91402	Peppers	small green hot	Padron	1/2c	ST (1/4c)	1/4c (25g)	60	20	1/4tsp
2014	51201	Radish		French Breakfast	1.45lbs				70	1tbsp
2014	51401	Radish		French Breakfast	2.75lbs					
2014	51301	Radish		French Breakfast	0lb				x	
2014	21201	Spinach		Bloomsdale savoy	1.8lbs				20	1tbsp
2014	21401	Spinach	Savoy	Bloomsdale savoy	2lbs	ST 2lbs	2lbs (1kg)	245	x	
2014	91403	Tomatillo		Purple	1/2 c				10	
2014	91404	Tomatillo		Mexican strain	1/2 c				10	150s
2014	91401	Tomatoes		Black cherry	1/2c				41	60s

Table 3 – Sales Log

Year of transaction	Fiscal year	Date of transaction	Date of payment received	Outlet	Item	Code	Amount	Price/un	Revenue	N
2014	2013			Stellar Seeds	Radish, French Breakfast		3.35 lbs		390	
2014	2013			Stellar Seeds	Romano bean, Hunter		15 lbs		525	
2014	2013			Stellar Seeds	Edamame, Beer Friend		7 lbs		280	
2014	2013			Stellar Seeds	Winter Savory		0.7 lbs		50	
2014	2013			Stellar Seeds	Copper Fennel		0.17 lbs		50	
2014	2013			UBC Farm symposium	Packages		31		105	
2014	2013			Vancouver Seedy Saturday	Packages		75		255	
2014	2013			North Van Seedy Saturday	Packages		20		75	
2014	2013			UBC Farm programs	Packages		15		30	
2014	2014	April	April, 2014	Truck Farm	Shelling bean, Teggia		1 lbs		25	
2014	2014	April	April, 2014	Truck Farm	Dry bean, Keanearly yellow eye		1 lbs		25	
2014	2014	April	April, 2014	Truck Farm	Snap pea, Super sugar snap		0.5 lbs		20	
2014	2014	April	Summer 2014	UBC Farm Saturday market	Packages		60		269.3	
2014	2014	Dec	April 16th '15	Stellar Seeds	Bulk				601	
2015	2014	Jan 29th		Westcadia	Bulk bean- Tiger's Eye	81306	6lbs	4.8	28.8	
2015	2014	Jan 29th		Westcadia	Bulk bean- Tiger's Eye	81411	2lbs	4.8	9.6	
2015	2014	Jan 29th		Westcadia	bulk bean- Aztec red kidney	81305	2 lbs	4.8	9.6	
2015	2014	Jan	Feb 6th, '15	Salt Spring Seeds	Packages		150	1.75	262.5	5
2015	2014	Feb-Mar		Traveling Kit #1	Packages		240	2.5		
2015	2014	Feb-Mar		Traveling Kit #2	Packages		200	2.5		
2015	2014	Feb-Mar		Traveling Kit #3	Packages		125	2.5		
2015	2014	Feb	Feb 26th, '15	Scarp	Packages		60	2	120	
2015	2014	Feb	Feb 26th, '15	Peter	Packages		2	2.5	5	
2015	2014	Feb		Mojave	Bulk				546.55	
2015	2014	Mar 7th	Mar 7th, '15	Richmond SS	Packages		42	3.5	142	$
2015	2014	Mar		Salt Spring Seeds	Packages		60 (+$15 shipp	1.75	120	6
2015	2014	Mar		Salt Spring Seeds	Packages		120 (+$20 shipp	1.75	230	C
2015	2014	Mar		Salt Spring Seeds	Packages		100pkg	1.75	175	O

Table 4 - Germination log

Test year	Date	Harvest ye	Crop	Variety	Seed lot number or details on germination label	Check date	Germination rate (%)	Pass = X	Comments
2014	Jan-28	2014	Arugula	Surrey	water treated	Feb-04	100	x	
2014	Oct-29	2014	Arugula	Surrey	#1 Aug 10th-Aug 27th	Nov-01	92	x	
2014	Dec-12	2013	Chard	Eldorado	2013	Dec-26	50		
2014	Nov-21	2013	Chard	Eldorado	2013	Nov-29	20		Seeds gone n
2014	Jan-28	2013	Edamame	Beer friend	2013	Feb-04	67	x	Not enough v
2014	Jan-28	2014	Edamame	Midori	2014	Feb-04		x	Moldy!
2014	Jan-28	2014	Edamame	Sayamusume	2014	Feb-04	71	x	Not enough v
2014	Nov-21	2012	Flowers	Agaratum	2012	Nov-29	70	x	
2014	Nov-21	2014	Flowers	Agaratum	2014	Jan-15	0		
2014	Jan-28	2014	Flowers	Agaratum	2014	Mar-08	0		
2014	Nov-21	2012	Flowers	Bachelor's buttom	2012	Nov-29	75	x	
2014	Jan-28	2012	Flowers	Bergamot	2012	Mar-02	55	x	Stratification
2014	Dec-12	2014	Flowers	Bupleurum	2014	Jan-15	98	x	Stratified
2014	Nov-21	2012	Flowers	Bupleurum	2012	Jan-15	5		Require light
2014	Nov-21	2013	Flowers	Bupleurum	2013	Dec-02	75	x	Require light
2014	Jan-28	2012	Flowers	Bupleurum	2012	Mar-08	25		
2014	Dec-12	2012	Flowers	China Aster	2012	Jan-15	61	x	Stratified