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## Seeds of Resilience: Learning from COVID-19 to Strengthen Seed Systems in Vermont

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# SEEDS OF RESILIENCE

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## LEARNING FROM COVID-19 TO STRENGTHEN SEED SYSTEMS IN VERMONT

*2022 Summary Report*

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The University of Vermont



# Executive Summary

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Seeds are central to crop-based production systems, yet in the United States seeds have been largely overlooked in both research and local and regional food systems initiatives. This report seeks to address the gap in seed-related research by assessing current strengths and vulnerabilities of Vermont's seed systems. In particular, the findings presented in this report illuminate how seed systems can maintain function in the face of external shocks such as the COVID-19 pandemic, and how we can apply the lessons learned toward building resilience for an uncertain future due to factors such as climate change. Despite the turmoil caused by the pandemic, the last several years have provided a unique opportunity to identify strategies to strengthen Vermont's seed systems.

The data presented and discussed in this report build on existing research and showcase a myriad of seed-related efforts in Vermont. We use an interdisciplinary approach to study the supply and demand for seed among farmers and gardeners in Vermont during the COVID-19 pandemic. To contextualize our report, we begin with a brief summary of findings taken from the 2020 and 2021 Vermonter Polls regarding seed system trends. Data from these surveys, conducted by the UVM Center for Rural Studies, were collected in February-March 2020 (before and during the onset of the pandemic in Vermont) and February-March 2021 (nearly a year into the pandemic). We then present the findings from two online surveys of commercial farmers (n=73) and non-commercial seed growers (n=75) in Vermont, which include a specific focus on five commonly grown crops in Vermont: garlic, tomatoes, squash, lettuce, and potatoes. In the future, this work can guide collaborative and participatory responses to seed system vulnerabilities exposed by the COVID-19 crisis.

Seed systems in Vermont consist of both formal and informal channels that circulate planting material. Formal seed systems are marked by centralized distribution, commercial transactions, and a strong presence of private seed companies. In contrast, informal seed systems are maintained by farmers and gardeners, often through localized, unregulated and/or non-market exchanges of planting material. During the COVID-19 pandemic, the limitations of formal sources like commercial seed companies and retail stores to maintain supply and make seed available became readily apparent, especially for non-commercial growers. Simultaneously, non-commercial growers in particular used alternatives to these systems in the form of community seed projects, seed saving, or other informal channels. In the future, growers are looking for more supports to help bolster their self-reliance and develop strong distribution networks. Based on these findings, we see an opportunity to further invest in informal seed systems in Vermont. Growers expressed a desire for seed with qualities like adaptation to local growing conditions, flavor, and cultural relevance, which are emphasized and commonly preserved by seed savers operating in the informal sector. We recommend further research that explores what mechanisms and opportunities exist to link informal seed work currently occurring throughout the state to formal channels, as well as what perceptions are held by those who work within the informal sector about forming or reinforcing those connections.

Our findings provide important detail to the broader trend of an increase in home gardening in Vermont that the COVID-19 pandemic precipitated. Elevated interest in food cultivation holds important implications for seed systems across the state. Seed shortages and supply chain disruptions have emerged, as have new and expanded seed networks. By learning from the immediate disruptions to—and lasting effects on—seed systems from COVID-19, this project works to identify areas of stress and durability in Vermont's systems and explore economic and community opportunities to foment investment in, and usage of, regionally adapted crop varieties. Through this work, we seek to contribute to efforts to build resilient local and regional food systems in Vermont and beyond.

## Key Findings

- **The COVID-19 pandemic had an impact on Vermont growers' ability to source seed for key crops.** More than 50% of respondents struggled to access seed during the 2020 season, with a higher percentage of non-commercial growers (57%) encountering challenges compared to commercial farmers (48%) during the same timeframe.
- **Growers cited difficulties acquiring seed for their usual crop varieties from established sources** as the most common barrier during the 2020 planting season, with 76% of respondents who reported having difficulty obtaining seed encountering this problem. Other frequently identified difficulties centered around long wait times on seed orders (42% of respondents) and certain crop species not being available from established sources (30% of respondents).
- **There was a decrease in sourcing for key crops (garlic, tomatoes, squash, lettuce, and potatoes) from channels within both the formal and informal sector among non-commercial growers.** Non-commercial growers' ability to source from formal sources declined the most—namely, from retail stores (24% decrease) and commercial seed companies (9% decrease). Notably, commercial farmers reported no change to their ability to access seed from several sources (both informal and formal) and a 1% increase in use of commercial seed companies, suggesting that commercial growers may have experienced disruptions to a lesser extent than their non-commercial grower counterparts.
- **In response to these disruptions, many growers shifted their production and sourcing strategies.** This included cultivating new crop varieties (59%) and species (35%), or turning to alternative sources for seed (50%). We also saw an increase in community- or home-based initiatives promoting seed access, including small-scale seed swaps, personal seed saving, and donation programs.
- **Growers valued certain crop characteristics over others in planning which varieties and species to cultivate.** Flavor was an important quality to 92% of respondents, and adaptation to local growing conditions was important to 83% of respondents. Furthermore, those who valued certain traits were often willing to pay a price premium to acquire seeds with those traits. Respondents most frequently cited flavor as a desirable trait and were willing to pay a premium of 8.9% above market value for that quality on average.

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## Introduction

Food and agriculture are an important part of the economic landscape and social fabric of Vermont. In crop-based production systems—both in the state of Vermont and globally—seeds and other planting material are among the most critical inputs. It is well established that adaptation of planting material to local growing conditions is a critical buffer for agriculture against the intensifying conditions of climate change. Despite this, seeds are often overlooked in food systems research, perhaps because approximately two-thirds of the global market share is dominated by only four seed companies (see, for example, [this ongoing research](#) on consolidation in the agro-industrial seed sector).

The importance of seed and other planting material was thrown into relief during the early months of the COVID-19 pandemic. Media reports of [panic buying](#), [seed shortages](#), and [supply chain disruptions](#) spotlighted vulnerabilities in the current seed system—one in which seed is principally sourced from outside the state. Moreover, these disruptions have extended beyond 2020, with similar reports of seed shortages and delays arising in the spring and summer of 2021. In the words of one home gardener interviewed for this project, “2020 didn't seem to be too much of a problem because the seeds were ordered to come in April. But boy, this year [in 2021] there was nothing. So much stuff was out of stock.”

This project explores the effects of the COVID-19 pandemic on Vermont's seed systems. Through this report, we seek to provide baseline information to guide future strategies for building seed system resilience by exploring current demand, seed sourcing behavior, and coping strategies among Vermont's commercial farmers and non-commercial seed growers.

We define a resilient seed system as one in which a sufficient number of quality seeds are available and accessible to consistently meet the demand of Vermont's farmers and gardeners. As climate change intensifies, it will become increasingly important that the seeds farmers and gardeners cultivate are adapted to Vermont's growing conditions. Especially against the backdrop of a changing climate, a system shock like the COVID-19 pandemic provides crucial insight to prepare for future disruptions caused by climate change or other natural and social forces.

This report draws on survey responses and interviews from seed growers in the state to better understand the strengths and weaknesses of Vermont's seed systems. Through this work, we aim to identify areas of stress and durability in Vermont's seed systems, explore economic opportunities to bolster investment in regionally adapted crop varieties, contribute to efforts to build resilient local and regional food systems, and inform improved methods to identify and conserve neglected and/or underutilized crop varieties.

## Sources of Data

The primary source of data used for this report is an online survey titled “COVID-19 Seed Grower Resilience Survey” that was deployed in February and March of 2021 to farmers and gardeners across Vermont. In order to contextualize our findings from this survey, we first present a broader overview of seed sourcing and preferences using data from a statewide representative survey of Vermonters. These data come from 2020 and 2021 Vermonter Polls collected by the Center for Rural Studies at the University of Vermont (UVM). The 2020 survey was conducted in February and March of that year using telephone polling methods supported by computer-aided telephone interviewing (CATI). A random sample for the poll (n=566) was drawn from a list of Vermont telephone numbers, which is updated quarterly and includes listed and unlisted telephone numbers. The 2021 survey was conducted using email-based outreach in March and April of that year. A random sample (n=636) for the poll was drawn from commercially available email lists. For both surveys, respondents who self-identified as current Vermont residents

**“When things become uncertain—and certainly COVID was [uncertain]—one of the things people do is plant gardens.”**

– female, late 60s, home gardener/educator

over the age of 18 were eligible to participate. Respondents answered questions about their household demographics and their involvement with agricultural systems, including gardening, food production, and seed saving in the prior year.

To collect richer and more specific data on seed activities amidst the COVID-19 pandemic, we deployed our COVID-19 Seed Grower Resilience Survey in February and March 2021. In total, we received 148 responses: 73 from commercial farmers and 75 from non-commercial seed growers. Throughout the report, we distinguish between commercial and non-commercial seed growers as two complementary subpopulations within our survey respondents. We define commercial growers as those who earn \$1,000 or more per year from the sale of agricultural goods (based on the USDA definition of “farm”), and non-commercial growers as those who cultivate seed and/or crops for personal, community, or other reasons not primarily commercial in nature. Because of their differing relationships to seed materials—commercial farmers often rely on seeds to sustain the income they derive from agricultural production, while non-commercial growers may take on seed-related projects that are unrelated to their means of creating income—the two groups of growers interact with Vermont's seed systems differently. We use insights from these two sub-groups to provide more nuance as we look at how both formal commercial channels and informal sourcing networks are used to obtain seed. Analyzing responses according to commercial or non-commercial status also allows us to explore how these two groups managed shocks to the seed system due to COVID-19. Finally, we use both groups' responses to the pandemic to look into the market potential that exists to localize seed supply as a strategy to enhance agricultural resilience.

Survey respondents were identified through their prior participation in related research and outreach conducted by UVM. Respondents answered a range of questions focusing on the food crops they cultivate, the characteristics of seeds they value and their willingness to pay premiums for those characteristics, how they source seeds, and how they experienced disruptions to seed sourcing due to the pandemic. Because the participants were not chosen randomly, the data cannot be assumed to represent all seed growers, commercial farmers, or seed systems in Vermont. However, the data presented in this report provide valuable insight into the state's seed systems and how they have functioned during the COVID-19 pandemic.

In addition to the survey, interviews were conducted with 31 Vermont seed growers in the spring and fall of 2021. These growers represent diverse perspectives, with participants ranging in their seed-related activity from saving and growing minimal amounts of the seed they use to saving and growing all of their own seed. All respondents were purposively sampled to highlight a range of informal and formal seed system involvement. This report includes excerpts from these interviews in which participants provide insight into the impacts of COVID-19 on Vermont seed systems through their firsthand accounts.



## Vermont Poll Results

This report draws on important insights gained from the 2020 and 2021 Vermont Poll surveys, and puts them in conversation with findings from the Seed Grower Resilience Survey and perspectives shared by interviewees. Sixty-five percent of respondents to the 2020 Vermont Poll reported planting seeds to grow food that year, highlighting the large proportion of the population engaged in agricultural activities when the COVID-19 pandemic hit. According to 2021 Vermont Poll data, among the 51% of respondents who engage in growing food, 86% relied on planting seeds to produce their crops.

Formal sources are important avenues through which growers access seed. Among Vermont Poll respondents who planted seeds in 2020, 89% reported accessing materials from retail stores and 60% used commercial seed companies (Figure 1). In 2021, those percentages increased to 94% and 73%, respectively. Informal seed sources are also widely used by Vermonters: 62% of

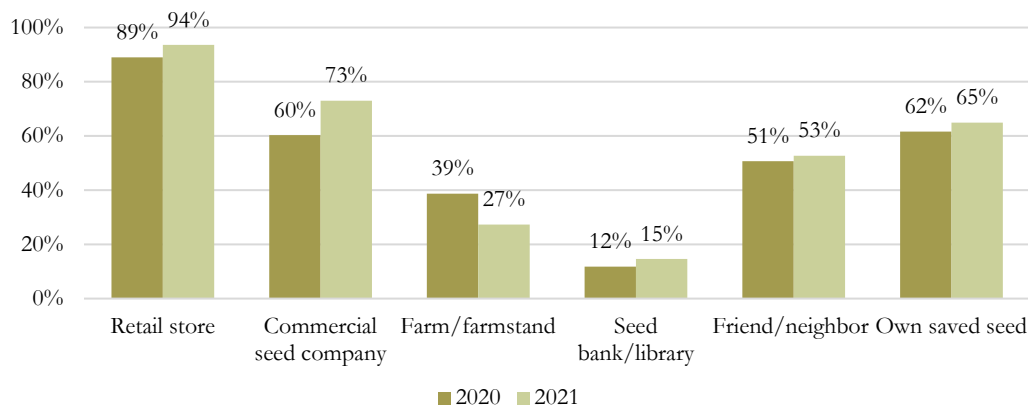


Figure 1. Sources of seed used by Vermont gardeners (n=351 [2020], n=369 [2021])

2020 respondents who planted seeds reported using materials they had saved themselves and 51% sourced materials from a friend, family member, or neighbor. In 2021, 65% of producers saved seeds themselves and 53% accessed materials from friends, neighbors, or relatives.

Vermont Poll respondents who planted seeds in 2020 and 2021 valued certain crop characteristics when deciding which seeds to cultivate (Figure 2). The highest percentage of respondents considered flavor to be an important quality both years (89% [2020], 84% [2021]). Many respondents also valued nutritional value (76% [2020], 82% [2021]) and adaptation to Vermont growing conditions (84% [2020], 81% [2021]). Notably, respondents' interest in seeds with certain qualities, including open pollinated (31% [2020], 50% [2021]), sourced from a local or regional seed company (53% [2020], 70% [2021]), and heirloom (38% [2020], 53% [2021]) seeds saw considerable increase between 2020 and 2021. The trends outlined here regarding the Vermont Poll are largely corroborated by the findings from the Seed Grower Resilience Survey, to which we now turn.

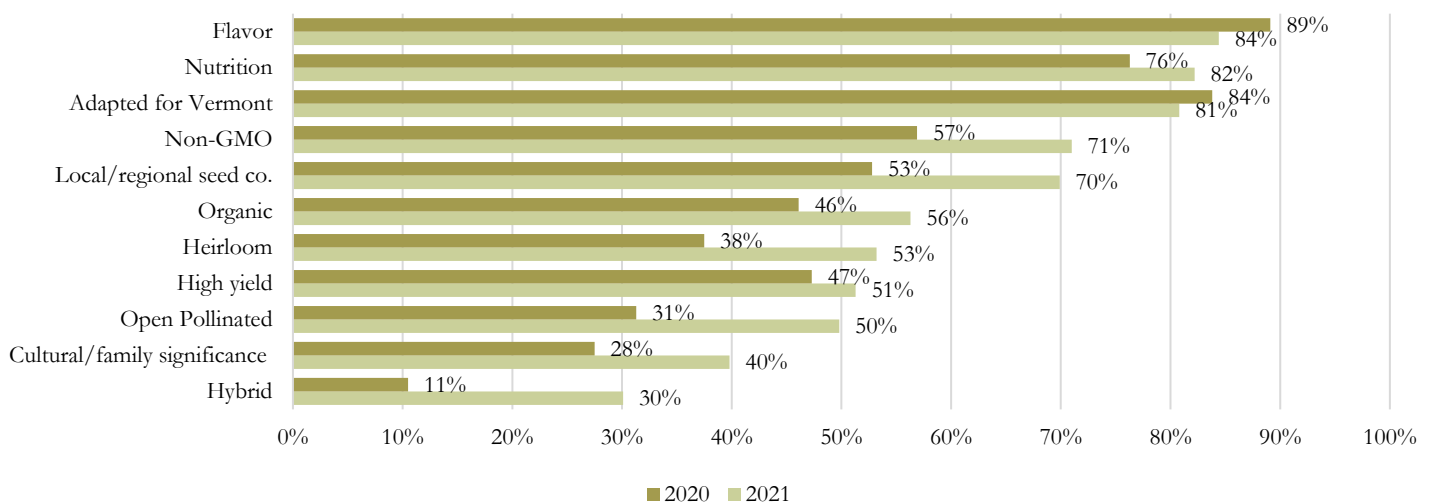
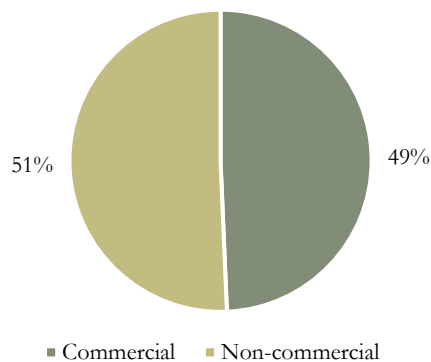


Figure 2. Percentage of respondents interested in various seed characteristics (n=351 [2020], n=369 [2021])

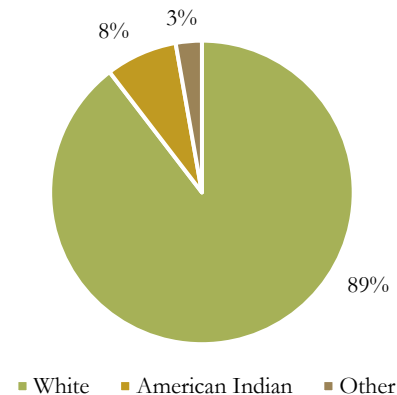
# COVID-19 Seed Grower Resilience Survey Results

## Demographics

Out of 148 respondents, our sample was split nearly evenly across non-commercial (n=75) and commercial (n=73) seed growers (Figure 3). Among the 144 respondents who indicated their race/ethnicity, White growers made up 89% of respondents, while 8% of participants identified as American Indian and 3% reported other racial or ethnic identities (Figure 4). Though there are Black farmers who save and cultivate seeds in Vermont, none of these farmers are represented in our survey—an important limitation of our research that must be addressed in future efforts.



**Figure 3. Commercial farmer and non-commercial grower survey respondents (n=148)**

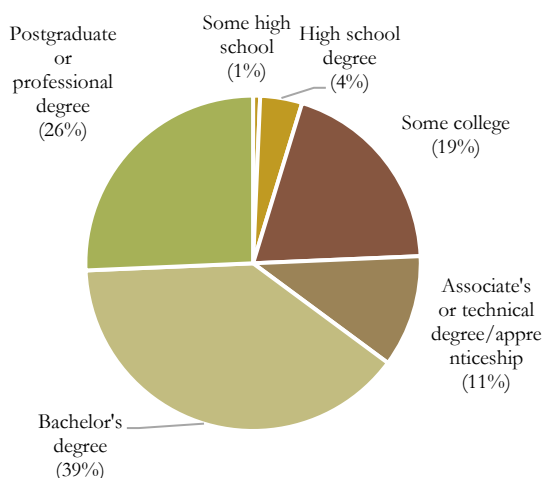


**Figure 4. Race/ethnicity of survey participants (n=144)**

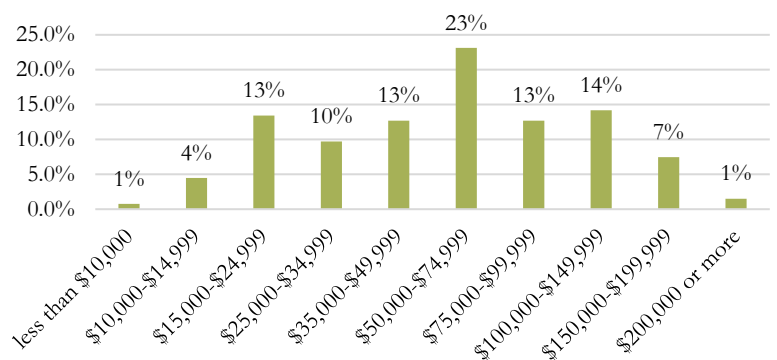
Out of 144 respondents who reported their age, we found a range between 28 and 85 years old ( $M=55$ ,  $SD=15$ ). Though our sample includes respondents from diverse age brackets, the average age was 55 years old, reflecting national trends in the agricultural sector that show an aging population of farmers. According to the [USDA's Census of Agriculture](#), the mean age of farmers in the US was 57.5 years in 2017.

Among all survey participants (n=148), over half held a bachelor's degree, postgraduate degree, or professional degree (Figure 5). An annual household income between \$50,000 and \$75,000 was the most common bracket among the 134 participants who reported income. Almost 20% of respondents reported an annual household income of less than \$25,000, while another roughly

20% made over \$100,000 annually, indicating a wide range of economic realities among the growers surveyed (Figure 6).



**Figure 5. Respondents' education levels (n=148)**



**Figure 6. Respondents' yearly household income ranges (n=134)**

# Land use and crop selection

We asked respondents whether they own or rent land for agricultural production and/or seed- and planting material production. Most growers in our sample own their land, with 10% renting land for agricultural use (Figure 7). More specifically, 83% of commercial growers (n=61) and 92% of non-commercial growers (n=61) are landowners of the areas they use for agricultural production.

Respondents were also asked to estimate how much land they dedicate to agricultural use. Figure 8 presents total land in production among commercial and non-commercial growers (n=135), including both crop production and planting material production. Most non-commercial respondents reported using less than half an acre in production (n=74), while the largest proportion of commercial growers cultivate between 10 and 50 acres (n=61). It is worth noting that some commercial farmers do not dedicate any land specifically to seed or planting material production, and only cultivate food and/or other commodity crops.

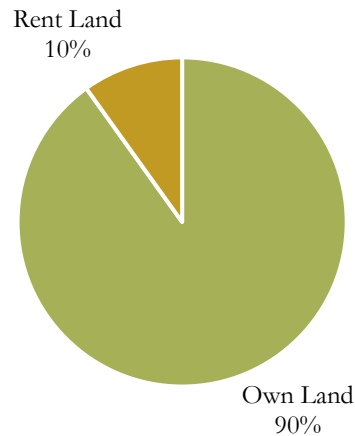


Figure 7. Land accessed through renting and owning (n=101)

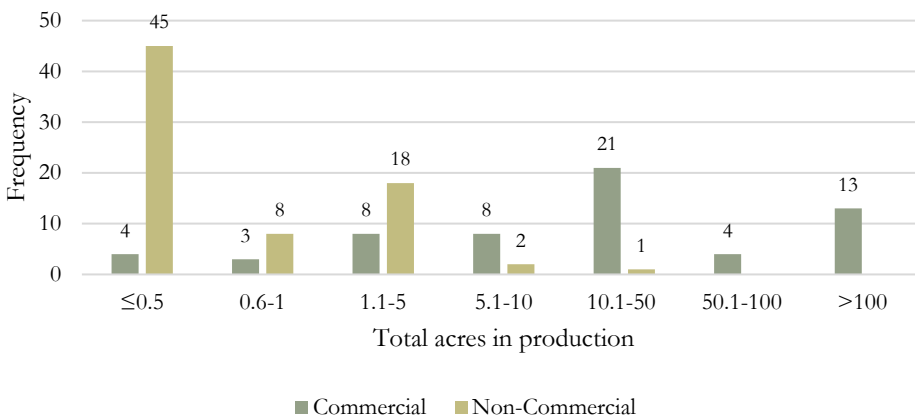


Figure 8. Total acres devoted to agricultural production among commercial farmers and non-commercial growers (n=135)

Several survey questions focused on five commonly grown food crops in Vermont that were selected to provide commonality across responses: garlic, tomatoes, squash, lettuce, and potatoes. These crops were selected based on USDA data indicating that a substantial portion of crop acreage in Vermont is dedicated to these food crops. Participants were asked to report which of these five crops they grow (Figure 9). Commercial farmers most often reported growing garlic and tomatoes (65%), followed by squash (63%). Each of the five crops of interest was grown by at least 50% of non-commercial growers, with tomatoes and lettuce reported as the most widely grown among this demographic (97% and 96%, respectively).

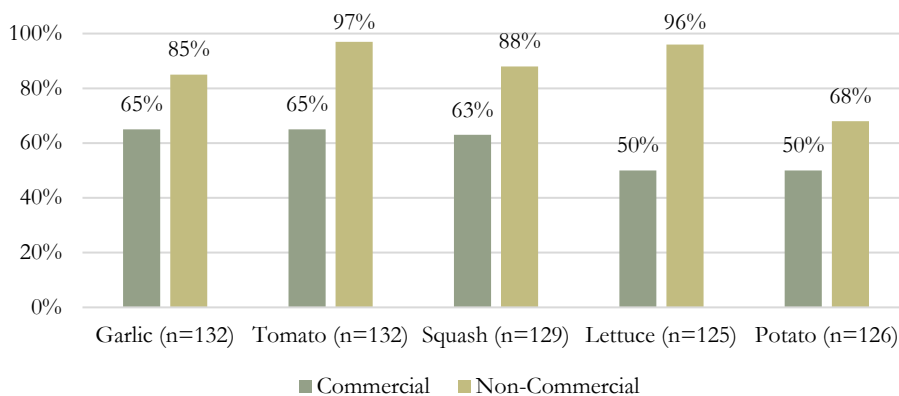


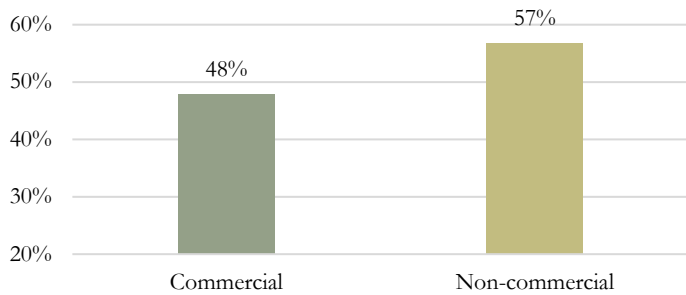
Figure 9. Percentages of commercial and non-commercial farmers growing five key crops

## Challenges to seed access since March 2020

**“Everyone decided they wanted to be a gardener [in 2020], and no one could get seed.”**

–female, mid-30s, owner of a small Vermont seed company

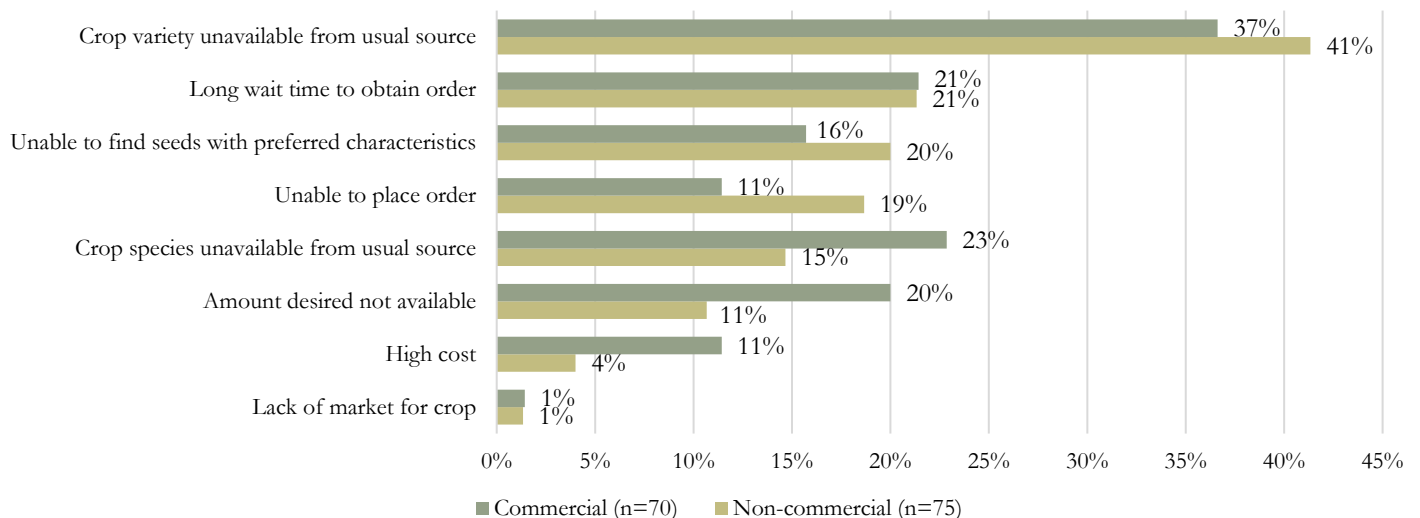
The interview excerpt above speaks to the significant changes felt by stakeholders in Vermont’s seed systems during the 2020 planting season. A sense of scarcity and disruption due to COVID-19, paired with an increasing demand for seed materials, was frequently echoed by other interviewees and survey respondents. One home gardener depicted the demand on seed companies in the spring of 2020 as “chaotic and insane” in her opinion.



**Figure 10. Percent of commercial and non-commercial growers who had difficulty accessing seed during 2020 (n=143)**

Our survey responses painted a similar picture: over half (n=75) of 143 respondents encountered some difficulty obtaining planting material during the 2020 season, with non-commercial growers reporting difficulty at a slightly higher rate than commercial growers (Figure 10). Overall, 57% of non-commercial growers (n=42) and 48% of commercial growers (n=33) reported difficulties sourcing seed materials in 2020, indicating that neither group was immune to the sourcing challenges provoked by the pandemic.

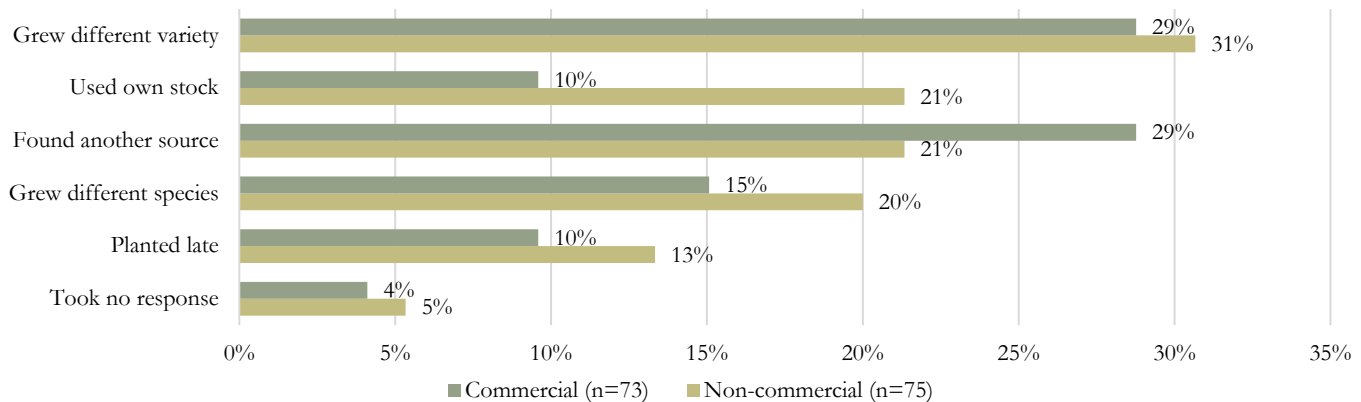
To capture the disruption to seed systems in Vermont caused by COVID-19, respondents were asked to report the difficulties they confronted when trying to access seed for their preferred crop species and varieties. Among 145 respondents, the most common challenges for seed growers arose when certain crop varieties (76%) and species (30%) became unavailable from a usual source, and when growers faced long wait times to obtain seed orders (42%) (Figure 11). These findings match [media reports](#) of panic buying of seeds in the early months of the pandemic, and personal stories of seed shortages shared among those involved in Vermont’s seed systems. Our contacts at regional seed companies likewise spoke to the challenges of meeting demand during this time, often citing shortages caused by the unprecedented stresses introduced by the pandemic, including rising demand, limited seed stock, and insufficient labor. This theme was salient during the Northeast Organic Seed Conference



**Figure 11. Barriers to access experienced by growers who struggled to source seed since March 2020 (n=145)**

held in January 2021, when the disruptions to seed sourcing were mentioned by many participants and speakers. In an interview, one seed company owner described the month of April 2020 as particularly hectic “because no one could get seed” as many people turned to gardening and food cultivation amidst lockdowns and grocery store shortages. Smaller seed vendors were affected as well, with one woman who usually sells seed at her local farmers market recalling that her town “shut down the market once COVID happened, so [she] didn’t have an outlet for seed at that time.” Another community gardener and seed library coordinator remembered the same timeframe as being “busier than ever” for seed distribution.

Growers responded to sourcing challenges during the pandemic in myriad ways, with many respondents using multiple coping strategies (Figure 12<sup>1</sup>). Survey participants most frequently adapted by growing different crop varieties (29% [commercial], 31% [non-commercial]), finding alternative sources of seed (29% [commercial], 21% [non-commercial]), or growing a different species (15% [commercial], 20% [non-commercial]). These strategies point to the potential benefits of flexibility in seed sourcing and planting behaviors. Those who were able to diversify either their crop choices or seed sources were likely better positioned to adapt to the uncertainties introduced by COVID-19. When we separate responses regarding barriers by commercial and non-commercial growers, several noteworthy differences emerge. Non-commercial growers (21%) were more than twice as likely as commercial growers (10%) to rely on their own seed stock. Conversely, commercial growers (29%) more commonly found a different source for seed materials than their non-commercial counterparts (21%). With the exception of turning to an alternative seed source, all response strategies were used by a higher percentage of non-commercial growers than commercial growers. Perhaps this points to a more diverse set of strategies used in response to barriers among non-commercial growers, or to the more acute challenges those growers faced in finding alternative sources during the pandemic. These possibilities may present an interesting line of inquiry for future projects looking at how growers working at different production scales or within different systems respond to challenges of seed access and sourcing.



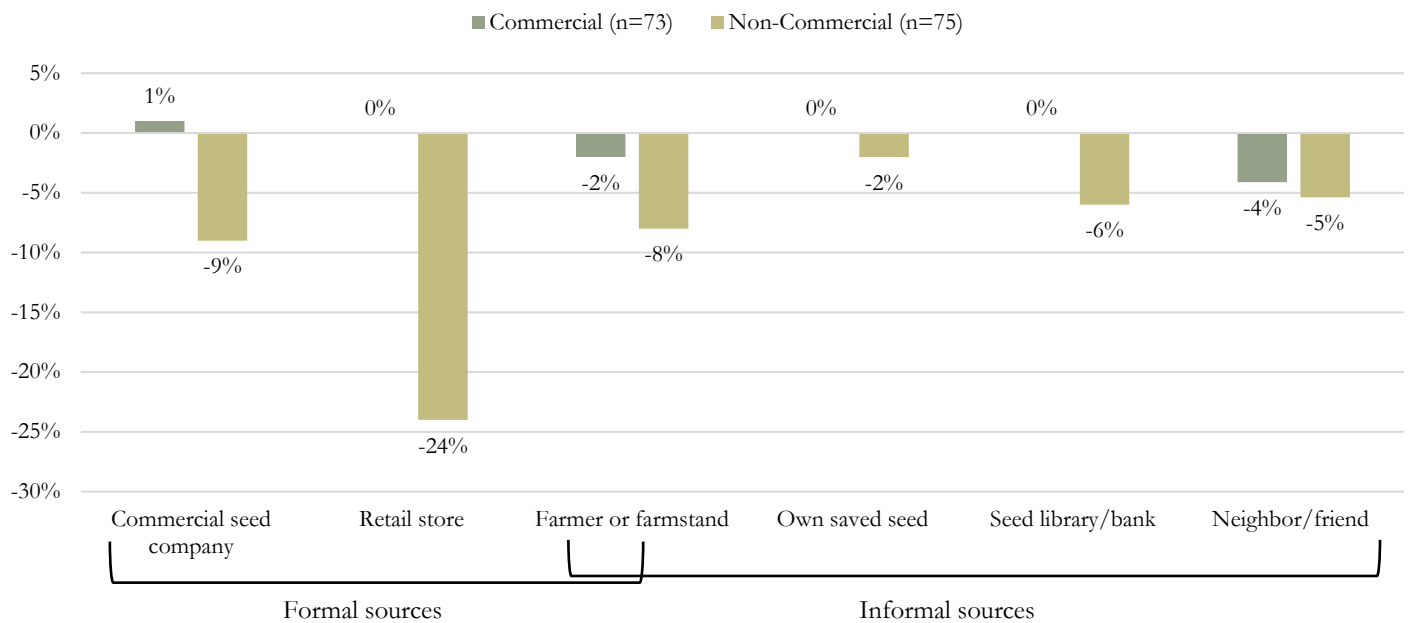
**Figure 12. Commercial and non-commercial growers’ responses to seed access barriers since March 2020 (n=148)**

Despite the challenges faced by growers throughout the COVID-19 pandemic, interview responses suggest that farmers, seed savers, and seed sellers made use of various strategies to adapt in order to assist their communities during difficult times. For instance, one owner of a small seed company described donating “quite a bit of seed to local schools, some community gardens, [and] public libraries.” Another seed saver discussed her desire to start a new seed library in her town; she was pleased to report that more than 25 people used the resource to obtain seed in 2020—the library’s first year in operation. Finally, one interviewee who belongs to a seed saving group discussed the creation of a community seed catalog targeting low-income households, stating that she and her friends “donated seeds that we had, made up a catalog of whatever was available, and gave [out] all our seeds.” These stories highlight that, even amidst a global pandemic, individuals worked towards ensuring seed access not only for themselves but also for their communities.

<sup>1</sup> Note that cumulative percentages exceed 100% because respondents were asked to check all answers that applied. Some participants selected multiple answers.

## Seed sourcing for key crops before and since COVID-19

Stakeholders in Vermont's seed systems use both formal and informal sources to access planting material. To explore how COVID-19 changed sourcing behaviors in Vermont, we asked both commercial and non-commercial growers about their seed sourcing habits for the five commonly grown crops highlighted in this report: garlic, tomatoes, squash, lettuce, and potatoes. We asked survey respondents how they had sourced seeds for those crops in the three years prior to the outbreak of COVID-19, compared to how they had sourced seeds for the same crops since March 2020. Many respondents' sourcing habits for the selected commonly grown crops were impacted during the COVID-19 pandemic (Figure 13<sup>2</sup>).



**Figure 13. Average total percent change in seed sourcing for five crops between 2019 and 2020 for commercial and non-commercial growers (n=148)**

Sourcing from formal channels saw the most change with the onset of COVID-19. In an interview, one gardener recalled the difficulties that many growers faced when trying to purchase seed: “I had difficulty getting seeds because...every time I'd log in and fill up my order, it would say, ‘We're overwhelmed with orders. We have plenty of seeds, but you have to wait and order on, say, March 1st.’ So, then I'd go on March 1st, and I got the same message: ‘You have to wait.’”

Non-commercial growers in particular reported challenges to sourcing seeds through formal channels, reporting the greatest change in access to seed from retail stores (24% decrease) and commercial seed companies (9% decrease). This finding suggests that non-commercial growers bore the brunt of disruptions within the formal seed system during a time of uncertainty. In comparison, commercial farmers reported a marginal increase in seed access through seed companies (1%) and no change in access to seed from retail stores. A higher percentage of non-commercial growers reported difficulties accessing seeds from all sources than commercial farmers between 2017-2019 and 2020.<sup>3</sup> These declines appear to have been felt most severely by non-commercial growers in their engagement with formal seed systems.<sup>4</sup> Across sources in the informal system, all growers reported

<sup>2</sup> Note that farmers and farmstands can be considered both as formal and informal sources depending on the nature of the exchange or transaction.

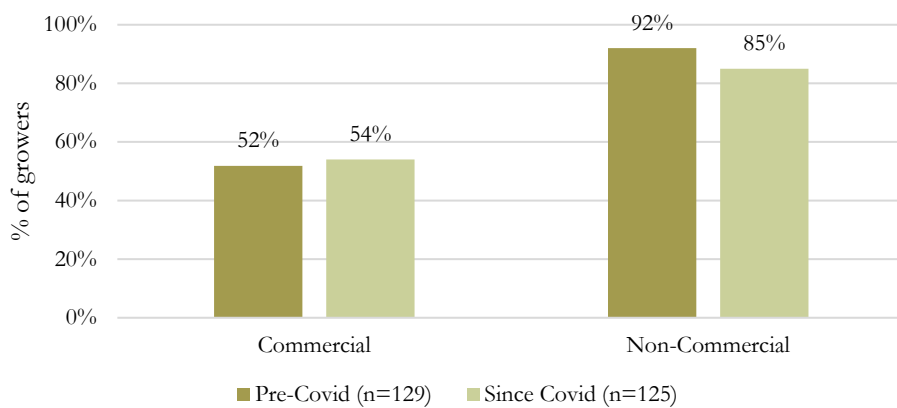
<sup>3</sup> Because our data do not provide insight into the underlying reasons for this trend, we see an opportunity for further research in these areas of inquiry.

<sup>4</sup> Because our survey captured sourcing patterns for five key crops alone, it is possible that the decrease we saw in sourcing seed for these crops could be partially attributed to a shift to other crops in response to shortages. These dynamics were not captured by our study but would be a worthwhile direction for future research.

decreases of 8% or less in their ability to source seed, indicating the possibility that non-commercial growers were able to rely more heavily on informal seed sources as they experienced increased difficulty navigating the formal seed system.

In response to the pandemic, a home gardener interviewee expressed her hope that Vermonters will “take seed saving more seriously, and direct attention to it, and begin to focus more on preserving the varieties [of crops] that are still available.” One owner of a small agricultural business views the increase in seed saving as a hopeful trend: “One of the best things that could happen is that people don’t need to get seed from me because they’re getting more from themselves. I’m talking to more and more people who are doing more and more seed saving and seed swapping themselves.” Furthermore, several interviewees spoke to the importance of seed sharing projects that sprang up during COVID-19 and the role those projects played in maintaining existing growers’ ability to source seed—as well as providing access to seed for new gardeners who began growing food or using seed for the first time since the pandemic began. One home gardener we interviewed contributed to a seed giveaway project in 2020 that was an attempt to lessen the burden on community members experiencing financial difficulties. The program then continued into the 2021 growing season and expanded its scope. “This year [in 2021],” she explained, “we’re trying to be a little more organized and we actually put together a little catalog and put it on our [email] listservs.” Another farmer involved in the same program noted that “it’s really awesome to be able to share and to give people the opportunity to grow their own food, especially in a time like this.”

The majority of growers we surveyed practiced seed saving both before and after the start of the pandemic (Figure 14). Among commercial farmers (n=54), 52% reported saving seed from at least one of the five key crops in 2019 and 54% saved seed from at least one crop in 2020. Ninety-two percent of non-commercial growers (n=69) reported saving seeds before the pandemic, a



**Figure 14. Percentage of growers who saved seed from at least one of five key crops before and after March 2020**

percentage that dropped to 85% in 2020 for the five crops we investigated. Because we only prompted for those specific crops in our survey, this result does not necessarily mean that seed saving overall decreased but may suggest that some producers shifted to different crop types after March 2020. Additionally, some commercial growers (28.5%) reported saving only garlic—a relatively easy crop to save and reuse as seed material—and did not engage in seed saving beyond this one crop.

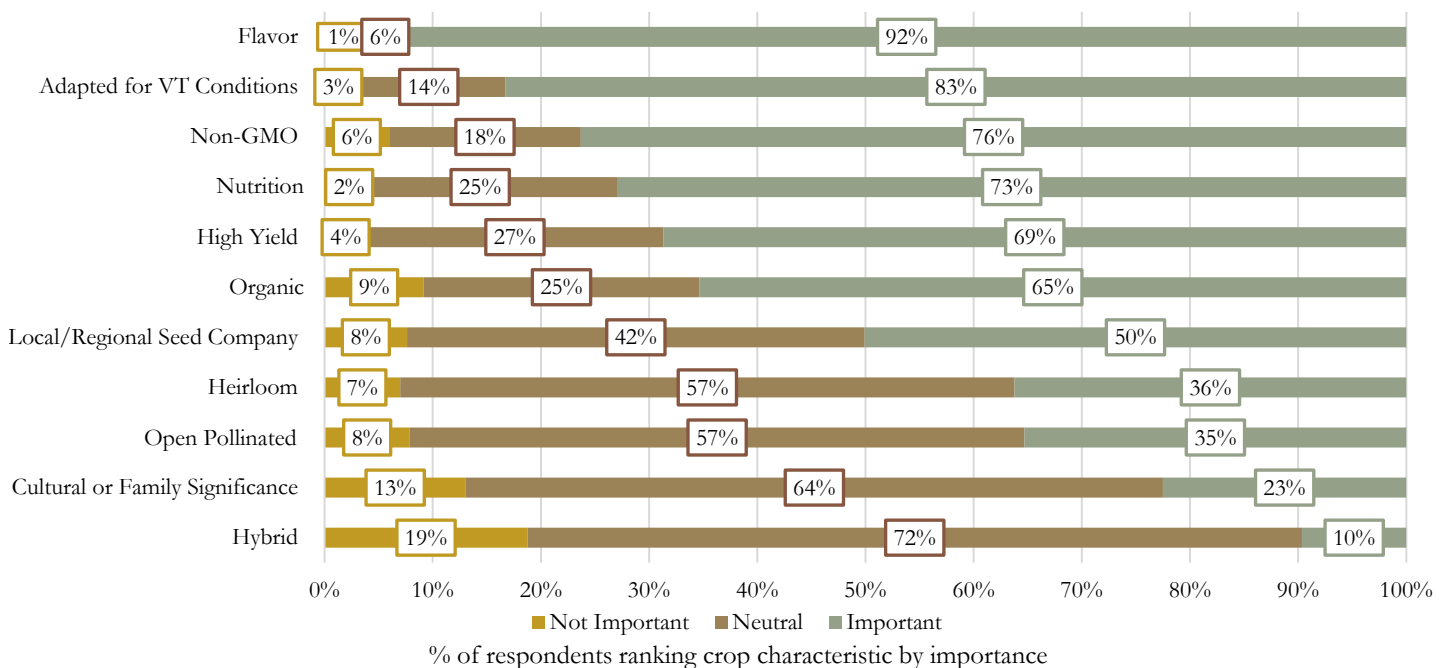
Taken together, insights from this survey, Vermont Poll responses, and interviews lead us to highlight personal seed saving as a point of interest in the context of system shocks and supply chain disruptions. Our findings suggest that seed saving efforts are a consistently important source of seeds and may also be an especially valuable resource amidst widespread disruptions to formal sourcing channels.



## Preferred crop characteristics and market implications

To better understand breeding and marketing priorities, we asked survey respondents to rank the importance of certain characteristics for each of the crops they grew. Growers deemed each crop quality to be “not important,” “neither important nor unimportant,” or “important.” The list included eleven characteristics that capture a variety of crop qualities, many of which demand a price premium: flavor, adaptation to Vermont growing conditions, non-GMO breeding, nutritional value, high yield, organic certification, sourcing from a local or regional seed company, heirloom variety, open pollination, cultural or family significance, and hybrid breeding. Figure 15<sup>5</sup> shows the percentage of respondents who considered each characteristic to be “not important,” “neutral,” or “important” across all crop types.<sup>6</sup>

Among 114 respondents, flavor was considered to be an important characteristic by the highest percentage of growers (92%), followed by adaptation to Vermont growing conditions (83%), non-GMO breeding (76%), and nutritional value (73%). With the exception of hybridity, which was considered an important characteristic by only 10% of growers, survey respondents deemed every characteristic to be important at higher rates than they considered the same traits to be unimportant.



**Figure 15. Percentage of growers ranking certain seed characteristics as “not important,” “neutral,” or “important” for the crops they grow across all crop types**

Additionally, for respondents who had marked that a trait was important, we asked whether they would pay a premium to obtain seed that possessed the preferred characteristic. Figure 16<sup>7</sup> shows the frequency with which respondents deemed the qualities listed above to be important for the crops they grow. To those growers who considered traits for a certain crop to be important, we presented the average market price for each crop and asked them to mark the adjusted price that they would pay above that average to ensure that they would obtain seeds with desired traits. For example, the survey indicated that the average market price for garlic was \$17.95/pound at the time. For each characteristic, we asked respondents to indicate whether they would pay

<sup>5</sup> Note that n-values for each characteristic in Figure 15 outnumber sample size because they are an aggregation of ratings across crop types. Participants were invited to rate each crop they grew, resulting in higher frequencies than sample size.

<sup>6</sup> n-values by characteristic: flavor (n=348); non-GMO (n=294); adapted to VT conditions (n=334); nutrition (n=227); high yield (n=281); organic (n=271); local or regional sourcing (n=194); heirloom (n=179); open pollinator (n=180); cultural or family significance (n=110); hybrid (n=60).

<sup>7</sup> Note that the frequency of “important” characteristics differs from that in Figure 15 because not all respondents chose to answer willingness to pay questions.



no more than the base price (\$17.95), or if they would pay prices that reflected a 5%, 10%, 15%, 20%, or >20% increase to that price (appearing in the survey as \$18.90, \$19.75, \$20.65, \$21.55, or more than \$21.55 for garlic). The light green line in Figure 16 represents the average percent premium across crop types that growers were willing to pay extra for seeds with the corresponding characteristic.

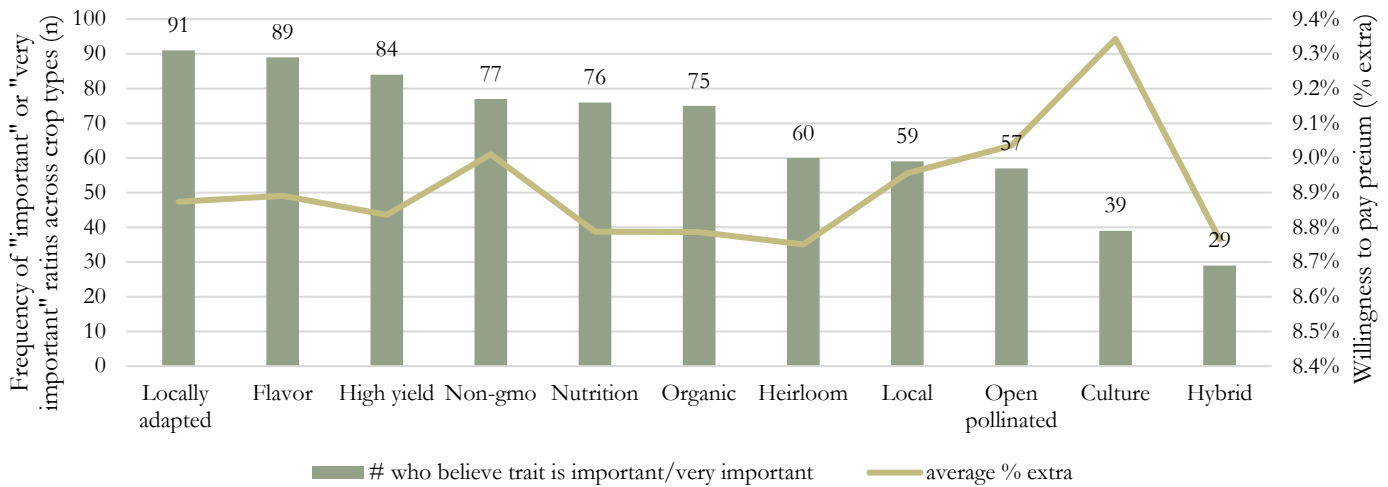


Figure 16. Preferred seed characteristics and willingness to pay for preferred characteristics

We found that many growers were willing to pay a premium for traits they considered to be important in their seed. As regional adaptation becomes an increasingly valuable trait in the context of climate change, we want to highlight this trait in particular as one that growers in Vermont may be willing to pay a premium to acquire. On average, those who considered locally adapted seeds to be important were willing to pay 8.9% above market value for those seeds. Local adaptation was an important point that came up across interviews as well, with one seed librarian suggesting that non-commercial seed sources are important for this very reason: “One of the points of having a seed library is to have people save seeds so that you’re developing more locally adaptable, resilient varieties for your climate.” This sentiment was shared by individuals who use commercial sources as well, including one small seed company owner who started her company to provide a source of seed better adapted to her environment. When asked what she perceived to be the most important change needed in the seed systems on which she relies, she responded: “Seeds [that] are adapted to the changing climate and are able to continue to produce within the stressors of our climate—which seeds are pretty amazing at—and they can do it within a year or two of starting to adapt.”

Some traits were important to only a small proportion of growers; however, they were still considered by those growers to be valuable enough to support a price premium. For example, cultural or family significance was chosen as an important crop characteristic 39 times—less frequently than any other trait except one (hybridity). However, those who did see this trait as important were, on average, willing to support a premium of 9.3% for planting material that holds cultural or family significance, which is a slightly higher premium than for any other characteristic. These findings raise interesting questions regarding the economic potential to emphasize characteristics like local adaptation or flavor that see more of a demand among growers but are widely available, versus a quality like cultural significance that may appeal to a smaller segment of growers but could still support a price increase. It may be that both of these characteristics fill different market niches and could provide economic promise. Leveraging the intersection of demand and price premium could play an important role in preserving and proliferating specialty varieties of crops in Vermont moving forward.

Exploring this area of inquiry is the first step to understanding more fully the dynamics of the market for planting material and sought-after crop characteristics. We see opportunity for further research that specifically investigates the potential economic benefits of different crops, aims to capture labor requirements and input usage for individual crops, and explores the motivations and priorities of seed systems actors in their willingness to invest in specific crop characteristics.

## Strengthening seed systems through grower supports

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We asked commercial and non-commercial growers who had difficulty accessing seeds for the crops they grew since March 2020 about the kinds of supports they would like to see that might mitigate similar challenges in the future. Our initial findings suggest that there are various kinds of support that would be of interest to Vermont growers in their work relating to seeds and planting material, and that areas of need often differ between commercial and non-commercial growers.

Among non-commercial growers, information on seed saving was the area of highest concern, with 34 of 38 respondents indicating interest in supports relating to this topic. Non-commercial growers also expressed interest in information about alternative seed sources (33 of 40 respondents) and technical support for seed saving projects (33 of 37 respondents). These responses may point to areas of challenge faced by non-commercial seed growers in accessing and storing seed materials, and may also reflect the lack of available information targeting resources, systems, and practices within the informal sector.

Every respondent out of 12 commercial growers was interested in information about alternative seed sources. Seven out of 9 respondents expressed interest in seed distributed by seed companies, and 11 out of 13 respondents reported interest in advice on seed selection. The interest in seed company distribution may be a reflection of commercial growers' more robust connection to the formal seed sector as compared to their non-commercial counterparts, as discussed in earlier sections. However, it is notable that other areas of interest indicate a desire among commercial growers to explore alternative options for accessing and selecting seed materials. Among both groups, these findings suggest that commercial and non-commercial growers are seeking supports that expand their options for seed sourcing in the future, including through connection to informal seed systems.

The number of respondents for these questions is small, especially among commercial growers, and therefore these data should be seen as an exploration of possible paths forward rather than a definitive representation of Vermont growers' future needs for securing access to seeds. However, as Vermont prepares for future disruptions, it is important to utilize these findings as a starting point for giving voice to seed system stakeholders' needs in the process of identifying strategies to enhance resilience in the seed system and the food system more broadly.

# Conclusions

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## Interpreting Results

Findings from our surveys, interviews, and Vermonter Poll data provide a first glimpse into the impact of the shock caused by the COVID-19 pandemic on Vermont's seed systems. They also give us some important metrics for understanding areas of strength and vulnerability as we explore ways to build a resilient seed system in which local growers are able to access sufficient and, ideally, locally adapted planting material in the state. While the data obtained from these surveys and interviews cannot be generalized to the entire population of seed producers in the state or projected onto other kinds of system shocks, they nonetheless communicate important information to help inform future avenues for study and action. In summary, we found that Vermont's supply chains for seed and other planting material were strained during the pandemic. However, we also saw that seed system stakeholders exhibited flexibility and innovation that helped the system to adapt in the midst of uncertainty.

Many growers encountered challenges when it came to sourcing seed materials for key crops. We found that non-commercial growers had relatively more difficulty obtaining seeds than commercial farmers, especially from the formal sector (retail stores and commercial companies), perhaps due to the fact that many seed companies restricted orders to commercial farmers only until the summer of 2020. Commercial growers, however, were not immune to disruptions: some also experienced reduced ability to obtain seed for key crops from certain sources. In response to difficulty sourcing seeds for commonly grown crops, growers sought out new crops and crop varieties to cultivate and found alternative sources of planting material. Our findings are focused on five important food crops grown in the state, and therefore raise the possibility that some individuals switched to other crop species outside of our research scope altogether. However, because our survey captured sourcing trends solely for garlic, tomatoes, squash, lettuce, and potatoes, we cannot definitively determine which crops may have taken the place of these staples in a time of disruption.

Despite these challenges, we heard accounts through interviews and other informal conversations with seed system actors of many Vermonters taking up gardening for the first time during the 2020 planting season. Rather than seed supply disruptions causing a widespread departure from gardening or crop cultivation, our research shows that growers found alternative means of staying engaged with seed- and food production through the changes brought on by the COVID-19 pandemic. When regular crop varieties became unavailable, or when established sources for seed failed to deliver, growers shifted to different crops or sourced seeds from alternative channels. This response to change gives us insights into the ability of Vermont's seed system actors to adapt to challenges. Moreover, as expressed across multiple interviews, Vermonters found new and innovative ways to help their communities access seed, whether through the creation of free seed catalogs, seed libraries, or by sharing more of their own stock. We saw community efforts and personal seed saving projects play an important role in creating solutions to shortages and disruptions. Additionally, personal seed saving practices have remained a significant means of sourcing materials throughout the pandemic and appear to be increasing in popularity. Looking forward, growers expressed a desire to learn more about practices that would enhance seed self-reliance, including seed saving, seed storage, and alternative sourcing methods.

We also found that growers valued certain crop characteristics—especially flavor and adaptation to local growing conditions—and were willing to pay more for those qualities in their seeds. Willingness to pay for locally adapted seed in particular may reflect an increasing awareness of the implications of climate change on crop viability among Vermont growers. It may also point to the limitations of formal systems to supply seeds with those desired characteristics. In fact, many interviewees cited this as a precipitant for an interest in seed saving, expressing that they simply were not finding what they wanted within the commercial sector anymore.

Though formal seed sources continue to play a major role in supplying Vermont seed materials, informal seed sources represent an equally important part of the state's seed systems. Building a resilient seed system in Vermont requires attention to both of

these parallel and often intertwined systems simultaneously. In particular, expanding informal systems and integrating them into Vermont's formal seed system could present an opportunity to emphasize regionally adapted, culturally significant, and otherwise locally relevant seed production in the future. Our findings show that there is a willingness to pay for these desired characteristics, and interest among seed actors who operate both commercially and non-commercially to learn about and engage with informal seed systems and practices. This initial research serves to elevate the potential that exists to build resilience in Vermont's seed systems by devoting attention and resources to the informal systems that proved so crucial during a time of upheaval.

## **Moving Forward**

The insights we have gleaned from the initial research detailed in this report will continue to guide the trajectory of our future work. By exploring the impacts of the COVID-19 pandemic on Vermont's seed systems, we hope to support efforts by actors throughout the state and across the Northeast to build a resilient seed system by focusing resources towards areas that need to be strengthened, while bolstering the parts of the system that have shown resilience in the context of COVID-19. The next steps for this project involve preparing a Vermont Seed Resilience Plan that is informed by this and other research projects. We intend to organize a participatory planning session with seed system stakeholders to review key findings from our research and identify strategies to enhance seed system resilience. We anticipate that strategies will include, but will not be limited to, developing participatory breeding systems, incentivizing supply of under-produced varieties, and building capacity through trainings centered around seed saving techniques.

We are also beginning to identify important regionally adapted crop varieties to store in the new Crop Genetic Heritage Lab at the University of Vermont, which is part of the [Consortium for Crop Genetic Heritage](#) (CCGH) under the leadership of Dr. Eric Bishop von Wettberg. Our plan is to store varieties that have important cultural heritage, hold potential for adaptation to climate change, are declining in prevalence, or have other valuable characteristics in order to ensure that these important varieties persist in our region. Our goal is to develop strategies for distributing these seeds back out to seed savers and producers to cultivate. We want to ensure that this initiative is done carefully, ethically, and in the spirit of building inclusive and diverse seed systems. To be clear, we view the work of growing varieties of crops in fields and gardens as the most essential undertaking, and intend to freeze store varieties only as a complementary insurance mechanism. To date the CCGH has assembled a collection of nineteen varieties of Abenaki heritage beans, five maize varieties, and two squashes, sourced from the [Seeds of Renewal Project](#) led by Dr. Fred Wiseman and the [Vermont Indigenous Heritage Center](#). It also holds a collection of maize varieties grown by communities of resettled refugees in Chittenden County, collected from growers in the [New Farms for New Americans Program](#) of the [Association of Africans Living in Vermont](#).

In a parallel line of inquiry, we seek to understand how diseases and pests influence seed resilience. For many crops, challenges related to pests, fungus, disease, and other stressors impact their production in the Northeast. With a changing climate and the potential for global trade to transport disease, these challenges are likely to intensify. Developing resources for growers and seed savers to meet the unique challenges posed by diseases and pests will be critical to maintaining seed system resilience.

Furthermore, we recommend continuing research that builds on and responds to the findings illustrated in this report. In particular, we see a need to further investigate the following areas:

- **Motivations that influence how and why Vermont seed growers select certain crops for cultivation**, especially as their choices relate to seed saving practices, sourcing habits, and preference for certain characteristics. We recommend research that seeks to understand more fully how growers maneuvered away from the five crops highlighted in this report in order to maintain their agricultural production during shortages caused by the COVID-19 pandemic.
- **Challenges that are uniquely experienced by non-commercial growers in Vermont**, especially in terms of barriers to accessing seed through the formal sector and alternative channels created and/or used in response to barriers. Considering the importance of informal networks to Vermont seed systems, we recommend a closer look

at the ways non-commercial farmers navigated partial exclusion from the formal sector during COVID-19 disruptions.

- **The role of seed savers in maintaining locally adapted seed varieties**, as well as potential strategies for elevating that work and integrating it into the state's commercial seed sector. Given that seed savers perform a critical role in propagating locally adapted and/or culturally significant seed varieties, we see a need to further investigate the mechanisms available to support that work through market incentives, connection to broader consumer bases, or integration into formal markets. We also believe that more work remains to be done to understand growers' perceptions of these kinds of agendas, and whether seed savers are interested in projects to scale up their work.
- **Resource limitations, particularly relating to access to land**, that inhibit the potential for farmers and gardeners to engage in plant breeding. Small-scale farmers and gardeners often play an important role in maintaining crop diversity in their gardens but do not have sufficient land to assure adequate isolation distances needed for breeding. We recommend exploring strategies that would connect seed growers who are interested in plant breeding with means of accessing larger tracts of land.

We see an opportunity to invest in informal seed systems in Vermont. While we recognize the potential to connect them more robustly to the state's formal seed systems, we believe that these informal systems are inherently valuable. We view meaningful investment in informal seed systems and further integration of those systems into formal markets as a two-pronged approach to building resilience in Vermont. Growers expressed a desire for locally adapted and culturally relevant seed, as well as for supports that specifically target the informal sector. We recommend programming that offers information on seed saving practices, technical support for seed storage, and avenues for alternative sourcing of planting material. Additionally, investment in community-based projects such as seed libraries and seed swaps could reinforce those networks and work to ensure availability of specialized seed to Vermont growers.

The ongoing goal of this work is to build a resilient seed system in Vermont, in which a sufficient number of quality seeds that are adapted to local growing conditions are available and accessible to meet the demand of local growers and gardeners. The need to pursue this work has been made apparent by the COVID-19 pandemic. The findings detailed in this report offer a deeper understanding of how Vermont seed system actors responded to the COVID-19 crisis, and provide a framework for the supports needed to move forward with increased resilience to similar shocks in the future.

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