Assessing the Impacts of the Loss of Specialty Crops in Michigan

Michigan State University Extension

March 2025

Authors:

Chris Bardenhagen, Ph.D. MSU Extension, Farm Business Management Team
Sarah Klammer, M.S. MSU Extension, Center for Local Government Finance & Policy
Steven Miller, Ph.D. Associate Professor, MSU Department of Agricultural, Food, and Resource Economics
Zachariah Rutledge, Ph.D. Assistant Professor, MSU Department of Agricultural, Food, and Resource Economics

Funding Acknowledgement:

Funding for this report was made possible by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service through grant 24-3208. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

Table of Contents

Executive Summary

Over the last decade and a half, Michigan has lost specialty crops at nearly twice the rate of the U.S. on average.[1] Growers have been experiencing intense, longer-term margin squeezes due to high labor and input costs. There is concern that several of Michigan specialty crop industries are near the tipping point. Our calculations show that an additional 10% increase in labor costs alone would lead to a 2.7% production loss and a 6.7% agricultural employment loss in Michigan.

Given the challenging state that many Michigan specialty crop industries are in, we worked to assess the economic contribution of specialty crops in Michigan, and what would happen if we lost specialty crop industries. We conducted interviews of growers, packers, and processors and modeled data from the National Agricultural Statistics Service to estimate these values and potential changes.

We found that the annual economic contribution of Michigan's specialty crop supply chain is $6.3 billion dollars and supports nearly 41,700 jobs. Farm gate receipts make up about half of that value -- $3.1 billion -- with downstream supply chain activities and indirect and induced economic activities making up the rest. Michigan's specialty crops play a crucial role in many of the regions where they are grown, often serving as the dominant economic driver. These areas experience a substantial economic multiplier effect, with specialty crops supporting not only agricultural-oriented businesses such as equipment fabricators, but also community businesses such as restaurants, grocers, and laundromats.

Most of Michigan's specialty crops are packed and processed within the state, but their market reach extends beyond its borders. Most of Michigan's specialty crops are eventually sold and consumed outside of the state, which brings a substantial amount of revenue into the state. Michigan specialty crop production serves the Midwest and other parts the United States, particularly east of the Mississippi River, and as such is a substantial resource contributing to our national food security.

We found that the diversity of crops grown in Michigan is important to the survival of specialty crop production generally. Numerous crops support each other by spreading equipment and facilities over a larger pool of production and acres. This provides consistent work over the year to help retain laborers. Anchor crops, including apples and asparagus, support other crops by bringing in laborers early in the year (asparagus) and creating a demand for labor late in the year (apples).

We identified that if an anchor crop or multiple industries were to fail in Michigan, a domino effect could occur due to crops' interdependence on one another. Labor gaps would result, leading to lack of processor profitability that would induce further production loss. As a result, many year-round jobs and housing benefits would be lost. Our data show that if specialty crop acreage was converted to row crops, Michigan would lose $5.2 billion in economic output – or 82.5% of our calculated economic contribution from specialty crop production activities. In other words, row crop production would not come close to bridging the gap from a massive loss of specialty crops. Such a loss would have a dramatic effect on community businesses in these regions, including repair and welding

[1] Michigan has lost 11% of its acreage in categories "vegetables, potatoes, and melons" and "Non-citrus fruits and nuts", whereas on average U.S. acreage shrunk 6% in those categories.

shops, lunch services, grocers, and more. Spillover effects on the tourism industry and lower revenues for school districts would also likely result. Furthermore, existing packing and processing infrastructure would be wasted, because it cannot be easily repurposed for uses outside of agriculture. These equipment and facilities are specific to food production and often distinct to certain commodities.

It is important to consider that there is a very low investment potential for specialty crop infrastructure, due to the high capital expenditures required for production and the low expected margins. This means that if production of a commodity stops in a region, future investment is unlikely. Even if future farmers sought to rebuild, as put by one grower, "… it would take 100 years to get back to where we were."

Introduction

Michigan's specialty crop sector, including the various fruits, vegetables, and nursery crops grown around the state, has been experiencing notable challenges over recent years. While most of these challenges are not unique to Michigan, the number and severity of issues have been a growing source of concern for growers and policymakers alike. Agriculture is an important part of Michigan's economy, particularly in certain areas of the state.

For this study, Michigan State University researchers were asked two questions:

1) What is the economic contribution of specialty crop production?

2) What might happen if specialty crop production were to be lost?

This report compiles answers to those questions using both quantitative and qualitative research methods across five chapters.

Chapter 1 describes industry viewpoints on what could happen if one crop were lost, and what could happen if more than one crop were lost. Industry perspectives were gathered and analyzed using qualitative methods, including interviews and focus groups.

Chapter 2 describes the economic contribution of farm-gate specialty crop production in Michigan. The authors utilized agricultural statistics to model the macroeconomic effects of production with IMPLAN software.

Chapter 3 evaluates the downstream contribution of Michigan specialty crops that occur after farming: processing, packing, and other supply chain activities. IMPLAN software was used for modeling, building on the results of Chapter 2.

Chapter 4 describes the economic changes that would occur if Michigan specialty crop production were to be replaced with row crops such as corn and soybeans (referred to as "program crops"), which are considered to be default land uses for much of Michigan acreage. Effects on farm gate and the downstream supply chain are considered, building on Chapters 2 and 3.

Chapter 5 evaluates the changes that would occur given a substantial rise in labor wages (10%). The authors describe resulting production and employment losses, as well as changes in the economic value of specialty crop production.

Taken together, these five chapters provide a sobering forecast of what a loss in specialty crop production might mean for the state of Michigan. The conclusions of our study are captured in the Executive Summary, above.

Chapter 1: Industry Perspectives on the Importance of Michigan Specialty Crops and the Potential Impacts of a Loss of Production

Michigan State University Extension

Chris Bardenhagen, Ph.D.

February 2024

Abstract: This chapter describes surveys of specialty crop farmers, processors, packers, and other industry actors to better understand the importance of Michigan specialty crops and the ramifications were specialty crop production to be lost in part or in whole. This is the first chapter of a 5-part analysis into specialty crop systems in Michigan.

Introduction

This chapter describes our research to assess the importance of specialty crops to Michigan's economy and how Michigan processors would likely respond under the extreme case that specialty crops could no longer be grown in Michigan. While such an outcome is not likely, the way processors respond to such an extreme event helps to describe the dependent relationships between specialty crop growers and food processors in the state. This is a qualitative component of our overall research project that focuses on fruit and vegetable crops in Michigan and highlights the importance of Michigan's production for national food security.

Over the last decade and a half, Michigan has seen a 10% loss in specialty crop acreage.[2] Michigan acreage loss was over 1.5 times the average rate of loss in the U.S. for the "vegetables, potatoes, and melons" category and nearly 6 times the U.S. loss rate for the "non-citrus fruits and nuts" category.[3]

Currently, fruit and vegetable growers are experiencing tighter margins due to higher input costs, high labor costs and in some cases, low availability of labor at any wage. Low-priced imports limit prices growers can charge. Concerns over these and other challenges experienced by specialty crop producers today led us to inquire about what might happen if any Michigan specialty crop industries begin to fail. We asked the following research questions:

- ❑ How would local and regional ag businesses, and their communities, be affected by the loss of specialty crops, considering the following scenarios:
  - How would the loss of one important crop affect the region?
  - What if more than one, or all, specialty crops were lost?

We found that some regions may be able to absorb the disappearance of a single commodity, while others may not. The diversity of crops in a region is critical to both farms and packers/processors, for labor retention and for cash flows. We found that the loss of an "anchor" crop in any region would likely affect the viability of other commodities within that region. Furthermore, the loss of more than one significant specialty crop has the potential to create a domino effect across multiple industries, with far-reaching implications for the affected region's economy.

Methods

To approach this topic, we developed research questions in collaboration with Michigan commodity group leadership and the contributing authors of articles in this report. The project team worked with

---

[2] In Michigan, the categories "Vegetables, Potatoes, and Melons Harvested for Sale", "Specified Fruits and Nuts by Acres", and "Berries by Acres" went from 312,602 acres in 2007 to 281,903 acres in 2022 (NASS, 2024).

[3] 2007 Census of Agriculture, United States Summary and State Data (NASS 2009); 2022 Census of Agriculture, United States (NASS, 2024).

key informants to identify a sample of interviewees across the major growing regions and over a representative range of specialty crop commodities.

Interview guides were developed to address the major questions and issues first constructed by the team. These guides were designed in a semi-structured manner that provided flexibility to capture new concepts and issues that arise through open-ended discussions. We asked questions including:

- Number of full-time, part-time, seasonal, and year-round employees
- Labor saving technology currently used, and future potential technology
- What might replace specialty crops in different scenarios
- What would happen if a critical mass of an industry stopped producing a product
- Effects on packers and processors
- Effect on workforce
- Sales markets for different crops

Data gathering entailed many individual interviews with growers, packers, processors, and other industry actors. We purposefully interviewed growers in each of the major specialty crop regions in Michigan. Several focus groups were conducted using similar interview questions. We invited attendees such as MSU Extension educators, commodity group leaders, consultants, and input providers with a regional perspective to capture sentiments across a wide range of growers. Finally, we researched industry production budgets, gathered basic agricultural statistic data, and drew information from the research captured in the other chapters of this report.

Qualitative methods were used to analyze the resulting data. All of the interviews and focus group notes were coded. Excerpts were taken based on various concepts that presented themselves in the data, which were placed into a new document. These concepts were organized by theme and then summarized. Summaries of the salient concepts and themes are discussed below.

Results

In total we held two fruit-oriented focus groups and one vegetable-oriented focus group. We had a total of 19 individual interviewees, many wearing more than one hat: 14 were growers, 5 were field packers, 4 had indoor packing facilities, and 4 represented processors. For several of them, marketing was part of their job duties. There were two academic professors in the mix, having agricultural production and market expertise.

The growers, processors, marketers, and packers we interviewed covered a substantial swath of the fruit and vegetable specialty crop sector in Michigan. Products within our interviewee pool included: apples, asparagus, blueberries, broccoli, carrots, celery, cherries (sweet and tart), cucumbers, grapes (juice and wine), green (snap) beans, lettuce (Iceberg, leaf, and Romaine), parsnips, peaches, pears, peas, peppers (bell and hot), plums, potatoes, pumpkins, rhubarb, rutabaga, squash (summer and winter), sweet corn, tomatoes, and zucchini. Most of these products were grown or packed by multiple interviewees. By the end of our interview window, we had reached a saturation of concepts: we were hearing similar ideas repeated regularly, and unique new concepts were not being contributed by further interviewees.

These interviews illuminated the importance of Michigan specialty crops for the United States food supply, as well as their importance for Michigan's rural economies and jobs. Market threats were identified in the data (labor costs, infrastructure holdouts, and investment risk). Growers detailed their current efforts and strategies for labor savings, and application of available technological solutions. The importance of the diversity of crops became clear when we considered the potential loss of a particular crop. This exercise also showed the critical importance of certain anchor crops such as apples and asparagus. When considering what might happen if multiple crops were lost, interviewees described the potential of a devasting level of farm employment loss, the loss of packing and processing infrastructure, and the negative effects on revenue for upstream and downstream businesses. Such losses have implications along the food industry supply chain in Michigan and for the households that provide labor and capital investment along that supply chain.

Importance of Michigan's specialty crop sector

Michigan is well known for the diversity of agricultural products it produces, due in large part to its geography and proximity to the Great Lakes. The two main themes that came out of the interview and focus group data were Michigan specialty crop production's importance to U.S. food security, and its importance as a provider of jobs in rural areas.

Food Security. Growers and other interviewees emphasized the fact that there are only so many places in the United States capable of consistent specialty crop production, especially for fruit. The western edge of the Lower Peninsula is next to Lake Michigan, enabling much of the fruit and other specialty crop production to occur. Lake Michigan keeps the growing environment cool during the mid and late spring, helping to fend off quick warming flashes followed by freezing temperatures. The sandy soils lend themselves well to vegetable crops that need good water drainage. Further inland and east, communities of specialty crop growers have also emerged, some having muck soils that lend themselves to lettuce and other vegetable production. Such geographic advantages have helped agricultural communities to develop and flourish in Michigan.

Michigan's capacity for production volume has historically been large and is an important part of U.S. food security. Michigan's fresh produce serves not only Michigan consumers and the upper Midwest with regularity, but also the East, Southeast, and Southern areas of the United States. Growers, packers, processors, and marketers regularly expressed that Michigan grows much more fruit and vegetables than it can consume. Most of Michigan's fruits and vegetables are packed and processed inside the state, as packing and processing businesses are located here to take advantage of the proximity to the farms, according to interviewees. As the majority of packed and processed products are exported from Michigan, this industry is an important source of revenue inflows into Michigan.

The strength of Michigan's processing infrastructure adds to its importance to U.S. food security. Due to the highly seasonal nature of the upper Midwest production window, processing capacity has grown in lockstep with farm production capacity. This enables products to be put up into shelf-stable form for distribution across the country. It should be noted that much of the machinery, buildings, and related capital assets required for processing and packing Michigan's specialty crop output is specifically designed for the crops grown. This means that such equipment is very expensive to acquire and has limited use outside of specialty crop packing and processing.

Interviewees generally agreed with estimates stating that about 60% of Michigan specialty crop production is processed. These are sold as either intermediate goods (for example, vegetables sold to soup companies) or retail products (e.g. dried cherries, pickled cucumbers, canned green beans). However, the amount of fresh products produced relative to processed products varies from region to region and commodity to commodity.

Employment. Interviewees reported that Michigan's specialty crop industry provides jobs in two ways – farm labor and processing/packing labor.

Specialty crop production requires far more labor on a per acre basis than field crop production such as corn, soybeans, and wheat. We found that labor-intensive vegetables such as fresh cabbage and asparagus can have labor costs that range from 35% to over 50% of total production costs. Small fruits can have a similar level of labor costs, with estimates for blueberries at about 42% of total costs. Apples, peaches, and other labor-intensive tree fruits can reach over 60% labor, due to the need for hand pruning, careful hand picking, and sometimes hand thinning. Even mechanically harvested specialty crops such as tart cherries can require 20% labor costs, due to both the pruning activities needed and the intensity of harvest units (1-yard boxes and tanks, versus semi-tractors with grain bins). They also require quick cooling due to perishability in most cases, creating additional work for loading, unloading, and transporting, generally over short distances.

Our qualitative approach and sample of interviewees do not lend themselves to generating hard statistics. Despite this, the focus group discussions highlighted a need to quantify relative employment effects on a per-acre basis. Looking at our farm-level data we can provide a range of the number of acres that can be served by a worker, based on farms' amounts of seasonal and year-round employment. On the less intensive end, we saw 45 acres per person for crop mixes including more mechanized fruit harvest (e.g. tart cherries) to 17 acres per person for crop mixes including both hand and mechanized vegetable harvest. On the more intensive end, there were many farm operations in the range of 3 acres per person to 8 acres per person, for crops such as fruit with high levels of hand labor.

This stands in stark contrast to the small amount of labor needed for field crop production. Many statements were made that indicate that only two people are needed to cultivate 1000 or 1500 acres of row crops like corn and soybeans, plus some trucking assistance at harvest season. A substantial number of farmers we interviewed already have some row crop production for rotational purposes among other reasons. They stated that they would have to let go of almost all of their employees if they switched to only row crops.

Packing and processing activities produce a large number of full-time jobs, especially in West Michigan. Most are year-round, but during the height of harvest seasons, some processors and packers augment labor needs with temporary seasonal workers as well. These packing and processing businesses serve many farms. A large part of the volume of specialty crops are freshly packed but much is also processed, such that both activities are needed to serve regions' production. For cabbage, apple, and blueberry production, a slight majority of output is packed as fresh produce. The rest is processed into shelf stable, frozen, or intermediate goods.

In one example calculation from our data, a full-time, year-round packing job is needed for every 25 or so fresh-variety apple acres. Those same 25 fresh acres help necessitate some processing

employment as well, because a certain amount of pick-outs from the fresh line are diverted to the processor.

Threats to Michigan's specialty crop industries

Interviewees named skyrocketing labor costs as the most major existential threat to Michigan's specialty crop production. Outside investment in infrastructure was also mentioned, as well as high investment risks.

Labor. While low-priced imports, extreme weather events, and a growing average cost of inputs such as fertilizer are very relevant, growers made it a point to mention that the high wage rate set by the Adverse Effect Wage Rate (AEWR) for H-2A-visa workers is unsustainable. These growers already must pay to transport people to and from their home country, ensure they have housing and transport here in Michigan, and provide a certain level of work per week. Interviewees noted that the growth in the AEWR has exceeded that of wage growth across the rest of the economy. They reported that, at the local level, it has pushed upward on local domestic labor prices.

Given labor's strong place in specialty crop production budgets, sustained high labor prices are causing concern about the long-term viability of certain commodities. Our data would support the notion that many growers are nearing the tipping point. The high prevailing wage "… makes us think about getting out of things or lessening [production] every day" according to one grower. Another stated that labor is the current major problem, whereas "… crop production, disease, even marketing we can figure out." One research expert mentioned that the costs incurred to get H-2A laborers here are incredibly expensive compared to what other developed countries do. That cost is borne by the grower either directly or indirectly, leading to reductions in often already thin margins.

This is in part because growers are generally price-takers. That is, they usually have to accept the price that is offered, rather than adjust the selling price to cover all relevant costs. One interviewee explained that she has no control over the price she receives – loads must be sent off, and growers must just cross their fingers. Growers state the inability to charge more to cover labor costs, with retailers pointing to the fact that consumers will not pay more. Rather, they can simply purchase products sourced from other countries such as Mexico, which can undercut domestic prices even after import transportation costs are included. In short, it is very difficult to compete when Michigan manual labor costs can rise to nearly $30 per hour considering the required H-2A benefits. Even some H-2A workers themselves have been asking whether their pay rate is sustainable; presumably, they don't want to lose long-term employment for a short-term benefit.

Outside Ownership in Infrastructure. Interviewees and focus group attendees mentioned that many large freezers that serve certain specialty crop industries have been purchased by outside investors. These investors want to see a high turnover throughout the year to optimize their profits. However, processed apple, cherry, and blueberry products, for example, may need to be in frozen inventory for a year or even longer in some cases. This raises the question of whether we might see agricultural assets shift to non-agricultural uses – for instance, to cold storage facilities being used for wholesaling activities around processed foods and meals.

High investment risk. In a normally functioning market, the infrastructure issues mentioned above might create an opportunity for investors, including the producers themselves, to develop more

freezer capacity. However, capital investments in specialty crops are considered high risk at present. At the farm level, tree fruit growers, for example, are struggling with whether to replant the needed amount of acreage to ensure continued long-term viability. Orchard establishments can easily cost between $20,000 and $30,000 per acre. With low profitability and continually shrinking margins, the risk is high relative to the costs for many, or most, Michigan specialty crops.

Farm investments in machinery, coolers, trucks, packing lines, etc. are becoming harder to justify. As one grower put it, he can keep the investments going – "keep the wheels turning" – but nobody would invest in crop infrastructure at the current low margins. For new growers or other potential downstream businesses such as packing or processing, "who can invest a million in infrastructure with such high risk and low rate of return?" Already risky due to weather and market considerations, specialty crops are feeling intense and shifting retailer requirements in addition to high labor and input costs. Given this environment, a grower asked "… How can we attract the next generation of farmers?".

Actions and potential for labor savings

The general perception of our interview and focus group pool is that farm, packing, and processing labor costs are exorbitantly high relative to returns, and finding qualified workers at an affordable wage is increasingly challenging. With labor costs at such a high level, we inquired about the current and potential use of labor savings devices, including robotics. We found that growers are currently intentionally using labor savings methods as much as reasonably possible. Growers felt that most farm-level robotics are not yet feasible, though some at the packing level are.

Current practices. One major change in apples comes through orchard design. Orchards are being trellised, making pruning and harvesting much easier and reducing labor needs. Orchards are being planted with GPS so that they are organized in precise rows in preparation for platforms and harvest robotics if they ever become feasible. To save on labor costs, apple growers are increasingly using chemical thinners, sometimes even at the expense of yield. This is because hand thinning is very labor-intensive and therefore expensive. Growers are also using mechanical hedgers more than in the past. Mechanical hedgers are labor-saving but generally produce outcomes inferior to hand pruning.

Beyond investing in processes and equipment that directly reduce manual labor requirements, some growers are finding other capital investments to reduce labor costs. For example, one vegetable grower mentioned a renewed focus on the process efficiency of his operations. According to him, purchasing more hauling wagons reduces worker and driver cue times to ensure people aren't waiting for boxes.

Unfortunately, another strategy commonly observed is to leave viable produce on the field. In crops with multiple pickings (apples, asparagus, blueberries), the metric for determining when to pick has changed with the shortage and high cost of labor. Growers may opt to leave the product out in the field rather than incur the labor-harvesting and transportation costs for lower margin processor-grade fruit and vegetables. This is especially true if the harvest is not expected to reach fresh grade.

Labor-savings Machinery and Robotics. Platforms are one type of technology currently used in apples as a labor savings device. A platform is a machine that people can stand to reach the top of a

tree. A platform can carry multiple people and can be driven down the row very slowly. This enables picking, pruning, and thinning without the use of a ladder. Apple growers report two major issues in the way of using platforms. First, for many existing orchards platforms are not feasible due to large trees and orchard design. Second, even with high-density orchards that are platform-ready, the number of platforms needed to serve their acreage at harvest time would come at a very large level of investment, with some platforms costing $70,000 to $80,000 each. Instead, growers might have one or two platforms that they currently use for pruning and hand thinning during a time of year when speed is less critical.

Weeding technology is currently available for vegetable crops but at a high price. In one case, a laser weeder was mentioned as having a price between one and two million dollars. The acreage limits of these machines also raise their effective price per acre, with some limited to 30 or 40 acres a day. Multiple machines may therefore be needed for one farm. Additionally, seasonality is an important factor we identified that hampers technology deployment for Michigan's vegetable production. The costs of a device that can weed 35 acres a day may be viable in California, where it will be used for most of the year. However, Michigan's relatively short season leads to lower overall use, increasing a machine's per acre costs relative to the cost savings. For example, an automated vegetable planter has the potential to offset substantial amounts of labor but may cost over $700,000 and require yearly maintenance of $100,000. This may work in California given multiple plantings in a year. In Michigan's short growing season, it will rarely be used twice each year.

Investment risk plays out noticeably in the area of high-tech machinery. In addition to the initial high level of investment, the machinery may not be well proven for effectiveness and furthermore might be made of all custom parts. providing few options for repair. The farm not only needs to bear the risks of ineffectiveness but also must bank on the longevity of the ag-tech company that produced it.

However, at the packinghouse level, advances in robotics and labor-saving devices can be more straightforward to implement. This is possible in part because existing packing facilities are controlled environments. They are the result of large capital investments over time, already using high-level technology and amenable to additional improvements.

Scenario: One commodity lost

To better understand the ramifications of the loss of specialty crop production, we asked interviewees and focus group attendees: How would the loss of one important commodity affect your region? We used different crops as examples with the interviewees, based on the region and the farmer's crop spread. Several important factors came to light through this question: the importance of a diversity of crops; the concept of an anchor crop; crops that fill a void; and, alternative uses. The answer to the question, however, depends on the region.

Diversity of crops. Looking at our interview data, there is a level of interdependence between certain specialty crops within regions. Cropping systems and related infrastructure for one commodity support other crops being grown within the same region. In part, this is due to being able to spread overhead for equipment, housing, and other assets over a greater number of crops, acres, and months. For farms and processors, this diversity can provide more consistent cash flow over the season, in addition to maximizing the use of farm and processing equipment.

Diverse spreads of specialty crops give regions the ability to provide consistent employment and retain labor – another critical factor to production. Laborers want consistent work, starting earlier in the year and ending later. Interviewees reported that having a full, long season of work helps to attract and retain the best workers. Where there are major gaps of time between work, people will gravitate towards farms and regions where better prospects can be had.

Anchor crops. It became clear that certain crops act as anchors. As anchors, they help retain other specialty crops by providing a strong attraction for laborers and for supporting services in the community. The anchor crops and their level of importance vary by region. For West Michigan, apples and asparagus are clearly anchor crops. Asparagus production begins early in the season, providing an early vegetable harvest. Apples go late in the season and due to voluminous acreage require a substantial amount of labor. Anchor crops also benefit input and service providers by providing a consistent amount of demand. These providers then serve other crops' needs in the area.

Processors have anchors as well, which are highly dependent on their particular portfolio of crops. In some cases, an anchor crop for a processor may be less of a major crop for the region but fill important labor and production gaps for the processing company.

Filling a void. Certain crops fill a void that cannot be filled well by other specialty crops or even row crops. Potatoes and asparagus, for example, can be grown on very sandy, well-drained soil. Asparagus fields might be in flat, low-lying areas relative to neighboring tree fruit grown on hillsides. In certain areas, growers report that if asparagus came out, the land might just be let go to fallow. The sandy nature might even make hay production a challenge in some cases.

Alternative uses. When asked about alternative uses for the ground used for that commodity, answers varied. Some growers would first look at other opportunities in their existing spread of crops, for example, putting in more of one type of tree fruit if the other is lost. Growers in many areas suggested that corn and soybeans would replace specialty crop acreage, but in others, row crops are less likely due to sandy soils, lower yield potential, and/or smaller field sizes. There is also substantial housing pressure in some regions, especially near cities or in areas with high tourism development (e.g. northwest Michigan).

Some growers expressed concern over pressure from solar development, mentioning solar projects that are planned for hundreds of acres in productive agricultural areas. In some cases, these plans involve versatile soil sites, including some muck soils that are highly advantageous for specialty crop production.

If one commodity were lost: Some areas could withstand the loss of one specialty crop. For example, due to the wide variety of crops in southwest Michigan, loss of one crop might not be critically detrimental to others. In northwest Michigan, the answer would depend on the crop. However, in west central Michigan, the loss of one crop has a greater likelihood of secondary effects on other crops, especially if it were an anchor crop. This is likely due to in part to the very tight and unforgiving margins that the industry is experiencing.

Scenario: Multiple crops lost

Finally, we asked interviewees and focus group attendees how the loss of more than one specialty crop would affect their region. Responses indicated that if multiple crops were lost, or in certain regional cases if an anchor crop were lost, a domino effect is likely to occur, leading to the disappearance of more commodities in the area. Since different crops and industries are interdependent when it comes to labor, growing conditions, farm equipment, and processing and packing infrastructure, they can be considered like the spokes of a bicycle wheel. The loss of one may be possible, but a loss of more than one begins to weaken the structure of the wheel, and the rest starts to unravel.

If multiple crops were lost, interviewees report that there would be "devastating" and "dramatic" changes for communities where specialty crop industries have grown over the years. The expectation is that much land would go to corn and soybeans, resulting in large changes in economic value (see Chapter 4 below). Direct changes in agricultural labor would be pronounced. For example, a 1000-acre specialty crop farm, employing hundreds of people, would likely drop to 2 workers if they shifted to row crops.

Farm jobs, housing benefits, and housing infrastructure. Growers mentioned a huge amount of job loss on the farm side. It is very important to note that housing is a benefit that is commonly provided for farm workers, both seasonal and year-round laborers in many cases. This would mean that in the different regions, "thousands of workers" would be looking for work, and many of them would be looking for housing as well. Some very expensive investments in housing, including some recent investments, would become "useless", as alternative uses may not be feasible in most cases.

Processing/packing job and infrastructure loss. Several thousand packing and processing jobs would be lost. Many or most of these are year-round positions. While processors can purchase from outside of the state for some of the product that they normally purchase within their region, called "covering", the cost of covering is often expensive. This is because raw product needs to be hauled in, often having a high level of pick-outs, peelings, and other non-valuable waste/trimmings. This means that it might take two trucks to get one truck worth of finished pounds for some crops, leading to very high overall transport costs. Costs to cover do vary greatly by commodity.

Some processors might be able to keep going in Michigan using outside crops, or at least they might continue to produce certain product lines. However, one processor mentioned that under that scenario, their competitiveness would be substantially lessened in the marketplace. Part of their competitive advantage is being near to the source of most of the products they process.

Specialty crop packers are likely to shutter operations in the absence of sufficient specialty crop output. As mentioned by one interviewee, the packing facilities are very specific in nature and there is not a lot else that the equipment and facilities can process. Michigan has an estimated 20 to 30 packing houses for apples, each employing 50 to 60 people. Should apple production cease in Michigan, each of these facilities would be at risk of closing.

Upstream and downstream businesses. There were numerous upstream and downstream businesses identified that would be negatively affected or at worst, have to shut down should more than one specialty crop cease production in their region. The effect will depend on the business and commodities impacted. Some key segments in Michigan that work with specialty crop producers, packers, and processors include bag and cardboard box companies. Michigan's vast industry of greenhouse and nursery businesses growing vegetable seedlings, blueberry bushes, and fruit trees

to the point where they can be safely transplanted would experience challenges. Growers also identified custom fabricators and welding companies that serve specialty crop producers as being at risk. Irrigation, seed, and warehousing companies would also be affected.

As mentioned, specialty crop production is more intensive than most row crops, and supports an industry of agricultural services, including scouting for pests. Scouts are highly trained individuals whose jobs would be at risk should specialty crop production experience significant loss. Interviewees reflected that there are many more input dealers and scouts in specialty crop regions than in regions of the state specializing in row crops. Due to challenging disease and pest issues, scouts help advise growers on what pests to be watching for and advise on what practices should be adopted and when to mitigate pest damage, among other things.

It is worth considering the local nature of these upstream and downstream businesses. Because they are located in specialty crop farming regions, the loss of their employment, incomes, and revenues will have a multiplier effect that reverberates to other industries. This effect is similar to the multiplier effect realized by farm producers, packers, and processors.

Community businesses. The multiplier effect described above reflects the interconnectedness of businesses in a local community, even when those businesses do not support the same production chain. When describing the impact on local communities, many interviewees talked about all the supporting businesses that have either expanded or developed specifically to serve the population of specialty crop workers. These include grocery stores, restaurants, laundromats, and lunch services. One interviewee mentioned a local beef producer who is making a living selling meat to seasonal workers. These examples are in addition to all of the propane and gas companies, hardware businesses, and trellis builders that serve the farmers more directly.

The list could go on at length, in terms of the economic contributions that specialty crop production brings to existing community businesses. But what became clear through the interviews is that large parts of these rural economies are dependent on specialty crop production. The word repeated most often when asked how communities would be affected was “devastating”.

Spillover – tourism, row crops, school districts. Other factors that came to light in the data could be grouped under the theme “spillover effects”. Some interviewees noted that tourism would likely be affected as more specialty crops are lost. For example, in northwest Michigan, the tourism economy is dependent in part on the rural character of the region. People travel and move there to see rolling hills and farmland in addition to lakes. But currently, the viability of tree fruit -- the area’s signature crop type -- is in question. As growers begin selling their properties -- often for development or housing --the long-term appeal of the region to tourists and agri-tourists is at risk.

Other spillover effects mentioned include potential impacts on school districts and on row crop markets. Especially in areas without as much tourism or urban housing pressure, school districts stand to lose a substantial amount of tax revenue if specialty crop farms and supporting businesses lose ground. This is likely to affect the level of service to students and possibly overall educational outcomes in these regions. For row crops, the entry of a substantial amount of Michigan acreage has the potential to create a glut of grains that would help push down prices. At the time of this writing, grain prices are depressed, and further volumes could exacerbate the situation. This would have a negative effect not only on existing row crop farmers but also on the farmers moving from specialty crop to row crop production. It should be noted that some specialty crop acreage has already been taken out of specialty crop production and put into row crop production, at the time of this writing.

Conclusion

One of the main discoveries of this research was the importance of the diversity of specialty crops in supporting one another. This is in part due to a spread of harvests over the year needed to sustainably support a labor force, both on the farm and throughout the supply chain. The importance of supporting a vibrant and diversified specialty crop industry is also apparent in the ability to spread equipment and facilities costs over a larger pool of production and acres. Diverse crops work on different schedules, allowing greater coordination of upstream and downstream activities and the use of labor and equipment. Relatedly, the importance of anchor crops such as asparagus and apples was identified. These crops create a strong demand for workers across a long season, benefiting the production of different crops in between.

Given Michigan's seasonality, past lessons show that processing infrastructure is important for the viability of the production of many crops. However, the capital investment in those packing and processing centers is substantial and can only work through high volumes. Such volumes can be realized by more acres under key commodities or by sharing processing across a multitude of different but related specialty crop products.

In the absence of in-region production, we found that some processors would be able to continue operations for at least some product lines by importing specialty crops for processing from out-of-state producers. However, as a matter of practice, this is normally only done for certain products. Our data, covering a substantial swath of industries, would suggest that with some exceptions, importing raw commodities for processing from other states would not be feasible for the long term.

An important concept discovered was how investment risk affects future cropping possibilities. Once lost, farm equipment, buildings, and cropping systems, as well as processing and packing infrastructure, suffer from a lack of investment potential. This is due to the high capital outlays necessary, coupled with low expected margins. Maintaining systems through tough times is feasible, but rebuilding is less likely to occur. Even if future farmers sought to rebuild, as put by one grower, "… it would take 100 years to get back to where we were."

Specialty crops have a very large effect on local commerce, farm employment, and community businesses compared to row crops like corn and soybeans. While the development of an average number is outside the reach of this research project, farm examples would suggest that an acre of specialty crops requires potentially 10 to 50 times the workforce needed to manage row crops (or more). This also posits benefits to the local community.

In addition to Michigan's geographical advantage for U.S. food security, specialty crops are a substantial source of employment for farmers, other Michigan residents, and seasonal workers alike. Given the importance of agriculture to many of the rural economies researched, it is difficult to overstate the effects that a loss of specialty crops would have on Michigan communities.

Chapter 2: Economic Contributions of Michigan's Specialty Crop Producers and Production

Michigan State University Extension

Steven Miller, Ph.D.

Sarah Klammer, M.S.

June 2024

Abstract: This chapter details the approach and findings of modeling the macroeconomic effects of Michigan's specialty crop production, describing in detail the distinction between an economic impact estimate and an economic contribution assessment, as undertaken in this study. The findings show that the value of specialty crop production in Michigan totals $3.12 billion on average. This supports about $2.3 billion in additional transactions across the state. Accordingly, 37,663 Michigan jobs can be linked back to specialty crop growers, either directly or indirectly.

Introduction

In this study, we undertake an economic contribution analysis of all specialty crop production in Michigan, estimating the present value of production and the larger macroeconomic effect of the specialty crop supply chain on the State's economy. Using economic simulation software, we trace the dollars spent by Michigan's specialty crop growers in the normal course of operations that are then re-spent in the economy. For instance, dollars spent in the economy are re-spent by those selling products and services to specialty crop growers. Those individuals who sell to growers also take their proceeds to restock inventories and pay for operational costs like wages, utilities, accounting services, and taxes, to name a few. These expenditures form a cycle of economic activity stimulated by specialty crop production. The economic contribution analysis outlined in this report captures the value of that activity in terms of total output, value added, labor income, and jobs supported.

Specialty crops are those crops that are important to American's diets and health and aesthetics but do not occupy the level of acres necessary to make them attractive to agricultural service providers. This threshold may differ by state and regulatory agency, but the USDA (USDA: ARS. 2024) has established a standard list of 327 specialty crops across 17 categories. Because the list of specialty crops is so extensive, it is often easier to list the 51 crops that are not considered specialty crops.

Category	Count
Specialty Crop Category	
Annual Bedding Plants	10
Broadleaf Evergreens	8
Christmas Trees	8
Culinary Herbs and Spices	71
Cut Cultivated Greens	6
Cut Flowers	10
Deciduous Flowering Trees	10
Deciduous Shade Trees	9
Deciduous Shrub	8
Foliage Plants	11
Fruits and Tree Nuts	47
Horticulture	5
Landscape Conifers	8
Medicinal Herbs	38
Potted Flowering Plants	9
Potted Herbaceous Perennials	16
Vegetables	53
Total Specialty Crops	**327**
Not Specialty Crops	51

Table 1. Crop Categories.

This analysis focuses on the economic contribution of the supply chain for specialty crops production, measuring all the economic activities that go into the production of Michigan's specialty crops. Economic contribution includes the portions of the economy that owe at least part of their

raison d'être to the existence of the market for specialty crops. It is important to note the distinction between economic contribution and economic impact, as both terms are often used interchangeably. The conventional use of the term *Economic Impact* denotes an estimate of the economy-wide effect of introducing a new industry or business to the local economy or the estimate of the overall net effect that losing a local industry or business will have on the economy. The burden of estimation is high for estimating economic impacts in that the estimates should also entail how other economic activity not directly related to the industry or business is squeezed out by its presence or pulled in by its absence. For specialty crops, the economic impact analysis of losing an orchard would have to encompass the lost economic activity the orchard generates, offset by the gain in the alternative use of those acres for other commodities, development, or other uses--whichever is the most likely use of the land in place of the orchard. Clearly this requires a level of conjecture on the part of the analyst in assigning the next best alternative use.

Alternatively, economic contribution assessments are a way of gauging the overall importance of an existing industry without conjecturing the economic merit of any displaced alternative uses. Economic contribution estimates are derived by tracing all the transactions necessary to generate a commodity output – that is the value of all the goods and services required to produce a given level of output. Such is dependent on the characteristics of both the commodity output being measured and the regional economy by which it is produced. As described above, a specialty crop grower incurs various expenditures in the course of a growing season to ultimately reach harvest and sale of their crops. Similarly, the analysis measures the expenditures required to generate the goods required by the specialty crop growers. Both the expenditures required to produce the output and the output are measured in dollar values.

Methods

The economic simulation model used in this analysis is the Minnesota IMPLAN Group Inc. model for economic impact evaluation, referred to as IMPLAN (Minnesota IMPLAN Group Inc. 2004). This is a general application economic simulation model that traces all transactions across industries and institutions (households, government) via a square (number of columns equals number of rows) matrix of transactions. Each column represents a single industry as a buyer while each row represents a single industry as a seller (Isard et al. 1998, pp. 283). In addition to industry rows and columns, the matrix has rows and columns that represent the transactions made to institutions (wages, profits and taxes) and by institutions (purchase of final goods for consumption). Finally, a row and column are added to represent the purchases of imported goods and services and for the export of locally produced goods and services. This construct builds a closed system that represents transactions within and amongst all industries: inter-industry transactions; transactions between industries and government; transaction between industries and households; transaction between households and government; and the purchases and sales between the state economic sectors and the rest of the world.

IMPLAN provides industry detail with over 540 different industry categories including agricultural, goods-producing, and service-providing industries. Institutions are broken out into households by

income group, federal, state and local government sectors, and by import and export markets. The model also provides household and government purchases of goods and services. Additional transactions are recorded within the model including transactions across households, government transfers to households and household transactions to government in the form of taxes and fees. Because the social accounting system examines all the aspects of a local economy, it provides a comprehensive snapshot of the economy and its spending patterns and is useful in modeling changes to that economy if one industry changes.

This modeling framework has a long history and was first described by Francois Quesnay in 1758 but later refined by Wassily Leontief (1960) into the standard model used today. The structure supports demand-driven responses, where changes in output demand in one industry materialize in changes in the demand for production of other industries. For example, an increase in local demand for printing services will spur demand for paper, ink, electricity, printer repair services and other goods and services required by printing companies. The companies that provide goods and services to the printer will also purchase other goods and services used in their respective production processes. Households that enjoy enhanced employment opportunities earn more and spend more on goods and services and taxes. Such household impacts generate additional direct and secondary transactions across the economy. The extent to which initial stimulus generates such secondary transactions is hindered by the degree of purchases made outside the modeled region. Industries that purchase inputs from local suppliers generate greater secondary transactions than industries that tend to purchase inputs produced outside the local area, holding all else constant.

Such economic simulation models, commonly known as Input-Output (I-O) models, have become staples for regional analysis (Blakely and Bradshaw 2002). They provide a systematic and intuitive approach to estimating economy-wide contributions of industries on the local economy. These models use linear relationships to reflect production processes that equate industry inputs and outputs. The linear transactions that underlie the model are generalized in a set of multipliers that capture the full extent of transactions associated with any changes in the level of production in an industry (Cabrera et al. 2008). To exemplify, within the I-O analysis, the total impact is specified in dollar value of transactions as,

$$Total\ Effect = Direct\ Effect + Indirect\ Effect + Induced\ Effect \qquad (1)$$

The I-O model takes changes in demand (direct effect) and relates them to overall economic impact (total effect) through a set of mathematical equations described above. The indirect effect is the value of secondary inter-industry transactions in response to direct effects. The induced effect is the value of transactions resulting from changes in institutional income in response to direct effects. Because the relationships are linear, the direct, indirect, and induced effects can be specified as multiples of the direct effect and equation (1) can be restated as,

$$Total\ Effect = (1 + k_1 + k_2) \bullet Direct\ Effect, \qquad (1.1)$$

where k_1 and k_2 can be called the indirect and induced effect multipliers, respectively and are greater than or equal to zero. More simply, Equation (1.1) can be restated as,

$$Total\ Effect = k \bullet Direct\ Effect \qquad (2)$$

where $k = (1 + k_1 + k_2)$. Equation (2) says that the economy-wide impact, Total Effect, is some multiple

of the direct effect, where the multiplier takes a positive value equal to or greater than one. The minimum value the multiplier can take, one, reflects the intuitive result that if the economy's output of agricultural products – for example – expands by $1 million dollars, the economy will expand at least by $1 million dollars. However, if the indirect and induced effects are not equal to zero, the $1 million increase in agricultural output will spur other industries to expand output of goods and services and will generate household income that are applied to the purchase of goods and services in the economy: generating a total economic impact greater than the initial $1 million expansion.

Generally, the economic multiplier is specified as a ratio of the total to direct effects. Rearranging equation (2) provides,

$$k = \frac{Total\ Effect}{Direct\ Effect} \tag{3}$$

where the multiplier, *k* encompasses all the direct, indirect, and induced effects for a given industry and denotes the impact of a change in direct effects on the total regional economy. Each industry in a region is characterized by its own multiplier *k*. Industries with expansive localized production chains will tend to have higher multipliers than industries that rely on suppliers from outside of the local economy. When there is adequate supply within the region, the region has more potential to retain the total effects of the industry. However, when producers must use supplies outside the region, leakage occurs, resulting in smaller total effects.

The production of orange juice is an excellent example of how the same industry in different regions will have different multipliers. An orange juice bottler in Michigan will likely generate a smaller economic effect than the same in Florida. That is because the Michigan bottler will be required to import oranges or orange concentrate from outside the state. Dollars used to purchase the oranges leave the local economy and will no longer circulate locally. Alternatively, the juice bottler in Florida is more apt to buy oranges or orange concentrate from local providers and those local providers will re-spend a share of those earnings in support of the local economy.

While the I-O model traces transactions measured in dollar value of sales transactions, other measures of economic activity may be of more interest. It is standard practice to report economic impact, and contribution estimates in employment and income terms in addition to the value of transactions. The standard approach to converting impacts into employment and income terms is to use fixed ratios of employment and income to sales from baseline years and apply them to the industry-specific estimated impacts. IMPLAN uses such an approach to report employment, labor income and regional income (gross regional product) impacts.

The I-O impact evaluation model requires several restrictive assumptions. First, the model imposes constant returns to scale, such that a doubling of output requires a doubling of all inputs. Second, inputs in the production of any industry are in fixed proportion to the level of output. These two assumptions impose that an increase in industry output requires an equal and proportionate increase in all inputs. Additionally, supply is assumed to be perfectly elastic such that there are no supply constraints. This final assumption also asserts that all prices are fixed, such that an increase in demand for any commodity will not result in a price change for that industry. I-O models have been criticized on the grounds that some of these assumptions are overly restrictive and the magnitude of the bias generated by these assumptions are greater the larger the industry direct effects are relative

the overall size of the industry (Coughlin and Mandelbaum 1991). Despite this criticism, I-O models have become a standard by which economic impact assessments are generated.

Results

Michigan's Specialty Crop Output

The USDA National Agricultural Statistics Service (NASS) is tasked with tracking agricultural statistics, including the value of commodity production. NASS has multiple programs for measuring agricultural output (sales) at the farmgate, including a once every five-year Census of Agriculture (USDA: NASS, 2024c), and annual surveys of growers (USDA: NASS, 2024b). The NASS data can be among the most complicated of the data collections of US government agencies, requiring data points on markets, commodity plantings, yields, acres under planting and harvest, and others across geography and time. Many of the crops have differing seasonality or multiple plantings per year, allowing acres to be applied to more than one commodity output in a calendar year. Similarly, annual crops like orchards, vineyards, asparagus and others do not have annual plantings but may have more than one harvest over the year. In addition to being tasked with documenting the production of agricultural commodities, the agency is tasked with protecting the identities of those responding to surveys. Given the nature of specialty crops to be grown on smaller acre plots across fewer growers, many points of data suppression are required to protect growers' information. Accordingly, some challenges exist to collect a complete data set that represents the value of all specialty crops produced across the state. These challenges render uncertain the complete representation of any one measure of specialty crop output based on aggregates of the underlying commodity outputs.

The economic valuation objective of this research was to establish a typical value of annual specialty crop output. Three NASS data sources were collected, compiled and compared to establish benchmark annual output estimates by special crop category. These included the Farm Economics database of the annual survey series (USDA: NASS, 2024b), the 2022 Census (USDA: NASS, 2024c), and the annual Statistics Bulletin (USDA: NASS, 2024a). The final benchmark estimates by classification were derived from three-year average total cash receipts as reported in the Annual Statistics Bulletin for MI, 2022-2023. These values were compared with tabulated totals using the USDA Farm Economics database and against the 2022 Agricultural Census for validation. Three-year averages are used to generalize annual output estimates by commodity, where the value of commodity production is subject to substantial year-over-year changes due to grower planting decisions, climatic events impacting yields and other market conditions affecting selling prices. Data limitations generated discontinuities in annual reporting of some commodities, including tomatoes, sweet corn, celery and carrots. Substitute values from best estimates of the Farm Economics database were used as proxy for these estimates. Where necessary, earlier annual estimates (before 2020) were used, adjusted for Inflation.

As the prior three years, from 2020 to 2023, experienced significant inflation, the annual output values should be adjusted to a common currency value based on producer prices. Farm production prices have been volatile over recent years, and the annual sales values reflect that change. However, for estimating the economic contribution, the analysis should take into account broader measures

of price variation afforded by the Consumer Price Index (CPI). Accordingly, annual sales values were therefore adjusted by the CPI (Bureau of Labor Statistics, 2024) for all commodities and reported in 2022 prices. Collectively, the estimates suggest that in 2022 prices, the typical value of specialty crop production in Michigan is $3.12 billion at the farm gate. The next step is to model the macroeconomic effects associated with this level of production.

To simulate economic contributions of Michigan's specialty crop output, all the commodity aggregates must be assigned to appropriate IMPLAN commodity aggregates. The IMPLAN model commodity groups do not necessarily match one-to-one with USDA commodity groups. Rather, IMPLAN has distinct commodity aggregates that represent common production practices. That is, the IMPLAN commodities groups are assigned based on common production practices and purchasing behaviors. For example, labor makes up a higher proportion of operational costs for vegetable and melon farming than for row crops. The estimated value of output by commodity group is reported in Table 2, below.

Specialty Crop Commodity Group	2020-2022 Average Receipts
Vegetable and Melon Farming	$1,190,549,502
Oilseed Farming	$15,409,125
Fruit and Tree Nut Farming	$523,309,553
Greenhouse, Nursery, and Floriculture Farming	$1,389,102,864
Total	**$3,118,371,044**

Table 2: Estimated Annual Michigan Output

The output values by commodity reported in Table 2 were modeled individually using the IMPLAN platform with 2022 data for the Michigan economy. The $3.12 billion in annual farmgate receipts for specialty crops are expected to spawn additional transactions throughout the state totaling $2.3 billion. Secondary business-to-business transactions (Indirect) make up about $1.1 billion of the secondary effects, while spending out of earnings make up the remaining $1.21 billion in secondary transactions. In total, about $5.42 billion of Michigan's economy can be attributed directly or indirectly to Michigan's specialty crop producers and production.

Table 3 shows the aggregated economic contribution estimates over all Michigan grown specialty crops, showing that approximately 24,064 Michigan jobs are directly supported by specialty crop growers, while secondary transactions associated with specialty crop production support an estimated additional 13,599 Michigan jobs. These job counts represent a standard Michigan job, where a standard job is established based on hours. A job does not necessarily imply a full-time job but rather the average number of hours for the average Michigan worker. Accordingly, one reported job supported may entail two or more workers working part time to make up the work effort equivalent to one typical Michigan job in agriculture.[4] In the aggregate, the estimates suggest that about 37,663 annual Michigan-equivalent jobs are supported in one way or another by Michigan's specialty crop producers and production. These jobs support about $1.72 billion in wages and contribute $3.04

[4] Notably, IMPLAN does not formally include H-2A visa workers in employment count estimates. This means that the average IMPLAN job likely appears more productive than it really is and would likely be spread across multiple workers.

billion in annual gross state product (Value Added), a measure of the total income earned in a year in Michigan.[5]

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	24,064	$982.18 Mil.	$1,777.01 Mil.	$3,118.37 Mil.
2 - Indirect	6,974	$357.62 Mil.	$577.58 Mil.	$1,096.44 Mil.
3 - Induced	6,625	$379.22 Mil.	$680.83 Mil.	$1,205.15 Mil.
Total	37,663	$1,719.01 Mil.	$3,035.42 Mil.	$5,419.96 Mil.

Table 3: Estimated Economic Contributions of Michigan's Specialty Crop Production *Columns may not sum due to rounding*

Finally, Table 4 breaks down the aggregate estimates provided in Table 3 for each of the IMPLAN production groups modeled. It shows that unsurprisingly, the commodity groups *Greenhouse, Nursery and Floriculture*, and *Vegetable and Melon Farming* make up the largest components with $2.42 and $2.11 billion in total output contributions, respectively.

Oilseed Farming

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	30	$2,890,000	$12,530,000	$15,410,000
2 - Indirect	10	$730,000	$1,340,000	$2,470,000
3 - Induced	20	$1,030,000	$1,850,000	$3,270,000
Total Effect	60	$4,650,000	$15,720,000	$21,140,000

Vegetable and Melon Farming

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	8,150	$344,900,000	$643,160,000	$1,190,550,000
2 - Indirect	2,960	$152,810,000	$246,200,000	$473,130,000
3 - Induced	2,470	$141,210,000	$253,560,000	$448,800,000
Total Effect	13,590	$638,930,000	$1,142,920,000	$2,112,490,000

Fruit Farming

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	5,340	$190,040,000	$353,320,000	$523,310,000
2 - Indirect	1,070	$49,810,000	$72,050,000	$128,170,000
3 - Induced	1,190	$67,920,000	$121,970,000	$215,880,000
Total Effect	7,600	$307,770,000	$547,340,000	$867,360,000

Greenhouse, Nursery and Floriculture

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	10,530	$444,340,000	$768,010,000	$1,389,100,000
2 - Indirect	2,930	$154,270,000	$257,990,000	$492,670,000
3 - Induced	2,950	$169,060,000	$303,450,000	$537,200,000
Total Effect	16,410	$767,670,000	$1,329,450,000	$2,418,970,000

Table 4: Estimated Economic Contributions of Michigan's Specialty Crop Production *Columns may not sum due to rounding*

[5] Gross state product is labor income, proprietors' income corporate retained earnings and net government revenues.

Conclusion

This is the second in a 5-report series detailing the contribution of the specialty crop industry to Michigan's economy. In this chapter, we calculated the economic contribution of production all the way from the purchase of seedlings and farm equipment to sale at the farmgate. We estimated that on receipts of $3.12 billion, secondary transactions totaling $2.3 billion occur. In total, about $5.42 billion of economic activity can be attributed directly or indirectly to Michigan's specialty crop producers and production. Approximately 24,064 Michigan jobs are directly supported by specialty crop growers, while secondary transactions associated with specialty crop production support an estimated additional 13,599 Michigan jobs. These jobs support about $1.72 billion in wages for agricultural workers.

References

Blakely, Edward J., and Ted K. Bradshaw. 2002. Planning Local Economic Development: Theory and Practice. 3rd ed. Thousand Oaks, CA: Sage Publications.

Bureau of Labor Statistics. 2024. Consumer Price Index. Retrieved from https://www.bls.gov/cpi/ on June 12, 2024.

Cabrera, V.E., R. Hagevoort, D. Solfs, R. Kirksey, and J.A. Diemer. 2008. Economic Impact of Milk Production in the State of New Mexico. Journal of Dairy Science 91:2144-2150.

Coughlin, Cletus C., and Thomas B. Mandelbaum. 1991. A Consumer's Guide to Regional Economic Multipliers. Review 73 (1):19-32.

Isard, Walter, Iwan J. Azis, Matthew P. Drennan, Ronald E. Miller, Sidney Saltzman, and Erik Thorbecke. 1998. Methods of Interregional and Regional Analysis. Brookfield, VT: Ashgate.

Leontief, W. W. 1960. The Structure of the American Economy, 1919-1939. New York: Oxford University Press.

Matthiessen, Lisa Fay, and Peter Morris. 2004. Costing Green: A Comprehensive Cost Database and Budgeting Methodology. Washington, D.C.: Davis Langdon.

Miller, Ronald E., and P.D. Blair. 1985. Input-Output Analysis: Foundations and Extensions. New York, NY: Oxford University Press.

Minnesota IMPLAN Group Inc. 2004. IMPLAN Professional Version 2.0: 3rd Edition. Stillwater, MN: MIG, Inc.

USDA: ARS. 2024. Specialty Crops. Retrieved from https://www.ams.usda.gov/services/grants/scbgp/specialty-crop on February 19, 2024.

USDA: NASS. 2024a. MI: Annual Statistical Bulletin. Retrieved from https://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/Annual_Statistical_Bulletin/stats23/AG%20Stats.pdf on May 15, 2024.

USDA: NASS. 2024b. Farm Economics Data File. Retrieved from https://www.nass.usda.gov/datasets/ on February 19, 2024

USDA: NASS. 2024c. 2022 Agricultural Statistics. Retrieved from https://www.nass.usda.gov/datasets/ on June 6, 2024

Chapter 3: Economic Contributions of Michigan's Specialty Crop Supply Chain

Michigan State University Extension

Steven Miller, Ph.D.

Sarah Klammer, M.S.

October 2024

Abstract: Michigan's specialty crop supply chain plays a vital role in the state's economy, benefiting from diverse soils, a favorable climate, and proximity to the Great Lakes. Specialty crops like blueberries, cherries, and greenhouse products contribute significantly to the agricultural sector, with farmgate sales averaging $3.12 billion annually. The economic impact extends beyond farming, supporting nearly 41,700 jobs and generating $6.3 billion in total output through processing, trade, and exports. Most economic contributions stem from agricultural production, while food processing, retail, and trade collectively enhance Michigan's economic landscape.

Introduction

Michigan is among the most diversified states, in terms of the number of agricultural goods produced. Key to this is Michigan's diverse soils and climate and the influence of proximity to the Great Lakes which moderates temperatures, elongates the effective growing season. Such variations in the climate and soil provide ideal growing conditions for a rich variety of crops, including cranberries, fresh flowers, blueberries, tart cherries, cucumbers and squash (USDA: NASS. 2024. Michigan Farm Bureau, 2024), to name a few. These climatic conditions have brought about a long history of growing specialty crops in Michigan, and the formation of strong support infrastructure and food processing industries that utilize Michigan's diverse agricultural products. The resulting supply chain, from agricultural production to household consumption, is the topic of this report.

Specialty crops are a distinct category of U.S. grown crops that do not meet a minimum scale in terms of acres planted, making them subject to economic threats not realized by crops commanding large acreage. The USDA lists 327 specialty crops, but it is more relevant to consider a specialty crop as any crop not meeting the USDA definition of a Commodity Crop (USDA: ARS. 2024). It is difficult to determine how many specialty crops are grown commercially in Michigan.

Figure 1 presents a stylized representation of the Michigan specialty crop supply chain, starting with instate support industries for agriculture and ending with Exports or purchases by Michigan households. Agricultural production, whether taking place in fields, orchards, or in greenhouses, draws inputs from agricultural support organizations. Specialty crops, especially food crops like apples, may be stored in onsite or third-party storage

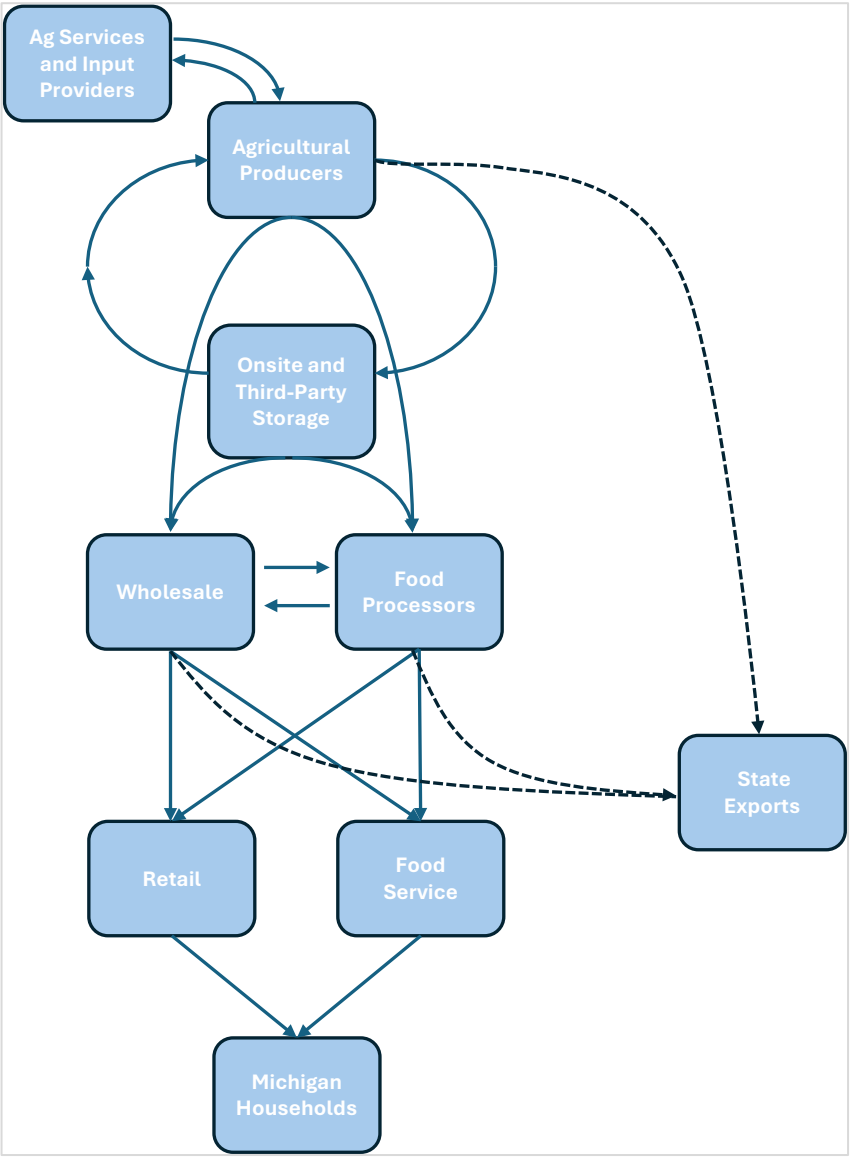

Figure 1: Stylized Supply Chain of Michigan Specialty Crops

facilities, like controlled atmosphere or cold storage for year-round distribution. They can also be shipped directly to wholesalers, food processors or to buyers outside of the state, as state exports. Wholesalers facilitate the transfer of fresh and processed foods to retailers and food services. Alternatively, processors add value to the raw agricultural products and sell to wholesalers, or directly to retailers and food services. Along each stage, demand from outside the state may drive export sales. All exports sales are considered termination points for the instate supply chain, as are the final purchases by households. While this is a stylized chain of processes from agriculture to households, many variations may exist, including direct sales to households and vertical integration that combines several legs of the supply chain under a single entity.

The next two sections of this report provide the methods and findings of simulating the economics of this supply chain. The methods are consistent with the methods presented in this series of economic reports for Michigan's specialty Crop supply chain.

Methods

Supply chain analysis entails observing the transactions that underly an industry from production, using raw materials, labor and capital, all the way to final consumption of the resulting output. Understanding the contribution of the supply chain to the overall economy requires tracing the transactions beyond the supply chain, recognizing that when parties within the supply chain make a sale, they take a portion of those sales revenues to restock inventories, pay for fixed cost items like rent, utilities, and business services, as well as pay workers taxes. The net income after expenses, or profits, is also distributed to business owners or stockholders. Households that benefit from labor and property-type income also spend from these earnings, generating subsequent rounds of new expenditures. Collectively, dollars originating in the specialty crop value chain disperse across the economy to impact most all sectors of the economy – some sectors more than others. Economists have a term for this phenomenon of original transactions dispersing into larger economic effects, the multiplier effect.

This analysis models the supply chain of Michigan specialty crops through the chain of transactions from growers to consumers and uses standard economic simulation approaches to simulate the multiplier effect throughout the supply chain. Data sources for the analysis includes USDA agricultural statistics, specifically, that of the 2022 Agricultural Census for the U.S. and for Michigan. The IMPLAN economic simulation software for Michigan is used for both modeling the supply chain transactions and for simulating economic impacts.

IMPLAN provides estimates of the dollar flows across industries using a regionalized version of the national social accounting matrix (SAM) (Stewart, Stone& Streitwieser, 2007). IMPLAN is a widely used economic simulation program, primarily used to measure economic impacts brought about by changes in industry production. In its most standard application, IMPLAN assumes a demand-driven change in output by industry and models the transactions necessary to support that change in output to derive multiplier effects. Accordingly, the standard application of the IMPLAN model is strictly backward-looking along the supply chain, measuring the input required for a given level of industry output. When measuring the economic contribution of a supply chain using IMPLAN, one should

start at the value of final sales for consumption and let the software estimate the chain of inputs required to support that level of final consumption.

There are several challenges to modeling the supply chain from a single data point of final sale value that render such an approach inoperable. Key to this is determining the value of final specialty crop purchases made by Michigan households and determining what share of those purchases followed a Michigan supply chain, versus other supply chains. Such estimates are difficult to establish, even with receipt data by marketing organizations like Neilsen. It is further clouded by challenges in determining the share of processed goods' values that can be attributed to specialty crop inputs. For instance, it would be difficult to determine the price of a can of cherry pie filling that should be attributed to tart cherries relative to other inputs, like sugar, packaging, labor, capital, marketing, etc. Rather than base the economic contribution estimates to the value of household purchases of Michigan grown specialty crops and products derived from them, it may be more effective to measure the farmgate sales of specialty crops and track the values and flows to purchasers of the specialty crops. In this approach, exports out of the region will mark the termination of the flow, as will final purchases for consumption.

The same regionalized social accounting matrix in the IMPLAN model for measuring multiplier effects also provides a detailed accounting of expected purchases across Michigan. This is because, as the name suggests, the social accounting matrix is a system of accounts across the economy detailing the annual transactions between and across industries and institutions (households, government units). This system of accounting is a double entry system, where all expenditure costs are the flipsides of equal and opposite sales revenues. That is, a purchase by one is a sale by another. While the standard use of IMPLAN for gauging economic impacts is to trace what purchases go into a given level of production, the supply chain view is to look at what sales a given level of production pursues.

Transposing the industry-by-industry SAM for Michigan from IMPLAN and dividing each row entry of the column by the column totals provides a matrix of columns for which every entry is the share of output purchased by the corresponding row. This is analogous to the technical requirements matrix used in standard impact analyses, for which each row entry for a column shows the share of production costs attributed to the respective row.

A single aggregated Specialty Crop industry was created by combining the following categories of the 546 sector unaggregated breakout in IMPLAN for the state of Michigan:

- Vegetable and melon farming
- Fruit farming
- Tree nut farming
- Greenhouse, nursery, and floriculture production

A spreadsheet cross-tabulation of the industry-by-industry detailed SAM exported from the IMPLAN platform is the basis for the regionalized SAM. The tabulation was transposed, and each entry is calculated as the percent of the column total to generate unit sales values. Household categories were combined into a single household entity. The resulting matrix is sorted from highest to lowest value for the top 20 entries, including households, domestic and international exports. Seventeen of the top 20 purchasing sectors are intermediate purchasers. Each of the 17 intermediate purchasing industries were then assigned a value based on the share of total output purchased multiplied by the

total values of specialty crop sales at the farmgate. To measure the multiplier effects of the intermediate uses, each of the 17 intermediate purchasing industries' economic effects were modeled based on the share of specialty crop purchases they make. The resulting economic contributions were aggregated across all intermediate uses, less the direct effects, as the processor direct effects of specialty crop value will be captured by estimating the multiplier effect of the specialty crop sector individually. Leaving the direct effects for the processors would exactly count the value of specialty crop output twice. Finally, because processors generate additional value from the inputs they purchase, we apply a 30 percent producers' margin on each of the intermediate industries' direct effects and add the economic contribution of that to our prior economic effect calculations. For the latter, direct effect (30% of the purchase of specialty crop inputs) is retained in the final estimates.

Results

Table 1 shows the estimated average annual farmgate sales of Michigan specialty crops over the three years spanning from 2020 to 2022 (Miller & Klammer 2024). We compare this estimate with another estimate derived from the 2022 Agriculture Census (USDA NASS, 2023), which measures the total value of sales by farms reporting specialty crops. The latter estimate was $3,554.3 million, which is consistent with our three-year average. Expect the Census estimate to be higher than the actual value of specialty crops produced, as Census estimates include the sales of all crops on farms with specialty crop sales. That is, it is not limited to the value of specialty crops sold.

Specialty Crop Commodity Group	2020-2022 Average Receipts
Vegetable and Melon Farming	$1,190,549,502
Oilseed Farming	$15,409,125
Fruit and Tree Nut Farming	$523,309,553
Greenhouse, nursery, and Floriculture Farming	$1,389,102,864
Total	**$3,118,371,045**

Table 1: Estimated Annual Michigan Output

Table 2 shows the distribution of specialty crops by destination. The largest category includes terminal destinations for Michigan specialty crops, including exports to other states (Domestic Trade), purchases by households, and exports to international markets (Foreign Trade). All shares and values reported in Table 2 are valued at farm gate prices. To be sure, household purchases do not reflect the price households pay, but rather the value/share of the crop output ultimately captured by households. The actual price households pay includes trade markups and producer margins, which are captured by the trade categories and 30 percent producer markup discussed above. Similarly, the share and value of specialty crops exported out of the state to domestic and international destinations reflect their values farm gate prices.

Purchase Category	Share	Value of Purchases
Domestic Trade	39.3%	$1,226,616,111
Households	30.6%	$954,919,569
Foreign Trade	7.4%	$231,449,892
Coffee and tea manufacturing	2.9%	$91,469,901
Canned specialties	2.9%	$89,868,270
Agricultural Producers	2.7%	$84,499,908
Frozen fruits, juices and vegetables manufacturing	2.0%	$62,751,334
All other food manufacturing	1.8%	$57,399,952
Landscape and horticultural services	1.3%	$40,346,133
All other miscellaneous manufacturing	1.2%	$38,636,804
Wineries	1.2%	$36,381,728
Canned fruits and vegetables manufacturing	0.8%	$26,145,182
Roasted nuts and peanut butter manufacturing	0.5%	$14,860,410
Retail	0.4%	$12,407,267
Spice and extract manufacturing	0.3%	$10,433,068
Breakfast cereal manufacturing	0.2%	$5,398,740
Full-service restaurants	0.2%	$4,993,217
Residual All other food manufacturing	4.2%	$129,793,558
Total Specialty Crop Output	**100.0%**	**$3,118,371,045**

Table 2: Top 20 Destinations of Michigan-grown Specialty Crops

Using the aggregated specialty crop sector in IMPLAN, a single impact simulation is undertaken that generates the economic impact estimate of specialty crop production, based solely on upstream activities – the economic activity required to make the farm gate sales of specialty crops. The results are shown in Table 3. Starting with output, as a measure of the dollar value of transactions supported, the $3.12 billion in farmgate sales supports an additional $2.3 billion in secondary transactions, combining indirect and induced output. Collectively, about $5.42 billion in Michigan transactions can be traced back to the production of specialty crops grown in Michigan. Similarly, the direct employment for specialty crop production is estimated to be 24,064 jobs. This figure may be misleading and underestimates the total number of jobs supported, as the number represents the expected number of Michigan-specific jobs supported, where a Michigan specific job, by industry, is a representation of the average hours worked in a year for a given industry. Moreover, IMPLAN does not explicitly count H-2A labor, which makes up about 25% of farm labor on average throughout the year. According to the U.S. Department of Labor, some 15,094 H-2A job certifications were received in fiscal year 2023 (Rural Migration News, 2024), indicating that the larger share of specialty crop workers come from migrant workers. Collectively, around 37,663 direct and secondary jobs can be attributed to specialty crop production alone. Subsequent simulations will show the additional economic contributions that can be linked to specialty crop activities downstream from farming activities.

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	24,064	$982.18 Mil.	$1,777.01 Mil.	$3,118.37 Mil.
2 - Indirect	6,974	$357.62 Mil.	$577.58 Mil.	$1,096.44 Mil.
3 - Induced	6,625	$379.22 Mil.	$680.83 Mil.	$1,205.15 Mil.
Total	37,663	$1,719.01 Mil.	$3,035.42 Mil.	$5,419.96 Mil.

Table 3: Estimated Economic Contribution of Specialty Crop Farming

Rather than report each of the 20 downstream supply chain link contributions separately, we model them individually but aggregate the results into three categories of downstream economic contributions, starting with agricultural buyers. According to IMPLAN, the Specialty Crops and Grain farming sectors are relatively large buyers of specialty crop output. This likely represents vertical integration of larger producers/processors, the supply of custom applicators/harvesters and shared agricultural services among growers. Regardless, their presence in the top 20 purchasing sectors indicates that the value of specialty crops they take up is significant and should be recognized as part of the downstream economy.

Table 4 shows the estimated economic contributions of downstream purchases of the agricultural sectors. Distinct in Table 4, relative to Table 3, is that the direct effects are blank. This is because the direct effects of this downstream sector are already accounted for by the output estimate in Table 3. That is, the inputs should be excluded from estimated effects of all downstream activities. What is reported is the secondary effects attributable to agricultural uses of specialty crop output, which may include harvesting, grading & sorting, packaging, marketing, and other processes with specialty crops. The secondary effects of agricultural producers purchase of specialty crops supports just about 369 Michigan jobs – some of which may entail multiple temporary and seasonal jobs – supporting around $19.96 million in labor earnings.

Effect	Employment	Labor Income	Value Added	Output
1 - Direct				
2 - Indirect	195	$9.99 Mil.	$16.23 Mil.	$31.06 Mil.
3 - Induced	174	$9.97 Mil.	$17.90 Mil.	$31.69 Mil.
Total	**369**	**$19.96 Mil.**	**$34.13 Mil.**	**$62.75 Mil.**

Table 4: Downstream Economic Contributions by Agricultural Producers

Collectively, food processors make up the largest block of intermediate purchases of specialty crops. This includes companies who categorize as coffee and tea manufacturers, canned goods producers, juice processors and others. Recall the direct effects are removed to avoid double counting. However, food processors also generate direct effects through producer margins. As shown in Table 5, food processors add an additional 3,528 jobs to the economy through both direct and secondary channels, providing an additional $214.10 million in annual labor income with $800.4 million in transactions.

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	330	$22.22 Mil.	$34.58 Mil.	$168.94 Mil.
2 - Indirect	2,065	$126.95 Mil.	$203.32 Mil.	$425.18 Mil.
3 - Induced	1,132	$64.93 Mil.	$116.50 Mil.	$206.28 Mil.
Total	**3,528**	**$214.10 Mil.**	**$354.40 Mil.**	**$800.39 Mil.**

Table 5: Downstream Economic Contributions by Food Processors

Trade sectors include retail trade and food services, like restaurants. Table 6 shows the estimated contributions of specialty crop production's share of trade sectors. In total, about 132 Michigan trade jobs can be linked back to the specialty crop supply chain, either directly or indirectly, with just under $5.6 million in annual labor income.

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	88	$2.81 Mil.	$4.47 Mil.	$8.57 Mil.
2 - Indirect	22	$1.52 Mil.	$2.30 Mil.	$4.59 Mil.
3 - Induced	22	$1.26 Mil.	$2.26 Mil.	$4.01 Mil.
Total	**132**	**$5.59 Mil.**	**$9.04 Mil.**	**$17.16 Mil.**

Table 6: Downstream Economic Contributions by Trade Sectors

Each of these sectors can be combined with each other to create an estimate of the total economic contribution of the specialty crop supply chain, from farmgate onward. Together, we estimate that the number of jobs that can be linked to Michigan's specialty crop supply chain is just under 41,700, commanding nearly $2 billion in annual labor income and contributing about $3.4 billion to annual gross domestic product with a total value of goods produced around $6.3 billion (Table 7).

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	24,481	$1,007.20 Mil.	$1,816.06 Mil.	$3,295.88 Mil.
2 - Indirect	9,256	$496.08 Mil.	$799.43 Mil.	$1,557.26 Mil.
3 - Induced	7,954	$455.38 Mil.	$817.50 Mil.	$1,447.12 Mil.
Total	**41,691**	**$1,958.66 Mil.**	**$3,432.99 Mil.**	**$6,300.27 Mil.**

Table 7: Specialty Crop Supply Chain Economic Contribution

Conclusion

This is the third report in a five-report series on the economic contribution of Michigan's specialty crop industry. This report traces the economic contribution across all legs of the supply chain for Michigan-grown specialty crops. As shown in Figure 2, most of the economic value attributed to Michigan's specialty crop supply chain can be attributed to the agricultural production of specialty crops, as we allocated the value of final consumption of fresh specialty crop produce and floriculture to this segment. It also claims the value of direct exports, which makes up nearly 50% of the value of specialty crop output. Agricultural support activities uptake of

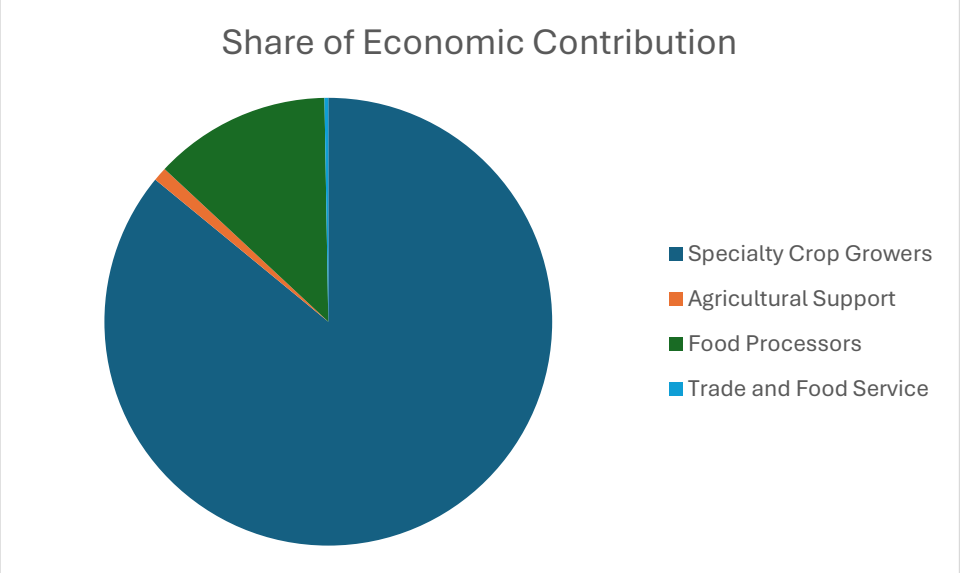

Figure 2: Output Share by Component of the Supply Chain

specialty crop output makes up a small overall share, as does trade margins earned by retailers, wholesalers and food service. Food processing commands just under 13% of the value, as measured by the total output of the supply chain.

In total, we estimate that the supply chain of Michigan specialty crops supports just under 41,700 Michigan jobs, contributes roughly $3.4 billion to annual gross state product, and has a total value of goods produced of $6.3 billion annually.

References

Michigan Farm Bureau. (2024). Michigan Agriculture Facts. Retrieved from https://www.michfb.com/agriculture/michigan-agriculture-facts on October 3, 2024.

Miller, S.R. S. Klammer (2024). Economic Contributions of Michigan's Specialty Crop Producers and Production. Michigan State University. East Lansing, MI.

Rural Migration News. (2024). H-2As: 5 States had 50% H-2A Jobs in FY23. Retrieved from https://migration.ucdavis.edu/rmn/blog/post/?id=2905#:~:text=The%20top%20five%20H%2D2A,685 on October 3, 2024.

Stewart, R. L., Stone, J. B., & Streitwieser, M. L. (2007). US benchmark input-output accounts, 2002. Survey of Current Business, 87(10), 19-48.

USDA: ARS. 2024. Specialty Crops. Retrieved from https://www.ams.usda.gov/services/grants/scbgp/specialty-crop on February 19, 2024.

USDA: NASS. (2024). MI: Annual Statistical Bulletin. Retrieved from https://www.nass.usda.gov/Statistics_by_State/Michigan/Publications/Annual_Statistical_Bulletin/stats23/AG%20Stats.pdf on May 15, 2024.

USDA NASS. (2023). 2022 Census of Agriculture. Washington DC.

Chapter 4: Considering the Impact of Michigan Specialty Crop Loss in Favor of Commodity Crop Production

Michigan State University Extension

Sarah Klammer, M.S.

Steven Miller, Ph.D.

October 2024

Abstract: This chapter estimates the potential economic shock produced by a shift of existing acreage for specialty crop production to program crop production systems. This document is the fourth chapter of a 5-part analysis into specialty crop systems in Michigan.

Introduction

The 2022 USDA Agricultural Census reports that there are 45,481 farms in Michigan, representing approximately 9.5 million acres of land with mixed agricultural uses. Of this, 7.5 million acres are utilized for crop production. For any given year, about 93% of this is planted to program crops, like corn, wheat, soybeans, etc. The remaining 545,594 acres are devoted to specialty crop systems across 10,088 farms (USDA: NASS, 2024a; USDA: NASS, 2023). This means that 22 percent of farms surveyed in Michigan engaged in at least some specialty crop production.[6]

The Specialty Crops Competitiveness Act of 2004 (7 U.S.C. 1621 note) defines specialty crops as fruits and vegetables, tree nuts, dried fruits, and horticulture and nursery crops (including floriculture). The USDA's Agricultural Marketing Service has established a standard list of 327 specialty crops across 17 broad categories, listed in Table 1. Michigan farms produce specialty crops in each of these categories.

Category	Count of Crops within the Category
Specialty Crop Category	
Annual Bedding Plants	10
Broadleaf Evergreens	8
Christmas Trees	8
Culinary Herbs and Spices	71
Cut Cultivated Greens	6
Cut Flowers	10
Deciduous Flowering Trees	10
Deciduous Shade Trees	9
Deciduous Shrub	8
Foliage Plants	11
Fruits and Tree Nuts	47
Horticulture	5
Landscape Conifers	8
Medicinal Herbs	38
Potted Flowering Plants	9
Potted Herbaceous Perennials	16
Vegetables	53
Total Specialty Crops	**327**
Not Specialty Crops	51

Table 1: Specialty Crop Categories
Source: USDA, https://www.ams.usda.gov/services/grants/scbgp/specialty-crop

[6] These 10,088 farms account for 1,581,999 acres of harvested cropland, of which only 545,594 acres are dedicated to specialty crops per the survey.

Michigan's specialty crop systems are incredibly diverse because of the temperate climate and variable geographic attributes across the state that creates microclimates. Most specialty crops prefer specific climate and soil conditions, and Michigan provides a variety of climate conditions that meet crop needs. This has made Michigan a top producer for many crops. Michigan is the top producer in the country of tart cherries and dry beans, as well as being the top producer of squash and asparagus for processing. Other notable specialty crops grown in Michigan include cherries, apples, asparagus, garlic, and Christmas trees. In terms of sales, Michigan ranks highest for specialty crops categories such as vegetables, fruits, and nursey products.

While the 2022 Agricultural Census highlights the agricultural diversity of the state, the numbers for specialty crop categories are more impressive in the context of average farm size. By their nature, farms with specialty crops tend to be much smaller than program crop systems. In the United States, 75 percent of the 239,703 farms that report growing at least some specialty crops are less than 100 acres in size (USDA: NASS, 2024). Despite their size, farms with specialty crops make up the majority of crop production employment in the state, with 3,630 farms with specialty crop production reporting 42,194 workers, not including labor hired through contractors (often a mix of foreign and domestic workers) (*Ibid*). While these numbers do not include a full picture of on-farm labor for specialty crop production, other data sets and surveys provide some context for on-farm employment.

Table 3 includes 2022 Michigan specialty crops census counts as well as Quarterly Census of Employment and Wages (QCEW) counts for specialty crops in Michigan (determined by NAICS code). The COA includes all hired workers except those hired through contractors. The QCEW includes only paid labor which qualifies for unemployment benefits. The data implies that there are approximately 26,626 hired jobs on farms with specialty crops, on average, that do not qualify for unemployment benefits. These are most likely seasonal positions and those occupied by workers here on an H-2A agricultural labor visa.

Specialty Crops			
Census of Ag		QCEW	
Farm Count	Employment	Farm Count	Employment
3,630	42,194	1,199	15,568

Table 3. Farm labor counts in Michigan: Census and QCEW
Sources: 2022 Census of Agriculture and QQYY Quarterly Census of Employment and Wages

Given the types of crops grown in Michigan with variable harvest times and peak labor needs, labor demand can vary a great deal. This means access to seasonal labor is fundamental to the production of specialty crops. A 2017 survey of Ohio and Michigan specialty crops growers found that only 35 percent of respondents reported having permanent employees on the farm, as compared to 66 and 30 percent who reported having seasonal (120 days or less per year) and migrant workers, respectively (Guang et al, 2018). Since 2017, the number of H-2A jobs approved in the state of Michigan have more than doubled. In fiscal years 2022 and 2023, there were over 15,000 H-2A jobs certified to work in the state of Michigan. The vast majority of these are likely to be employed on farms with specialty crops.

While Census data for the entire state indicates that migrant labor is approximately 28 percent (19,367 workers) of all farm labor, this is likely much higher for specialty crops. A large chunk of migrant workers come from neighboring countries such as Mexico, but a large portion of migrant farm workers are also naturalized citizens of the United States who make a living doing agricultural labor.

Without specialty crop production, much of this seasonal and migrant labor demand would cease to exist. Program crop systems do not generally require fewer workers to undertake hands-on agricultural activities like fruit and vegetable harvesting. Table 4 shows employment data for all farms versus farms with specialty crops, excluding contract labor.

Specialty Crops		All Farms	
Farm Count	Employment	Establishments	Employment
3,630	42,194	10,269	68,950

Table 4. Farm labor counts in Michigan: Specialty Crops and All Farms
Source: 2022 Census of Agriculture

Different methods of calculating worker counts in agriculture across data sources make it difficult to get a full picture of specialty crop labor. Using 2022 Census and H-2A data for the state of Michigan, we estimated a higher hired labor count of than what is reported in the 2022 Census above of 52,366 jobs, including both H-2A labor and non-contract migrant labor (but excluding non-H-2A migrant labor sourced via farm labor contractors). The Census estimates (and our subsequent estimated employment count) include counts of both full-time and part-time workers at each reporting farm. Therefore, it is possible that there is some double counting if workers move from farm to farm, which is often the case.

Relative to program crops which are grown and harvested using capital-intensive processes and few inputs, growing specialty crops requires significant inputs and labor throughout the growing season. Specialty crops command higher sales revenues per acre, but also higher production costs relative to program crops. According to the 2022 Census, the market value of crop-based agricultural products sold on Michigan farms with specialty crop production was $3.6 billion (USDA: NASS, 2024b). According to earlier estimates from the CEA, specialty crop production represents approximately $3.04 billion in annual gross state product (Value Added), a measure of the total income earned in a year in Michigan (Miller and Klammer, 2024). When considered on a per acre basis, this means that specialty crop production, on average, yields around $6,500 in revenues and costs per acre. Program crops, in contrast, have average revenues of just over $1,000 per acre.[7]

This analysis seeks to estimate the relative economic significance of specialty crop production over that of program crops. This is accomplished by generating a hypothetical situation where all acres in specialty crops are converted to program crops and simulating the economic outcomes that account for all direct and indirect changes in transactions underlying the state's economy. An economic impact simulation model is specified for Michigan. The model traces all the underlying transactions

[7] This estimate was derived using the 2022 Ag Census estimate of "Market value of Crops, including nursery and greenhouse" (USDA:NASS, 2024a). As such, it likely overestimates revenues due to the inclusion of nursery and greenhouse production, both of which are specialty crops.

across businesses and institutions, like households, recognizing that the revenues of any given industry equates with its respective expenditures. The next section describes the methods used for estimating comparative economic contributions. This is followed the findings and conclusions of this analysis.

Methods

The economic simulation model used in this analysis is the Minnesota IMPLAN Group Inc. model for economic impact evaluation, referred to as IMPLAN (Minnesota IMPLAN Group Inc. 2004). This is a general application economic simulation model that traces all transactions within and amongst all industries: inter-industry transactions; transactions between industries and government; transactions between industries and households; transactions between households and government; and the purchases and sales between the state economic sectors and the rest of the world.

IMPLAN provides industry detail with over 540 different industry categories including agricultural, goods-producing, and service-providing industries. Institutions are broken out into households by income group, federal, state and local government sectors, and by import and export markets. The model also provides household and government purchases of goods and services. Additional transactions are recorded within the model including transactions across households, government transfers to households and household transactions to government in the form of taxes and fees. Because the social accounting system examines all the aspects of the state economy, it provides a comprehensive snapshot of the economy and its spending patterns. This makes it useful in modeling changes to that economy, as changes in if one industry changes. More details about the IMPLAN model and the modeling techniques used in this analysis can be found in Chapter 2 of this report (Miller and Klammer, 2025).

Agricultural production expenditures per acre for program crops replace the same for specialty crops. This represents the hypothetical impact of the conversion of Michigan specialty crop acreage to program crop production. To simplify the analysis, relevant IMPLAN model industries are aggregated into two aggregates: Specialty Crops and Program Crops. The industry aggregates are the sums of the underlying transactions of the constituent industries to derive an aggregate average transaction profile. As specialty crop production requires more labor per acre than program crops, a larger share of specialty crop expense goes to labor. Similarly, specialty crops generally require on-premise processing and packaging, while program crops tend to be collected and shipped in bulk. In total, the aggregated industries in the IMPLAN model represent the underlying transactions in proportion to that of the size of the underlying categories. Imposing the hypothetical simulation entails specifying the loss in sales (output) of specialty crops based on the value per acre, and increasing the sales of program crops based on the same number of acres.

The 2022 Agricultural Census provides the number of acres in specialty crop production and the farmgate sales per acre for the mix of specialty crops and program crops for Michigan. Accordingly, there were 7.5 million acres of cropland in Michigan in 2022, with a market value of crops of over $7 billion. For specialty crops specifically, there were 545,599 acres engaged in production with a market value of $3.6 billion. Using these numbers, we estimate a per-acre value of $1,011 for program crop production and $6,515 for specialty crop production. These numbers are inputted into

IMPLAN as if the specialty crops sector lost the full value of production across all acreage, while program crop systems gained the foregone acreage at a value of $551.6 million. From there, the model will trace the impact of this change in production across the agricultural industry to estimate direct effects as well as throughout the rest of the economy to produce an estimate of indirect and induced effects.

Specialty Crops	
00003	Vegetable and melon farming
00004	Fruit farming
00005	Tree nut farming
00006	Greenhouse, nursery and floriculture production
Program Crops	
00001	Oilseed farming
00002	Grain farming
00009	Sugarcane and sugar beet farming

Table 5: IMPLAN Aggregation

While the economic simulation model traces transactions measured in dollar value of sales transactions, other measures of economic activity may be of more interest. It is standard practice to report economic impact, and contribution estimates in employment and income terms in addition to the value of transactions. The standard approach to converting impacts into employment and income terms is to use fixed ratios of employment and income to sales (output) from baseline years and apply them to the industry-specific estimated impacts. IMPLAN uses such an approach to report employment, labor income and regional income (gross regional product) impacts.

The simulation model requires several restrictive assumptions. First, the model imposes constant returns to scale, such that a doubling of output requires a doubling of all inputs. Second, inputs in the production of any industry are in fixed proportions to the level of output. These two assumptions impose that an increase in industry output requires an equal and proportionate increase in all inputs. Additionally, supply is assumed to be perfectly elastic such that there are no supply constraints. This final assumption also asserts that all prices are fixed, such that an increase in demand for any commodity will not result in a price change for that industry. The IMPLAN approach to economic simulation models has been criticized on the grounds that some of these assumptions are overly restrictive and the magnitude of the bias generated by these assumptions is greater the larger the industry direct effects are relative to the overall size of the industry (Coughlin and Mandelbaum 1991). Despite this criticism, I-O models have become a standard by which economic impact assessments are generated.

A Note on Jobs in IMPLAN

It is difficult to estimate hired farm labor on farms with specialty crops specifically due to the cyclical nature of farming seasons and the large quantity of seasonal and migrant labor employed on these farms. Moreover, many of these laborers remit their incomes back to their home state or country, meaning these earnings do not circulate in the Michigan economy.

IMPLAN uses a variety of employment statistics to estimate jobs. Data on migrant workers can be underreported in official employment statistics, especially for workers who are undocumented or employed informally. Findings from the 2019-2020 National Agricultural Workers Survey (NAWS) indicated that nationally, 56% of all farm workers were authorized to work in the US (Gold et al, 2022). If the regional data used by IMPLAN does not capture migrant labor fully or accurately, the job estimates understate their contribution. This is the case for Michigan specialty crops data.

Results

The loss of specialty crop lands in Michigan would severely impact the local economy, not only triggering immediate losses but also triggering a downstream shift in the supply chains reliant on fresh produce and other specialty crops in the state. At least in the short term, it would lead to a large reduction in demand for farm labor, as labor-intensive crops are replaced with highly mechanized crop systems like wheat and corn.

Of course, over time, acreage lost is likely to be converted to a variety of uses, including recreation, conservation, development, and other uses when applicable. Some of these uses could mitigate ecosystem service losses or even improve existing services. Development could also further stimulate the economic environment. In this analysis, however, we consider the impact of an extreme scenario: the conversion of all specialty crop acreage to row crop production including oilseed crops, grains, sugar beets and sugarcane (Table 6).

Impact	Employment	Labor Income	Value Added	Output
1 - Direct	-25,410	-$1,022 Mil.	-$1,720 Mil.	-$3,003 Mil.
2 - Indirect	-6,340	-$ 327 Mil.	-$ 524 Mil.	-$ 987 Mil.
3 - Induced	-6,660	-$ 381 Mil.	-$ 685 Mil.	-$1,212 Mil.
Total Effect	-38,410	-$1,730 Mil.	-$2,928 Mil.	-$5,202 Mil.

Table 6. Estimated Economic Change from Converting Specialty Crop Acreage to Program Crops

Table 6 shows both the direct and downstream economic losses if all farmland in specialty crops were converted to program crops. Total potential losses including downstream effects of the change include job losses of 24,409 annual Michigan-equivalent jobs and $1.7 billion in lost wages, for a total reduction of annual gross state product (value added) of $5.2 billion.

Given the nature of seasonal work on these farms, the average lost “job” likely represents work completed by multiple part time workers. Given our understanding of the agricultural labor market, the presence of significant numbers of undocumented workers in addition to visa-based labor could lead to further understated IMPLAN job count estimates.

These losses are in addition to the lost ecosystem services, health benefits, and food security provided by a diverse crop production system. While we don’t attempt to estimate them in this study, these impacts would change the landscape for farming in the state, having ripple effects not captured in a one-time event model in IMPLAN.

Conclusion

The findings of this study highlight the significant economic and employment contributions of Michigan's specialty crop industry. The analysis demonstrates that replacing specialty crops with program crops would lead to substantial economic losses, including an estimated reduction of 38,410 jobs and a total loss of $5.2 billion in annual gross state product. These figures account for both direct and indirect impacts, illustrating the essential role that specialty crops play in Michigan's agricultural economy.

One of the most striking conclusions is the heavy reliance of specialty crops on labor-intensive production methods, particularly seasonal and migrant labor. The shift to program crops, which require far fewer workers, would not only result in direct employment losses but also disrupt communities and industries that depend on these jobs. Furthermore, the loss of specialty crops would reduce the demand for on-premise processing, packaging, and other related services, leading to a ripple effect throughout Michigan's economy.

Beyond economic consequences, the shift away from specialty crops would also have significant environmental and food security implications. Specialty crops contribute to agricultural biodiversity, support healthier dietary options, and provide essential ecosystem services. Their loss could impact soil health, water usage, and climate resilience, though these effects were beyond the scope of this study.

While some of the lost acreage may eventually be repurposed for conservation, recreation, or development, such transitions would take time and may not fully compensate for the immediate economic disruption. The study underscores the importance of policies that support specialty crop production to maintain a balanced and resilient agricultural sector.

In conclusion, specialty crops play a crucial role in Michigan's economy, employment landscape, and food system. Policies that protect and promote these crops are essential to sustaining the state's agricultural diversity and economic health.

A Note on Additional Benefits of Specialty Cropping Systems

Much has been written over the past several decades about the implications of a changing agricultural policy and economic landscape that supports the large-scale movement towards intensive management cropping systems (see Spangler, Burchfield, and Shumacher (2020) for a reference list). The United States produces more corn than any other country, relying on large-scale monoculture to achieve increased yields with reduced costs to meet growing demand nationally and worldwide. Yet the lack of diversity and intensive management these systems require come with significant costs to eco-system services such as soil fertility, biodiversity, and water systems that can greatly impact human health and well-being (Horrigan, Lawrence, and Walker, 2002). Specialty crop systems, in part due to their smaller size and the likelihood of a single farm producing a varied selection of specialty crops, can mitigate some of these issues in a large agricultural area. Moreover, a varied agricultural landscape including specialty crop operations promotes food security and access to fruit and vegetables specifically (Balis et al, 2024).

This report focuses on the economic impact of shifting acres from one use to another as it might ripple through the Michigan economy in its current state. The long-term socio-political and ecological implications of such a shift require further research.

References

Balis, L. E., E. Shaw, W. Fung Uy, K. Nelson, M. Isack, L. Flournoy, D. Vest, J. Deelo, and A. L. Yaroch. (2024). Midwestern specialty crop impacts on the environment and health: a scoping review. Agriculture & Food Security, 13(1), 38.

Horrigan, L., R. S. Lawrence, & P. Walker. (2002). How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture. Environmental Health Perspectives, 110(5), 445-456.

Gold, A., W. Fung, S. Gabbard, and D. Carroll. (2022). Findings from the National Agricultural Workers Survey (NAWS) 2019–2020: A Demographic and Employment Profile of United States Farmworkers. Research Report No. 16. JBS International.

Miller, Steven and Klammer, Sarah. (2025). Economic Contributions of Michigan's Specialty Crop Producers and Production. Michigan State University. East Lansing, MI.

USDA: NASS. (2024a). 2022 Census of Agriculture: Michigan State and County Data. Volume 1, Geographic Area Series, Part 22.

USDA: NASS. (2024b). 2022 Census of Agriculture: Specialty Crops. Volume 2, Subject Series, Part 8.

USDA: NASS. (2022). 2022 Census of Agriculture: Michigan State Profile.

USDA NASS. (2023). 2022 Census of Agriculture. Washington DC. \

Han, Guang, Ethan D. Schoolman, Lois Wright Morton, and J. G. Arbuckle. 2018. 2017 Survey of Specialty Crop Growers in Michigan. Sociology Technical Report 1054 (Iowa State University) | HE-2018-02 (Rutgers University). Department of Sociology, Iowa State University, Ames, Iowa. 40 pp. Retrieved from https://www.climatehubs.usda.gov/sites/default/files/2017%20Survey%20of%20Specialty%20Crop%20Growers%20in%20Michigan.pdf

Chapter 5: Considering the Impact of Farm Employment Shocks on Michigan Specialty Crop Production

Michigan State University Extension

Zachariah Rutledge, Ph.D.

Sarah Klammer, M.S.

Steven Miller, Ph.D.

February 2025

Abstract: This chapter estimates the potential economic shock produced by an increase in farm wages on farm employment and industry output. This document is the fifth chapter of a 5-part analysis into specialty crop systems in Michigan.

Introduction

Over the past two decades, the American labor force has experienced a decline in available laborers across the agricultural sector. These shortages are most sharply felt in labor-intensive crop production systems like those for specialty crops. To maintain and increase operations in the face of these declines, many industries rely on immigrant and non-citizen migrant labor, particularly from Mexico and Central America. Because immigrant and non-citizen migrant workers in lower-skilled industries, such as agriculture, were willing to accept lower wages than domestic laborers, overall labor costs remained relatively low compared to other industries for many years (see Figure 1). Until the height of the Great Recession, the number of immigrants from the region steadily increased, surpassing 11 million by 2007 (US Census and ACS). In recent years, however, a sharp drop in immigration has contributed to severe labor shortages in the sector. Contributing factors to this decrease in labor availability include rising education levels in the US and abroad (Charlton and Taylor, 2016; Taylor, Charton & Yunez-Naude, 2012), competition from non-ag sectors (Richards and Patterson, 1998), increased difficulty in obtaining temporary work authorization for migrant workers, and a general reduction in follow-the-crop migration (Fan et. Al., 2015), to name a few.

Though severity varies by market, the shortage of farm workers is widely recognized. An abundance of evidence suggests that the supply of US-based farm employees is declining, which has caused domestic producers to make significant changes to their production and labor management practices (Taylor et al., 2012; Fan et al., 2015; Charlton and Taylor, 2016; Richards, 2018; Rutledge and Taylor, 2019, Rutledge and Mérel, 2022). For example, farmers have reported adopting labor-saving technologies when possible, utilizing the services of farm labor contractors to bring workers to their farms, and changing the timing and intensity of certain cultivation practices, such as pruning, weeding, and harvesting.

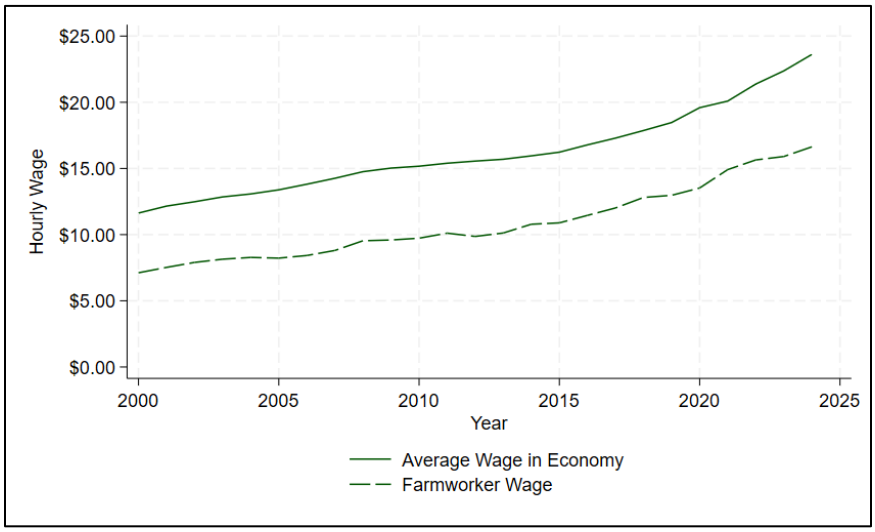

Figure 1. Average Farmworker Wage vs. Average Wage in Economy

Source: Current Population Survey data processed by author (Flood et al., 2025).

Labor supply pressures have caused farm wages to rise across the US, and Michigan is no exception. According to the National Agricultural Workers Survey, the wages of domestic crop farm workers in the Lake region grew at an average rate of 3.7% per year between 2012 and 2022, reaching year-over-year growth rates as high as 14% (see Figure 2). According to the US Bureau of Labor Statistics' Current Population Survey, the average wage growth in the entire economy was 3.2% over that same time period, with a peak of 6.4%.

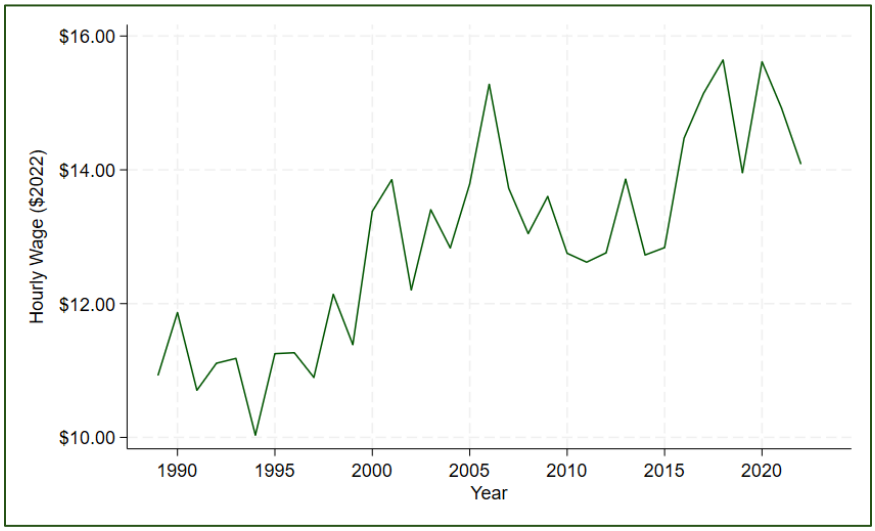

Figure 2. Real Lake Region Wages (in $2022)

Source: National Agricultural Workers Survey and Consumer Price Index data processed by author.

In 1952, the H-2 program was initiated by the Immigration and Nationality Act, permitting foreign laborers to enter the country on a temporary basis to perform "low-skilled labor" in both the agricultural and non-agricultural sectors. With the passage of the Immigration Reform and Control Act in 1986, the H-2 program was broken into the H-2A program for agricultural workers and the H-2B program for non-agricultural workers. Currently there is no cap on the number of H-2A visas that can be issued, but agricultural employers must certify that they are unable to find domestic workers before they are approved to hire H-2A workers. Foreign agricultural workers present in the country under the H-2A visa program must leave the US once their visas expire. Under the current provisions of the program, job vacancies filled by H-2A workers must be considered seasonal in nature, precluding industries with nonseasonal (i.e., year-round) labor shortages, such as the dairy industry, from using the program.

In the wake of the declining farm labor supply, US farmers have increased their use of the H-2A visa program. Over the past decade, use of the H-2A program in Michigan expanded rapidly from roughly 1,300 jobs certified in Fiscal Year 2014 to over 15,000 in Fiscal Year 2023 (see Figure 3).

There are also other rules H-2A employers must follow. First, employers must provide housing for H-2A workers and pay for the employees' transportation to and from their home country. Second, they must pay the highest of the state or federal minimum wage, the prevailing wage rate as determined

by a State Workforce Agency, the agreed upon collective bargaining wage rate, or a super minimum wage known as the Adverse Effect Wage Rate (or AEWR). The binding wage rate for H-2A workers in Michigan is almost always the AEWR, so the AEWR sets the minimum wage for H-2A employees.

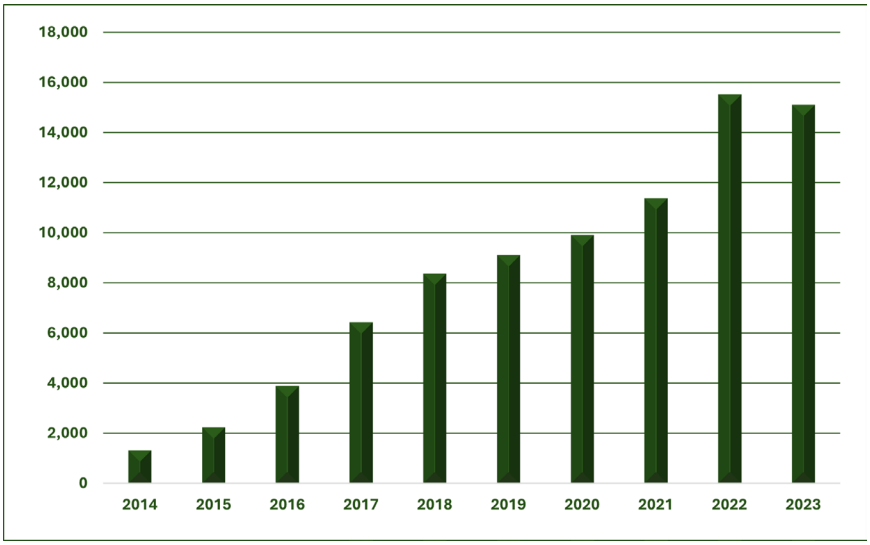

Figure 3. H-2A Jobs Certified in Michigan

Source: US Department of Labor's H-2A Disclosure data processed by authors.

The United States Department of Agriculture (USDA) conducts the Farm Labor Survey (FLS), which serves as the basis for the AEWRs. In recent years, the AEWRs have risen substantially compared to previous years, sparking interest in the labor challenges facing US agriculture and the H-2A visa program rules and methodology.

The FLS is a survey conducted by the USDA's National Agricultural Statistics Service (NASS) and provides "the basis for employment and wage estimates for all workers directly hired by U.S. farms and ranches (excluding Alaska)" (NASS, 2024). The FLS was not designed for the H-2A program (Florida Growers v. DOL, 2023) and does not survey farm labor contractors or other types of indirect hire farm employees, such as those that may be hired by a farmer to perform tilling or custom harvesting. The FLS surveys farmers in 18 Farm Labor Survey regions, excluding Alaska. All the regions contain more than one state except for California, Florida, and Hawaii. The Lake region includes the states of Michigan, Minnesota, and Wisconsin.

The Adverse Effect Wage Rate for the Lake region reached $18.50 in 2024 and increased 61% at an average annual rate of 4.9% over the past decade. Notable increases occurred in 2023 ($1.97) and 2024 ($1.16) prompting industry groups to become concerned about the data source and methodology used to calculate these wage values (see Figure 4).

Recent research by Rutledge et al. (2024) suggests that rising AEWRs put upward pressure on the wages of non-H-2A workers so that when H-2A minimum wages rise, so do wages across the entire farm labor market. Rutledge et al. (2024) find that a 10% increase in the AEWR could cause as much as a 2.8% increase in the wages of non-H-2A workers and that policy proposals that would freeze or

cap the AEWRs would slow the wage growth of both H-2A workers and non-H-2A workers. In this study, we estimate the impact of rising farm wages on specialty crop employment and production, regional income, and regional economic activity.

Figure 4. Lake Region Adverse Effect Wage Rates, 2010 – 2024

Source: U.S. Department of Labor

Methods

Our economic impact analysis is conducted in two stages. The first stage involves a simulation analysis that estimates the impacts of rising labor costs on the employment of farm workers and the production of specialty crops. The second stage takes the results from the first stage and models how these changes in specialty crop production and employment are likely to impact the state's economy. This stage uses a standard economic impact modeling approach called input-output modeling in measuring how other segments of Michigan's economy are impacted by changes in specialty crop production due to constraints from labor shortages.

Modeling the Effect of Increases in Farm Wages

The first stage of this analysis involves the use of an equilibrium displacement model to derive a set of equations that relate rising farm wages to changes in farm employment and specialty crop production. The equilibrium displacement model is based on the work of Muth (1964) and has been utilized for similar purposes in other studies (e.g., Gunter et al., 1992; Brady et al., 2016; Cassey et al., 2018; Rutledge and Mérel, 2023). We adapt the model to characterize the equilibrium in the local specialty crop industry under the assumption that producers use labor (L) and capital (K) to produce specialty crops. Additional details of the model can be found in the Technical Appendix, but the basic premise involves the derivation of a set of equations that allow an analyst to estimate the impact of

a disequilibrium in the labor market due to rising wages on farm employment and its effect on specialty crop production.

Modeling the Macroeconomic Effects of Resulting Production Changes

Estimating how the change in specialty crops resonates throughout the Michigan economy is the second stage of this analysis. In modeling the macroeconomic effects of changes in specialty crop production, an IMPLAN economic impact simulation model is developed for the state of Michigan. As described in more detail in Chapter 2 above (Miller and Klammer, 2025), the IMPLAN model traces dollars throughout the state economy, recognizing that one party's expenditures are another's revenues. Therefore, as expenditures change in one segment of the economy, its effect reverberates through other segments of the economy. For instance, if sales revenues of specialty crop growers are reduced, they spend less on production inputs, labor and other purchases that would otherwise be required to maintain the previous higher level of output. Reducing these expenditures means that worker earnings, and therefore household incomes, decrease. Similarly, the services of fewer crop consultants and fewer agri-chemicals are purchased. As households and supplying businesses experience lower earnings, they in turn reduce their expenditures. This process continues to propagate throughout all industries of the state's economy. The IMPLAN model simulates all the underlying transactions in the economy to recognize how all other sectors are impacted. These estimates are determined in stage one of the analysis. When setting up the IMPLAN model, all agricultural sectors that make up specialty crop production are combined into one aggregate specialty crop sector.[8]

Results

Rising Labor Costs and Production Changes

To estimate the impacts of rising labor costs on changes in the production of specialty crops, we utilize the equilibrium displacement model described above parameterized by elasticities and cost shares in Table 1. We conducted 1,000,000 simulations and retrieved the median estimate across the set of results to obtain the central tendency of the simulations. Our analysis suggests that a 10% increase in all farm wages in Michigan would cause a 6.7% decrease in overall employment and a 2.7% decrease in specialty crop production. These changes will then be simulated using IMPLAN in the second stage of the analysis.

10% Wage Increase	2.7% Production Loss	6.7% Employment Loss

Table 1. Estimated Production and Employment Losses from 10% Wage Increase

[8] The IMPLAN segment Specialty Crops is an aggregation of the following IMPLAN sectors: Vegetable and melon farming, Fruit farming, Tree nut farming, and Greenhouse, nursery, and floriculture production.

Economic Impacts of Rising Labor Costs

The IMPLAN aggregate specialty crop sector determines the baseline wages, production (output) and employment. The changes in those values are imputed into the IMPLAN model to measure the macroeconomic effects on the Michigan Economy. The top part of Table 2 below shows the baseline economic contributions of Michigan's specialty crop sector as found in Chapter 2 of this report (see Miller and Klammer, 2025). The bottom table in Table 2 shows the change in economic contributions of Michigan's specialty crop sector under the simulated wage effects from stage one.

One caveat of IMPLAN simulation modeling is that migrant or H-2A labor is not explicitly captured in the data used to derive the employment piece of the model. While the downstream transactions resulting from all labor are captured (i.e. # of goods produced, their value, and subsequent transactions resulting from spending in the economy), this production value is attributed to employment counts from QCEW and other sources that do not include H-2A labor. This means that the ratio of an IMPLAN "job" to output is excessively high, implying that the modeled labor productivity is higher than actually observed.[9] On an industry scale, this is unlikely to cause issues with direct and indirect effect estimates, since the vast majority of H2A labor income leaves the region. It does, however, pose an issue when attempting to estimate changes in the industry related to H-2A wage shifts. As a result, we simulate only the net change in direct and indirect effects of the specialty crop industry as a result of the first stage modeling: a 10% increase in existing labor income and a 6.7% decrease in employment (non-H-2A domestic workers), with an associated production loss of 2.7%.

With these assumptions in hand, we utilize the direct economic contribution output generated in Chapter 2 (see Table 2) to calculate the change in direct effects. IMPLAN then applies the industry multipliers resulting from such shifts, giving us an idea of the net change in the economic contribution of the industry resulting from a 10% wage increase (see Table 3).

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	24,064	$982.18 Mil.	$1,777.01 Mil.	$3,118.37 Mil.
2 - Indirect	6,974	$357.62 Mil.	$577.58 Mil.	$1,096.44 Mil.
3 - Induced	6,625	$379.22 Mil.	$680.83 Mil.	$1,205.15 Mil.
Total	**37,663**	**$1,719.01 Mil.**	**$3,035.42 Mil.**	**$5,419.96 Mil.**

Table 2: Estimated Economic Contribution of Specialty Crop Farming
Source: Miller and Klammer

[9] IMPLAN takes benchmark levels of output and of employment by industry from government reporting agencies. Because the reporting agency does not count H-2A jobs, they are omitted from the employment estimate for that industry. IMPLAN uses the ratio of employment to output to determine how many jobs would be required for a given change in output. Because H-2A jobs are omitted from that ratio, IMPLAN can only project the expected change in non H-2A jobs.

Effect	Employment	Labor Income	Value Added	Output
1 - Direct	(1,612)	$79.58 Mil.	$58.42 Mil.	($84.2) Mil.
2 - Indirect	(182)	($9.37) Mil.	($15.17) Mil.	($28.76) Mil.
3 - Induced	339	$19.47 Mil.	$34.92 Mil.	$61.83 Mil.
Total	**(1,455)**	**$89.68 Mil.**	**$78.17 Mil.**	**($51.13) Mil.**

Table 3: Net Change in Estimated Economic Contribution of Specialty Crop Farming Resulting from a 10% Wage Increase

Table 2 shows that a 10% increase in wages in the specialty crops sector in Michigan will result in mixed short-term economic effects. First, the 10% increase in wages increases the household incomes across all specialty crop workers. Direct incomes for specialty crop workers are expected to increase by $79.6 million, while labor income across the state increases by $89.7 million. Keep in mind, wages to immigrant workers are assumed to leave the local economy. A keen observer will note that indirect labor income declines by an estimated $9.4 million, while induced incomes increase by $19.5 million. The reduction in indirect incomes arises because output in the state shrinks by $51.1 million, and wages from indirect effects arise from business-to-business transactions, which shrink with output. The rise in induced labor income is associated with higher overall household incomes, as induced effects capture the macroeconomic effects of household expenditures. Unfortunately, the improved income effects are expected to be realized by fewer workers, as the decline in output reduces overall employment. In total, the simulation anticipates employment to shrink by just under 1,500 jobs. Value added tracks with labor income, as value added is the sum of labor income, proprietor's income (which experiences a decline) and net revenues to government units.

Conclusion

In this chapter, we estimate the impact of a 10% wage increase across the entire labor market and in the H-2A labor market on specialty crop employment and production, as well as on the economic activity generated by rising wages and lost production. Our estimates indicate that a 10% increase in wages across the entire specialty crop labor market will lead to a 6.7% employment loss and a 2.7% production loss. While the expected impact of these changes is an increase in state wage and salary income of $90 million, a smaller workforce gets to benefit from the wage gains, as statewide employment is likely to experience a decline by about 1,500. In addition, the estimates show an expected loss in output (or economic activity) totaling about $51 million. These findings highlight the complex effects of rising labor costs on U.S. agriculture. While wage increases can improve income for farm workers, they can also lead to reductions in employment and production, which can have cascading effects on the broader economy. These findings underscore a need to carefully consider policy changes related to labor costs, immigration policy, and visa programs, as they have far-reaching impacts on both the agricultural industry and the broader regional economy.

References

Brady, Michael P., Gallardo, R. Karina, Badruddozza, Syed, and Jiang, Ziaojiao. Regional Equilibrium Wage Rate for Hired Farm Workers in the Tree Fruit Industry. Western Economics Forum, 15(1): 20-31. https://s3.wp.wsu.edu/uploads/sites/290/2017/05/WEF_Brady.pdf.

Cassey, Andrew J., Lee, Kwanyoung, Sage, Jeremy, and Tozer, Peter R. Assessing Post-Harvest Labor Shortages, Wages, and Welfare. Agricultural and Food Economics, 6(17): 1-24. https://agrifoodecon.springeropen.com/articles/10.1186/s40100-018-0112-6.

Charlton, Diane and Taylor, J. Edward. (2016). A Declining Farm Workforce: Analysis of Panel Data from Rural Mexico. American Journal of Agricultural Economics, 98(4): 1158–1180. Retrieved from: https://onlinelibrary.wiley.com/doi/abs/10.1093/ajae/aaw018.

Diamond, John W. and Zodrow, George R. 2021. Key Elasticities in the Diamond-Zodrow Model (Working Paper). Rice University's Baker Institute for Public Policy. https://www.bakerinstitute.org/sites/default/files/2021-02/import/cpf-elasticities-diamond-zodrow-020421.pdf.

Fan, Maoyong, Gabbard, Susan, Alves Pena, Anita, and Perloff, Jeffrey. (2015). Why Do Fewer Agricultural Workers Migrate Now? American Journal of Agricultural Economics, 97(3):665–679. Retrieved from: https://onlinelibrary.wiley.com/doi/abs/10.1093/ajae/aau115.

Flood, Sarah, King, Miriam, Rodgers, Renae, Ruggles, Steven, Warren, J. Robert, Backman, Daniel, Chen, Annie, Cooper, Grace, Richards, Stephanie, Schouweiler, Megan, and Westberry, Michael. (2024). IPUMS CPS: Version 12.0 [dataset]. Minneapolis, MN. https://doi.org/10.18128/D030.V12.0.

(Florida Growers v. DOL) Florida Growers Association, Inc. et al. v. Julie A. Su et al. (2023). US District Court for the Middle District of Florida. Case no. 8:2023cv00889. Retrieved from: https://dockets.justia.com/docket/florida/flmdce/8:2023cv00889/413381.

Gunter, Lewell F., Jarret, Joseph C., and Diffield, James A. (**DATE**).Effect of U.S. Immigration Reform on Labor-Intensive Agricultural Commodities. American Journal of Agricultural Economics, 74(4):897-906. https://www.jstor.org/stable/1243187.

Hill, Alexandra E., Ornelas, Izaac, and Taylor, J. Edward. (2021). Agricultural Labor Supply. Annual Review of Resource Economics, 13: 39-64. https://www.annualreviews.org/content/journals/10.1146/annurev-resource-101620-080426.

Huang, Kuo S. and Lin, Biing-Hwan. (2000). Estimation of Food Demand and Nutrient Elasticities from Household Survey Data. USDA-ERS Technical Bulletin No. TB-1887. https://www.ers.usda.gov/publications/pub-details/?pubid=47347.

Knoblach, Michael, Roessler, Martin and Zwerschke, Patrick. (**DATE**). The Elasticity of Substitution Between Capital and Labour in the US Economy: A Meta-Regression Analysis. Oxford Bulletin of Economics and Statistics, 82(1): https://onlinelibrary.wiley.com/doi/10.1111/obes.12312.

Miller, Steven and Klammer, Sarah. (2025). Economic Contributions of Michigan's Specialty Crop Producers and Production. Michigan State University. East Lansing, MI.

Muth, Richard F. (1964). The Derived Demand Curve for a Productive Factor and the Industry Supply Curve. Oxford Economic Papers, New Series 16(2): 221–34. https://academic.oup.com/oep/article/16/2/221/2360247.

Richards, Timothy J. (2018). Immigration Reform and Farm Labor Markets. American Journal of Agricultural Economics, 100:1050–1071. Retrieved from: https://onlinelibrary.wiley.com/doi/abs/10.1093/ajae/aay027.

Rutledge, Zachariah, Castillo, Marcelo, Richards, Timothy J., and Martin, Philip. (2024). H-2A Adverse Effect Wage Rates and U.S. Farm Wages (Working Paper). https://www.zachrutledge.com/uploads/1/2/5/6/125679559/aewr.pdf.

Rutledge, Zachariah and Mérel, Pierre. (2022). A Declining Farm Labor Supply Could Cost California Farmers Billions. ARE Update, 26(2). https://s.giannini.ucop.edu/uploads/pub/2022/12/22/v26n2_1.pdf.

Rutledge, Zachariah and Mérel, Pierre. (2023). Farm Labor Supply and Fruit and Vegetable Production. American Journal of Agricultural Economics, 105:644-673. https://onlinelibrary.wiley.com/doi/10.1111/ajae.12332.

Rutledge, Zachariah and Taylor, J. Edward. (2019). California Farmers Change Production Practices as the Farm Labor Supply Declines. ARE Update, 22(6): 5-8. https://s.giannini.ucop.edu/uploads/giannini_public/b6/f5/b6f5e1cb-807f-4150-b365-76366d30607f/v22n6_2.pdf.

Subedi, Dipak and Giri, Anil K. (2024). Specialty Crop Farms Have the Highest Labor Cost as Portion of Total Cash Expenses. USDA ERS Chart. https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=110172.

Taylor, J. Edward, Charlton, Diane, and Yúnez-Naude, Antonio. (2012). The End of Farm Labor Abundance. Applied Economic Perspectives and Policy, 34(4): 587-598. https://onlinelibrary.wiley.com/doi/abs/10.1093/aepp/pps036

Technical Appendix

Estimating Employment and Production Losses

To estimate the change in specialty crop production (Q) and employment (L), equations (J) and (K) below are derived from the model. The variables dQ^* and dL^* denote the percentage change of the variables Q and L, respectively. Each equation relates the outcome of interest to the change in wages using a distribution of parameter values informed by values from the academic literature, which are described below. After populating the equations with the parameter values, the change in production and employment can be determined by inputting the corresponding change in wages desired. We use a 10% wage increase value for reference, but other values can be inferred by multiplying our estimates by the desired factor (e.g., multiply by a factor of 2 to obtain the impacts of a 20% increase in wages).

Our model assumes that farmers in a county produce a single homogeneous labor-intensive FV good (Q) using two factors: labor (L) and capital (K). The aggregate, production function $Q(L,K)(Q,L,K,p,w,r)$ These considerations suffice to generate equilibrium conditions that implicitly define all quantities and prices in the input and output markets. Specifically, the industry equilibrium is characterized by six equations in six endogenous variables (Q,L,K,p,w,r) as follows:

$$Q = f(p) \quad \text{(A)}$$

$$Q = Q(L,K) \quad \text{(B)}$$

$$w = pQ_L(L,K) \quad \text{(C)}$$

$$r = pQ_K(L,K) \quad \text{(D)}$$

$$L = g(w) \quad \text{(E)}$$

$$K = h(r), \quad \text{(F)}$$

where p is the output price in the specialty crop market, w is the wage, and r is the price of capital. The symbols Q_L and Q_K denote the marginal product of labor and capital (i.e., the partial derivatives of the production function with respect to L and K). Equation (A) denotes the output demand function, while equation (B) denotes the aggregate production function. Equations (C) and (D)

denote the first order conditions from profit maximizing behavior. Equations (E) and (F) denote the labor supply and capital supply functions, respectively. In our model, the only relevant shock has to do with the labor supply, denoted β, so the market equilibrium in relative changes (i.e., percentage changes) can be derived as follows, where the parameter values are described in Table A1 below:[10]

$$dQ^* - \eta dp^* = 0 \quad \text{(A')}$$

$$dQ^* - k_L dL^* - k_K dK^* = 0 \quad \text{(B')}$$

$$-dp^* + \frac{k_K}{\sigma} dL^* - \frac{k_K}{\sigma} dK^* + dw^* = 0 \quad \text{(C')}$$

$$-dp^* - \frac{k_L}{\sigma} dL^* + \frac{k_L}{\sigma} dK^* + dr^* = 0 \quad \text{(D')}$$

$$dL^* - e_L dw^* = \beta \quad \text{(E')}$$

$$dK^* - e_K dr^* = 0. \quad \text{(F')}$$

Parameter	Parameter Value Ranges	Source
σ (elasticity of input substitution)	(0.45, 0.87)	Knoblauch et al., 2019
η (specialty crop demand elasticity	(-1.22, -0.22)	Huang and Lin, 2000
kL (labor share of production costs)	0.38	Subedi and Giri, 2021
kK (capital share of production cost	0.62	Subedi and Giri, 2021
eK (elasticity of capital supply)	(1.00, 3.00)	Diamond and Zodrow, 2021
eL (elasticity of labor supply)	(0.25, 0.53)	Hill et al., 2021

Table A1. Equilibrium Displacement Model Parameter Descriptions and Values

We solve the system of equations for each of the endogenous variables for which the equations for dQ^* dL^*, and dw^* are presented below:

[10] These equations are derived from Muth (1964).

$$dQ^* = -\frac{k_L \eta e_L(\sigma + e_K)}{D''}\beta \quad \text{(G)}$$

$$dL^* = -\frac{[\sigma\eta - (k_K\sigma - k_L\eta)e_K]e_L}{D''}\beta \quad \text{(H)}$$

$$dw^* = -\frac{e_L(k_L\sigma - k_K\eta + e_K)}{D''}\beta \quad \text{(I)}$$

where D'' is defined as:

$$D'' = \sigma\eta - \sigma(k_L e_L + k_K e_K) + \eta(k_K e_L + k_L e_K) - e_L e_K < 0.$$

We solve equation (I) for β and substitute it into (G) and (H) to derive equations that relate specialty crop production and employment to wages. We use equation (J) for to simulate the impact of the change in wages on the change in production and equation (K) to simulate changes in employment.

$$dQ^* = \frac{k_L \eta e_L(\sigma + e_B)}{e_L(k_L\sigma - k_K\eta + e_K)}dw^* \quad \text{(J)}$$

$$dL^* = \frac{[\sigma\eta - (k_K\sigma - k_L\eta)e_K]e_L}{e_L(k_L\sigma - k_K\eta + e_B)}\ dw^*. \quad \text{(K)}$$