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Potential Benefits of Extended Season Sales Through Direct Markets

Irvin Yeager
Utah State University

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Potential Benefits of Extended Season Sales Through Direct Markets

By

Irvin Yeager

A thesis submitted in partial fulfillment of the requirements for the degree

of

MASTER OF BUSINESS ADMINISTRATION

In

International Food and Agribusiness

Awarded by the Royal Agricultural College
In cooperation with Utah State University

Approved:

____________________  ____________________
Kynda Curtis  Ruby Ward
Major Professor  Committee Member

____________________  ____________________
Don Snyder  Mark McLellan
Committee Member  Dean of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah
2012
Potential Benefits of Extended Season Sales Through Direct Markets

By

Irvin Yeager

This dissertation is submitted in part fulfillment of the requirements for the Masters Degree in International Food and Agribusiness of the Royal Agricultural College at Cirencester, England, 2012
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I declare that this dissertation embodies the results of my own research or advanced studies and that it has been composed by myself. Where appropriate, I have made acknowledgement to the work of others.

Signed,

Irvin Yeager
Dated April 20, 2012
ABSTRACT

Potential Benefits of Extended Season Sales Through Direct Markets

By

Irvin Yeager, Master of Business Administration
Utah State University, 2012

Major Professor: Dr. Kynda Curtis
Department: Applied Economics

This study examines fresh produce production sold through local farmers’ markets in the U.S. Rocky Mountain region to determine likelihood and benefits for extending production and marketing of fresh produce. Surveys were conducted with producers and farmers’ market managers to determine the likelihood of season extension, marketing realities, and potential products. Prices for eight commonly found produce items were collected at farmers’ markets in Utah and Colorado to model expected off-season pricing.

Surveys responses show producers have a short marketing season, limited acreage, and receive low revenues, but are experienced and have adopted some season extension techniques. High tunnels, one of the most effective season extension techniques, had limited usage in the survey among participants. Market manager surveys show the need for many markets to move indoors in the off-season and felt that consumers were unlikely to pay premiums in the extended season.
Collected prices were analyzed using ARMA and ARIMA methods to provide a forecast for prices in the extended season. The results show that some produce items are priced higher in the early season, while others are higher in fall, while prices for some items are near constant.

The study concludes that although producers could benefit from market and season extension, additional season extending techniques should be adopted as well as consider diversifying offerings. Profitability in an extended season is likely to be constrained by market availability and market manager responses, despite increasing consumer demand for local foods.

(65 pages)
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My committee members Dr. Don Snyder and Dr. Ruby Ward were also an important part of the completion of my dissertation. Dr. Snyder provided invaluable expertise in economic modeling and always made time to answer any question I had. Dr Ward’s understanding of the region’s producers helped focus my research.

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Dr. Stephen McGary, Jeremy Slade and Jacqui Webb also need recognition. Stephen introduced me to direct marketing while at BYU-Idaho, showed great faith in me as a person, and was a key influence in my choice of studying agricultural economics. Jeremy introduced me to the IMBA program and provided important
encouragement to seek a graduate degree. Jacqui provided invaluable help while in England and is my family away from home.

Both my parents and grandparents played an important part, my mother was an example of continual learning and my father taught me hard work and our conversations about business while working on the family feedyard were some of my favorite and influential times. I also had the opportunity to spend many hours with my grandparents in their garden where I learned to love all things that grow.

Lastly, my wife Amber gave me much needed encouragement, balance and perspective. Through this time she has been my pillar. I am a fortunate man to be married to someone so willing to sacrifice for me.
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LIST OF ACRONYMS

AR--- Autoregressive
ARIMA --- Autoregressive Integrated Moving Average
ARMA --- Autoregressive-Moving Average
C --- Constant
CSA --- Community Supported Agriculture
CO-OP --- Cooperative
EA --- Each
LB --- Pound
MA --- Moving Average
M --- Meter
MIRR --- Modified Internal Rate of Return
NA --- Not Available
$R^2$ --- Coefficient of Determination
RMSE – Root Mean Squared Error
S.E. --- Standard Error
SSR --- Sum of Squared Residuals
STD --- Standard
U.S. --- United States
USDA --- United States Department of Agriculture
Chapter 1

Introduction

Direct marketing outlets such as farmers’ markets have seen large increases in the U.S. with the number of farmers’ markets tripling to over 7,000 in the past 15 years (USDA, 2012). A relatively easy market for producers to participate, the surge in popularity can be attributed to many benefits such as the availability of higher quality and locally produced products that provide value to consumers. Also supporting the growth and development of direct markets is the USDA’s “Know Your Farmer, Know Your Food” program initiated by President Obama which aims to “strengthen local and regional food systems” with goals such as increasing access to fresh and affordable local foods, and offering support and new opportunities for producers (USDA, 2012). In tandem with President Obama’s effort is Michelle Obama’s “Let’s Move!” program which aims to increase child health with initiatives increasing access to healthy foods through avenues such as farmers’ markets (Let’s Move! 2012).

The Rocky Mountain region has seen the highest levels of direct market growth in the U.S., where approximately 38% of direct markets have been in existence five years or less in 2006. The region also boasts the second highest average attendance in seasonal farmers’ markets according to the USDA National Farmers Market Manager Survey 2006 (Ragland and Tropp 2009). Although these are positive signs, the long term sustainability of these markets comes into question when one examines reported revenues from farmers’ markets, where 80% of vendors receive revenues of $5,000 dollars or less. They also operate under the shortest marketing season amongst U.S.
regions at a reported 3.92 months, which also reflects the arduous growing conditions. A key motivation for this study, the report also finds that producer revenue at farmers’ markets increases three-fold when operating seven months or longer compared to markets operating for five months or less (Ragland and Tropp 2009). Revenue becomes especially important to this study as many participants are lower revenue small farms (Low and Vogel 2011). Direct markets represent an important source of income for these agribusinesses, which often participate in and supply much of the goods found at farmers’ markets.

Even with the recent growth in direct markets, local product availability has been found to be a weakness in multiple studies. While findings show 87% of consumers reported that freshness and availability of produce had an impact on their purchases (Govindasamy et al. 2002), Andreatta and Wickliffe (2002) found availability was the second largest complaint of farmers’ market attendants. Onozaka et al. (2010) found in a national survey that locally grown produce’s only weakness was availability.

The use of season extension techniques in fresh produce production are an important response to low revenues, a short marketing season and product availability. Season extension allows producers to increase their production, marketing season and sales. For example, techniques such as high tunnels have been shown to lengthen production periods (Gatzke et al. 2009), increase yields (Rowley et al. 2010) and improve profitability (Ward et al. 2011) in the Rocky Mountain region. However, the availability of marketing outlets is equally important. Even though producers may be able to grow produce, a market to match their production is also required. Is it possible for markets in the region to extend their season? What are the potential obstacles they
face? What products and produce can be offered and what are consumers willing to pay for it?

This study has two main objectives. The first objective is to determine the likelihood of season extension by identifying producer capabilities for extension and the marketing realities faced by producers in an extended season. The second objective is to provide insight into the products that could be offered to consumers and what prices producers could expect to receive for those products.

The first objective is addressed through a survey of both producers and farmers’ market managers in the region. Farmers’ market managers were surveyed on topics related to their current marketing season, consumer expectations and obstacles such as weather and additional costs. Producers were surveyed on their farming background, acreage under production, revenues, as well as their marketing and production strategies including their use and attitudes towards season extension techniques.

The second objective is addressed through the collection and analysis of fresh produce prices and attributes from 14 farmers’ markets in the Rocky Mountain region from May to early November 2011 on a weekly basis. The average weekly price was then found for eight commonly found goods with similar attributes and then used to estimate models to predict prices in an extended season. Included in the surveys with the intention to add additional insight into potential pricing, both market managers and farmers were also asked what produce could be offered in an extended season, and if any premiums are currently or likely to be received based on availability of produce. The results of this study are expected to better inform producers and market managers
on the capability and the potential benefit of extended season sales situations, as well as insights into what to products to market and when.

The next chapter reviews the important literature used as a foundation for this study and will cover topics including market extension, season extension techniques, and seasonal fresh produce pricing. Following the literature review, the methods of the study are described including pricing data collection, as well as a survey collection and results. The chapter on the results details the analysis and results of the early, late and off season potential pricing. A conclusion and summary discusses the primary results and application of the study. The final chapter contains the author’s thoughts and views on the research project.
Chapter 2

Factors of Market Extension

The decision to extend the season for fresh produce sales isn’t made solely by consumers, market managers or producers. Instead, it represents a mix of the desires, risks, and opportunities available to all three. As such, the literature review will cover important literature relating to studies in consumer motivations, season extension techniques, farmers’ market extension, and lastly, seasonal produce pricing. While there has been work done in consumer motivation and season extending techniques, there is limited work done in market extension and seasonal produce pricing in direct markets. Pricing represents a particular challenge as data has to be recorded manually and supply can be uncertain. This paper will instead rely on literature based on national wholesale seasonal produce pricing studies.

Consumer Motivations

Studies show that attendants across the U.S. purchase from direct markets for similar reasons. Govindasamy et al. (2002) provides results from a survey of farmers’ market attendants in the New Jersey area. The survey shows that 98.5% of consumers expected quality to be higher than retail facilities and approximately 60% of consumers were motivated by quality and freshness. It should also be noted that 54% of consumers expected prices to be lower when compared to retail. Curtis (2011) in a survey comparing CSA and farmers’ markets consumers in Nevada, find that along with quality, freshness and taste were rated very important or extremely important. Pricing and value were also considered important and very important respectively. Wolf et al.
(2005) found similar results in California and Andreatta and Wickliffe (2002) in North Carolina. The results from these studies show that although consumers expect higher quality, they can be price and value sensitive. Other reasons such as the effect on the environment, access to organic produce, benefits to the local economy, and enjoyable atmosphere were consistently mentioned as important rationale for local direct market purchases, but at lower rates in these studies as well as others (Onozaka et al. 2011; Martinez et al. 2010).

The rapid growth of direct markets is convincing evidence that consumers have a preference for the products they offer. Further, it seems additional growth is possible as studies suggest unmet demand as Govindasamy et al. (2002), Andreatta and Wickliffe (2002) and Onazaka et al. (2010) find availability as important but a perceived weakness by consumers. Specific to this study, Ragland and Tropp (2009) find that 44.8% of farmers’ market managers in the Rocky Mountain region reported consumer demand greater than supply in the markets they manage.

**Season Extension**

An important part to understanding the potential benefit to producers in implementing season extension techniques is the additional effort involved. The use of high tunnels, also known as hoop houses or unheated greenhouse has greatly increased and has allowed producers to extend their season. Essentially a clear plastic cover attached to curved poles planted in the ground tall enough to walk in. Their function is to not only protect crops from the elements, but to act as a form of temperature and pest control, often providing the ability to plant crops a month early and
extend the growing season out an additional two to three months (Gatzke et al. 2009). Although there are several other season extension techniques, this study is primarily interested in high tunnels because of recent studies involving their use for small farmers’ specialty crops found at direct markets. Specialty crops have been the primary focus of high tunnels usage because a higher return per area is expected to offset the additional costs, and their relatively small size lends itself to labor intensive fruits and vegetables. Gent (1991) in a three year study in Connecticut, grew tomato and peppers in high tunnels and found increased yields and extended production for both crops. Waterer (2003) compares low tunnels, also a form of temperature control and weather protection to high tunnels over three years in Canada. Specialty crops such as tomatoes, peppers and melons were grown in each system. Results showed that the use of high tunnels increased marketable yield, mature fruits and extended production season when compared to low tunnels. Although both Waterer (2003) and Gent (1991) offer a brief economic analysis in their conclusion both were based on wholesale prices.

While studies such as Gent’s (1991) focus on the production benefits high tunnels provide with specialty crops, only recently have studies addressed the full economic impact on a farm with respect to direct marketing. Ward et al. (2011) conducts a profitability analysis of a potential grower purchasing one acre of land in northern Utah, along with inputs including watering system, machinery, and high tunnels. Revenues are based on prices and yields for specialty crops observed from the area and local farmers’ markets. The study finds high tunnels on one acre of ground in Utah growing a double crop of tomatoes and summer squash has an 11.49% modified internal rate of return (MIRR) and a payback period of six years. Also
important to note the authors stressed the importance of utilizing premium markets to achieve their profitability estimates.

Rowley et al. (2010) grew strawberries in Utah both in-ground and in a high tunnel system to compare results. The study finds that high tunnels brought production approximately 4 weeks forward and increased profitability by $13/m² when compared to the in-ground system and like Ward, based profitability on marketing to premium direct markets.

Conner et al. (2010) examines the impact high tunnels in multi-year study with nine different producers in Michigan. The results showed that with efficient management skills, hoop houses could have a payback period as little as two years. The study also brings to attention the possibility of lost profit. The report found some farmers lost money and failed to follow instructions given to them by Extension personnel.

Donnell et al. (2011) found that breakeven prices for tomatoes, summer squash, strawberries and spinach grown in high tunnels in Oklahoma were highly sensitive to changing yields, percent marketability and labor costs. These three studies also cite crop selection, individual skills in marketing and production efforts as important influences on profitability. Considering the typical low revenues received by many direct marketers, and the risks mentioned, the cost and benefits of high tunnels should be weighed by the producer. Dependant on make, size and quality the cost to purchase and install a high tunnel can vary greatly from as low as about $1000 dollars for a self constructed one (Black et al. 2008) to many times that amount (Conner et al. 2010) for a
commercially rated high tunnel. Even though high tunnels have been shown to increase profitability, cost may still be a likely objection among other reasons including risk aversion, lack of knowledge, past experience and time constraints. Waterer (2003) confirms cost is an important issue by concluding that low cost material selection would increase high tunnel profitability. These issues may play an important part in fully determining the benefit of an extended season. If producers can’t or aren’t willing to effectively utilize new techniques to raise profitable crops, the practice will quickly lose favor and extended markets will disappear. For this reason the region’s experience, use and attitudes towards season extending techniques were gathered.

**Market Extension**

Direct markets and specialty crops make sense for small producers in the U.S. as it allows additional income with the use of land and expertise they likely already have. Direct markets also have little contractual obligation and present themselves as a ready market. This is an important aspect as many small farmers’ are part-time farmers and have time constraints limiting their production and marketing efforts. Market entry and flexibility has also become easier with the recent growth in farmers’ markets availability and other direct market opportunities, but present a set of complex decisions for producers.

Studies have shown that many small farmers rely almost solely on farmers’ markets as an outlet for their produce (Low and Vogel 2011). The reliance on farmers’ markets creates a potential problem, even though they may be able to offer produce for a longer period, producers may need an additional farmer’s market or alternative outlet
to extend their season. LeRoux et al. (2010) provides a case study of producers in New York and concludes producers should use multiple markets to optimize overall farm performance. Hardesty and Leff (2010) analyzed three organic producers in California, and compared their costs and revenues when utilizing direct and wholesale organic produce markets. The study also recommends using direct markets as a risk management tool. It should also be noted that the farms in both studies were 18 acres or larger and full time producers, whereas in Ward et al. (2011) they study was only one acre of production and recommended the primary use of direct markets. Monson et al. (2008) reconciles the above findings by analyzing farmer characteristics in Virginia using an ordered logit regression model and concludes that size of farm has a considerable impact on marketing efforts. Even though size may have an impact on marketing efforts, Brown et al. (2007) conducted a study examining the importance of farmers’ markets in West Virginia to direct marketers and possible ways to increase income. Using regression analysis, Brown estimates that branching out to one additional farmer’s market leads to an estimated $2,681 increase in revenue.

The farmers’ market selected has also been discussed as an influence on profitability. Ward et al. (2011) and Rowley et al. (2010) based their profitability analyses on utilizing premium farmers’ markets in Utah. Low and Vogel (2010) suggest this relationship when they found that over half of small farms with direct sales were located in metropolitan counties. Ragland and Tropp (2009) have the same conclusion from their nationwide survey of farmers’ market managers by finding monthly sales in less urban regions like the Rocky Mountains region were half than more populated regions such as the Mid-Atlantic and Far West. Martinez et al. (2010) finds that
revenues decrease from $10,987 for farms located in metropolitan counties, to $6,767 in counties adjacent to metropolitan counties. These findings represent a challenge for direct marketers in the Rocky Mountain region. While cities like Denver and Salt Lake City provide producers some access to metropolitan markets, travel may be prohibitive for producers at a larger distance from the market and larger markets tend to have waiting lists. Even though the region may lack many metropolitan areas for farmers’ markets, a higher percentage of consumer attendance may help offset this disadvantage. Bond et al. (2009) finds in a national survey that consumers in the Rocky Mountain region are more likely to prefer shopping at direct markets than retail and Ragland and Tropp (2009) find seasonal farmers’ market attendance rated second in the U.S.

Considering the low revenues received by many producers in the region, many are likely part-time and have differing obligations and preferences which LeRoux et al. (2010) suggests has an influence on marketing efforts. Especially for farmers’ who rely on one or two farmers’ markets the additional effort may prove too much. By identifying current marketing outlets used by producers in the region, this study gauges additional marketing efforts required and potential risks in an extended season situation.

Limited studies on market extension so far show promising results. Brown et al. (2007) predicts extending one week would lead to a $448 increase in sales, a significant amount for low revenue farmers. Conner et al. (2009) uses surveys, focus groups and experimental auctions with attendants from three farmers’ markets in Michigan to determine the benefits of extension. The authors conclude that market extension would be beneficial by finding that 91% of farmers’ market consumers in Michigan would be
willing to attend late fall and winter markets while 69% reported they would be willing to attend as early as January or February. The study also finds that 91% of consumers were willing to pay premiums for local produce offered at farmers’ markets. Although the studies estimate revenue and attendance, the pricing or amount consumer would be willing to pay for individual produce is uncertain.

**Pricing**

There is very little literature related to seasonality in farmers’ market prices. We do have some qualitative insights from Eastwood (1996) who reports that 23% of consumers at farmers’ markets in Tennessee felt prices were too high in the beginning of the market season while only 8% felt similarly a month later.

From a quantitative perspective, studies in produce pricing using national level data find that there is seasonality in prices, and that as expected, price decreases when supply available increases. Goodwin et al. (1988) examines factors affecting potato prices in U.S. terminal markets, found prices for a variety of potatoes dropped at harvest time and then prices increased until next year’s harvest. Huang and Lin (2006) use a hedonic model to predict prices for tomatoes using information such as region, season, outlet, organic and packaging. The study finds that tomato prices are lower in the summer across most of the U.S. and organic tomatoes commanded a $.26/lb. premium in the west. The study also found prices in general to be lower in the west suggesting a possible downward effect on prices received by producers in the region.

Along with organic premiums found by Huang and Lin (2006), state branded produce has been found to command premiums. In an Arizona study, Nganje et al.
(2011) uses conjoint analysis and regression to determine preferences and premiums for various attributes relating to produce such as origin, production method, certification, and quality. The study reports that consumers are willing to pay a $0.10/lb. and $0.18/lb. for carrots and spinach respectively for Arizona Grown brand when compared to unbranded spinach and carrots. Explaining the source of the premium, the brand was viewed by consumers as a way to support the local economy, as well as superior product quality.

Darby et al. (2006) suggests that for producers at farmers’ market, the local premium may already be captured. In an Ohio study, 530 consumers at various produce markets both direct and retail completed a survey and a set of choice experiments. The choice experiments were set up to determine attributes consumer’s willingness-to-pay for a quart of fresh strawberries. The results show that consumers were willing to pay an additional $1.17/quart for strawberries considered locally produced, and $0.80/quart premium for produce from a family farm, but no additional premium when comparing berries that were grown nearby to grown in Ohio. Validating other studies on consumer motivations Darby et al. (2006) also finds consumers were willing to pay an additional $1.38/quart premium based on freshness.

Although the focus of this study is fresh produce, producers have also been known to offer processed products, such as jam or salsa. These processed products increase total offerings to consumers, make use of damaged produce, and bolster revenue in the extended season. Onken et al. (2011) examines premiums for strawberry preserves in the Mid-Atlantic region. The study concludes that consumers are consistently willing to pay more when the same product is offered at a farmers’ market.
when compared to a grocery store. This conclusion provides useful insight for producers who currently are or considering offering processed products, and how to ensure revenue in an extended season.
Chapter 3

Data and Methodology

Data was collected by contacting the farmers’ market managers by email in Utah, Idaho and Nevada and asking them to complete an online survey conducted through Survey Monkey. They were also asked to forward a separate survey to the producers in their area also to be completed on Survey Monkey. Additional surveys were conducted with producers at farmer’s markets to increase the sample size. Farmers’ markets were chosen as they provided easy access to multiple direct marketers, are popular amongst consumers and allow small producers to capture premiums (Govindasamy et al. 2002). Eighteen farmers’ market managers responded with ten from Utah, five from Nevada and three from Idaho. Twenty-five surveys were completed by farmers through Survey Monkey and an additional 32 surveys from producers were also collected from the Logan, Richmond, Salt Lake City, Park City, Kaysville, and Sugar House farmers’ markets in Utah from September and October 2011. A total of 57 producer surveys were completed with 45 from Utah, four from Idaho, five from Nevada and two with no location given. The information from both surveys is expected to provide an outlook of the potential benefits and likelihood of providing an extended marketing outlet, as well as producer interest and capability of offering additional fresh products during an extended season.

Growers

The producer’s surveys gathered information relating to farm scale, marketing season and strategies, and the use and attitudes towards season extension techniques.
Producers were also asked what products they could offer in an extended season and product premiums they had received for offering produce when normally not available.

The majority of producers in the survey, by the USDA’s definition, would be considered small (Low and Vogel 2011) with 62% of producers receiving $10,000 or less in annual gross revenues (see Table 3.1).

Table 3.1 Producer Characteristics

<table>
<thead>
<tr>
<th>Acreage</th>
<th>Percentage</th>
<th>Revenue</th>
<th>Percentage</th>
<th>Experience</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: &lt;1/4 Acre</td>
<td>9%</td>
<td>1: &lt;$1000</td>
<td>25%</td>
<td>1: 1 year or less</td>
<td>12%</td>
</tr>
<tr>
<td>2: 1/4 to 1 Acre</td>
<td>45%</td>
<td>2: $1,000-$4,999</td>
<td>19%</td>
<td>2: 2 to 3 years</td>
<td>25%</td>
</tr>
<tr>
<td>3: 2 to 5 Acres</td>
<td>23%</td>
<td>3: $5,000-$9,999</td>
<td>18%</td>
<td>3: 3 years or more</td>
<td>60%</td>
</tr>
<tr>
<td>4: 6 to 10 Acres</td>
<td>4%</td>
<td>4: $10,000-$19,999</td>
<td>9%</td>
<td>4: NA</td>
<td>3%</td>
</tr>
<tr>
<td>5: 11 to 50 Acres</td>
<td>5%</td>
<td>5: $20,000-$39,999</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: 50+ Acres</td>
<td>14%</td>
<td>6: $40,000-$59,999</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7: $60,000-$99,999</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8: $100,000-$249,999</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9: $250,000-$499,999</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10: $500,00+</td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11: NA</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A high percentage of the producer respondents work with limited acres, with 54% utilizing an acre or less. Although many are small scale, 60% percent reported having three or more years of direct marketing experience, and 37% reported three years or less of direct marketing experience (3% with no response). This is in line with studies examining farmers’ markets, particularly in the Rocky Mountain region (Ragland and Tropp 2009). Even though low revenues may provide a motivation to extend direct markets and experience as an indicator of ability, limited acreage would motivate producers to reconsider marketing strategies and invest in yield increasing techniques. As many of the surveys were collected at farmers’ markets, an expected 91% of producers sold at farmers’ markets, with 35% of the sample relying on them exclusively.
When asked to list their top three markets, 39% of producers reported only using one market, 19% using two markets, and 25% using three or more (17% did not report) (see Table 3.2).

**Table 3.2 Producer Marketing Efforts**

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing Season</td>
<td></td>
<td>Market Strategy</td>
<td></td>
</tr>
<tr>
<td>1: 3-4 months</td>
<td>10%</td>
<td>1: Organic</td>
<td>23%</td>
</tr>
<tr>
<td>2: 4-5 months</td>
<td>28%</td>
<td>2: Naturally</td>
<td>67%</td>
</tr>
<tr>
<td>3: 5-6 months</td>
<td>14%</td>
<td>3: Local Label</td>
<td>28%</td>
</tr>
<tr>
<td>4: 6-7 Months</td>
<td>12%</td>
<td>4: Grass-fed</td>
<td>5%</td>
</tr>
<tr>
<td>5: 7+ months</td>
<td>15%</td>
<td>5: Other</td>
<td>9%</td>
</tr>
<tr>
<td>6: NA</td>
<td>21%</td>
<td>6: None</td>
<td>5%</td>
</tr>
<tr>
<td>Farmers' Market Season</td>
<td></td>
<td>Potential Premiums</td>
<td></td>
</tr>
<tr>
<td>1: &lt; 2 months</td>
<td>6%</td>
<td>1: Organic</td>
<td>61%</td>
</tr>
<tr>
<td>2: 2-3 months</td>
<td>6%</td>
<td>2: Local</td>
<td>61%</td>
</tr>
<tr>
<td>3: 3-4 months</td>
<td>28%</td>
<td>3: Naturally</td>
<td>56%</td>
</tr>
<tr>
<td>4: 4-5 months</td>
<td>28%</td>
<td>4: Availability</td>
<td>67%</td>
</tr>
<tr>
<td>5: 5-6 months</td>
<td>0%</td>
<td>5: Other</td>
<td>28%</td>
</tr>
<tr>
<td>6: 6-7 months</td>
<td>22%</td>
<td>6: NA</td>
<td>17%</td>
</tr>
<tr>
<td>7: 7+ months</td>
<td>5%</td>
<td>Produce Offered</td>
<td></td>
</tr>
<tr>
<td>8: NA</td>
<td>5%</td>
<td>1: Fruit</td>
<td>65%</td>
</tr>
<tr>
<td>Marketing Outlets</td>
<td></td>
<td>2: Vegetables</td>
<td>88%</td>
</tr>
<tr>
<td>1. Farmers' Market</td>
<td>91%</td>
<td>3: Greens</td>
<td>60%</td>
</tr>
<tr>
<td>2. CSA</td>
<td>23%</td>
<td>4: Flowers</td>
<td>18%</td>
</tr>
<tr>
<td>3. Grocery Store</td>
<td>21%</td>
<td>5: Beef</td>
<td>5%</td>
</tr>
<tr>
<td>4. Farm Stand</td>
<td>25%</td>
<td>6: Lamb</td>
<td>2%</td>
</tr>
<tr>
<td>5. You Pick</td>
<td>11%</td>
<td>7: Pork</td>
<td>2%</td>
</tr>
<tr>
<td>6. Wholesale</td>
<td>19%</td>
<td>8: Other</td>
<td>12%</td>
</tr>
<tr>
<td>7. Co-op</td>
<td>5%</td>
<td>9: NA</td>
<td>2%</td>
</tr>
<tr>
<td>8. Other</td>
<td>9%</td>
<td>Process Products</td>
<td></td>
</tr>
<tr>
<td>9. NA</td>
<td>5%</td>
<td>No:</td>
<td>68%</td>
</tr>
<tr>
<td>Number of Farmer's Markets</td>
<td></td>
<td>NA:</td>
<td>21%</td>
</tr>
<tr>
<td>1: 1 Market</td>
<td>39%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: 2 Markets</td>
<td>19%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 3+ Markets</td>
<td>24%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: NA</td>
<td>18%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CSA’s, farm stands, wholesale, and grocery store contracts were equally popular as each gained approximately 10 responses or 18% each, inclusively. The results although influenced by survey methods, show a dependence on farmers’ markets as an outlet and the most familiar strategy for producers to utilize in an extended season.

Extending the marketing season is also of interest as 52% of vendors market for
six months or less, 12% between six and seven months, while only 15% for seven months or longer. Although these numbers show a short marketing season, 21% weren’t able to accurately describe their marketing season. When asked what produce they offer, 65% reported growing fruit, 88% vegetables, 60% greens, 18% flowers and 16% other and only 11% responded that they sell processed products. Although we expected the producers to grow a variety of products, the lower usage of fruit and greens was surprising and also provides insight into extended season strategies considering processed goods, and certain fruit and greens such as strawberries and spinach (Rowley et al. 2010; Donnell et al. 2011) that can be offered in an extended situation. When asked what they could offer in an extended season, tomatoes received the highest response at 61%, while peppers, herbs, greens and carrots were all between 40%-50%. Sweet corn and cherries received the lowest response at 5%, while berries, apples, pumpkins, potatoes and value-added items were all under 20% (see Figure 3.1).

**Figure 3.1 Percent Responded: Produce Possibly Offered in an Extended Season**
To determine the capability of producers to offer produce in an extended season the survey asked if producers were currently using or considering season extension techniques, as well as the type used, and reasons for use and non-use. Although 33% of producers reported using no techniques, many of the remaining producers used multiple methods to extend their season. When asked if they would consider using season extension techniques, 39% responded yes while 18% responded no. Frost cloth was the most popular, as 35% of producers reported use, while high and low tunnels, raised bed and plastic cover each had similar response rates of about 25%. Considering the potential expense involved (Conner et al. 2011) and the low revenues received by producer respondents, the 24% adoption rate of high tunnels among the sample was unexpected. When asked why they used season extension techniques, 60% of producers reported an extended sales season, 51% for increased yields, 39% for increased quality and 14% for other reasons.

For producers not considering season techniques, expense was the biggest objection at 35%, followed by lack of information, previous experience and unknown supplier receiving similar responses all at 16%. These two questions originally intended for producers to rank each reason on a scale of 1 to 4, with 1 the highest, but many ranked the alternatives as equally important. Instead they more closely represent the number of responses over the total sample. Although cost received the most votes, an extended season readily addresses this concern as the investment in techniques would likely receive immediate returns when product is sold (see Table 3.2).
Table 3.2 Producer Season Extending Techniques

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considering using season extending techniques in the future</td>
<td>1: Yes</td>
<td>39%</td>
<td>1: Increased yields</td>
</tr>
<tr>
<td></td>
<td>2: NA</td>
<td>44%</td>
<td>2: Increased quality</td>
</tr>
<tr>
<td>Season extending techniques used</td>
<td>3: Extended sales season</td>
<td>60%</td>
<td>3: Extended sales season</td>
</tr>
<tr>
<td>1: High tunnel</td>
<td>25%</td>
<td>4: Other</td>
<td>14%</td>
</tr>
<tr>
<td>2: Low tunnel</td>
<td>21%</td>
<td>5: Other</td>
<td>7%</td>
</tr>
<tr>
<td>3: Raised beds</td>
<td>25%</td>
<td>6: Heating</td>
<td>7%</td>
</tr>
<tr>
<td>4: Plastic cover</td>
<td>26%</td>
<td>7: Other</td>
<td>18%</td>
</tr>
<tr>
<td>5: Frost cloth</td>
<td>35%</td>
<td>8: None</td>
<td>28%</td>
</tr>
<tr>
<td>6: Heating</td>
<td>7%</td>
<td>9: NA</td>
<td>14%</td>
</tr>
</tbody>
</table>

Farmers’ Market Managers

The market manager represents a key player in the decision making process for farmers’ market location and time, as they have a unique insight into the consumers, producers and logistical challenges specific to their market. The farmers’ market manager survey was meant to assess the region’s current marketing realities, obstacles to season extension, and possible produce offered in an extended season. Location, marketing duration, number of vendors, producer concentration, likelihood of extension, possible produce offered in an extended season and premiums for various attributes were topics included in the survey. Farmers’ markets included in the sample were relatively small with 44% of markets having 20 vendors or less, but have a somewhat strong produce producer representation as 67% of markets have 40% producer concentration or higher. As expected, the marketing season results are similar to that of the producer survey as 68% of markets are open for less than six months and only 5% are open for seven months or longer (see Table 3.4).
Table 3.3 Market Characteristics

<table>
<thead>
<tr>
<th>Farmers' Market Season Length</th>
<th>Description</th>
<th>Percentage</th>
<th>Concentration of Produce Vendors</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: &lt; 2 months</td>
<td>1: &lt;20%</td>
<td>11%</td>
<td>2: 20%-40%</td>
<td>2: 2-3 months</td>
<td>6%</td>
</tr>
<tr>
<td>3: 3-4 months</td>
<td>3: 41%-60%</td>
<td>22%</td>
<td>4: 61%-80%</td>
<td>4: 4-5 months</td>
<td>28%</td>
</tr>
<tr>
<td>5: 5-6 months</td>
<td>5: &gt;80%</td>
<td>34%</td>
<td>7: 7+ months</td>
<td>5: &gt; 200 Vendors</td>
<td>0%</td>
</tr>
<tr>
<td>6: 6-7 months</td>
<td>6: NA</td>
<td>17%</td>
<td>8: NA</td>
<td>6: NA</td>
<td>5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market Size</th>
<th>Description</th>
<th>Percentage</th>
<th>Potential Premiums</th>
<th>Reported by Market Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:&lt;20 vendors</td>
<td>1: Organic</td>
<td>61%</td>
<td>2: Local</td>
<td>61%</td>
</tr>
<tr>
<td>2: 20-50 vendors</td>
<td>2: Local</td>
<td>61%</td>
<td>3: Naturally</td>
<td>56%</td>
</tr>
<tr>
<td>3: 51-100 vendors</td>
<td>3: Naturally</td>
<td>56%</td>
<td>4: Availability</td>
<td>67%</td>
</tr>
<tr>
<td>4:101-200 vendors</td>
<td>4: Availability</td>
<td>67%</td>
<td>5: Other</td>
<td>28%</td>
</tr>
<tr>
<td>5: &gt; 200 Vendors</td>
<td>5: Other</td>
<td>28%</td>
<td>6: NA</td>
<td>17%</td>
</tr>
</tbody>
</table>

When asked if they are considering extending their season 39% of the managers responded yes, and 61% responded that customers would prefer moving indoors during an extended season, 44% of managers also cited a need to move indoors. Finding an indoor location could present a challenge as 44% have not yet identified a suitable site and 67% reported an expected significant cost to move indoors. Straining the possibility of market extension further, 61% managers also reported that their attendants would not be willing to pay higher prices. In contrast, 67% of managers reported their attendants were willing to pay premiums for availability and 32% of producers reported receiving premiums for offering produce when not normally available and 50% of market managers reported their produce vendors would use their farmers’ markets in an extended season (see Table 3.5).
Table 3.4 Extended Season Obstacles

<table>
<thead>
<tr>
<th>Question</th>
<th>Percentage</th>
<th>Yes</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you considering extending your farmers' market season?</td>
<td>39%</td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Do produce vendors want to use your market in an extended season?</td>
<td>50%</td>
<td></td>
<td>11%</td>
</tr>
<tr>
<td>Would customer prefer shopping indoors in an extended season?</td>
<td>61%</td>
<td></td>
<td>11%</td>
</tr>
<tr>
<td>Will extending require moving indoors?</td>
<td>44%</td>
<td></td>
<td>12%</td>
</tr>
<tr>
<td>Do you have a suitable location identified for the extended season?</td>
<td>28%</td>
<td></td>
<td>28%</td>
</tr>
<tr>
<td>Is there a significant involved in securing a suitable extended season location?</td>
<td>67%</td>
<td></td>
<td>28%</td>
</tr>
<tr>
<td>Are customers willing to pay higher prices in an extended season?</td>
<td>22%</td>
<td></td>
<td>17%</td>
</tr>
<tr>
<td>Have you received premiums based on availability?</td>
<td>32%</td>
<td></td>
<td>16%</td>
</tr>
<tr>
<td>Do you currently process products to be marketed in the off season?</td>
<td>11%</td>
<td></td>
<td>21%</td>
</tr>
</tbody>
</table>

When asked what product they felt producers could offer in an extended season, 61% reported winter squash as being likely followed by greens, apples, onions, potatoes, pumpkins, herbs and carrots, all between 45% and 50%, while many berries and warm-season produce such as tomatoes and peppers received a 22% or less responses (see Figure 3.1). These results were unexpected as many of the products mentioned were opposite of those reported by the producer respondents.

Potential Pricing

Individual prices and attributes for common produce items were collected from 14 farmers' markets in Colorado by Colorado State University Extension and four from Utah through Utah State University Extension from May to November 2011 to determine pricing trends. Produce chosen for analysis is based on survey results from both producers and managers with consideration given to the availability of recorded prices and consistency of a like product. Although the producer survey had asked producers if they had received premiums and their magnitude for offering produce when not
available, the data from the pricing sheets were used to provide quantitative insight for production and marketing decisions.

Eight items were selected: tomatoes, cucumbers, summer squash, potatoes, herbs, greens, carrots and green peppers. The recorded prices were sorted by week and then averaged across markets to find the representative price for that week. Each week was numbered based on 52 weeks in a year. Missing data points were filled in using data imputation, which is regressing the average weekly price on the week number to estimate a coefficient. The coefficient is then multiplied by the missing week number to provide an estimate for that week (Wise and McLaughlin 1980). Consideration also needs to be given that each week’s price is representative of a varying number of markets, each with their own unique attributes and consumer base. No indicator of supply is recorded.

Unlike produce sold at the retail level, where Nielsen Scanner data and the volume of data allows for complex forecasting models, sales data from farmers’ markets often goes untracked. Organic produce, a comparable product to direct market produce present some useful parallels. Until recently, there was limited supply and pricing data available, but now such data is available making effective forecasting models possible (Huang and Lin 2006). Gubanova et al. (2005) found autoregressive-moving average (ARMA) models to be the most effective when forecasting produce prices by collecting and analyzing U.S. prices for nine organic produce items. ARMA models take into consideration past time periods and changes in past time periods to generate a forecast. ARMA models were compared to spectral decomposition and exponential smoothing models based on their root mean square error (RMSE), Henrik Merton
criterion and Giamocini-White tests for a 10-day forecast, 1, 2, and 6 month forecast. In the vast majority of tests ARMA proved to be the most effective model for all nine produce items.

Especially beneficial for this study's objective of providing insight for producers, is the simplicity of the models, which allow producers to quickly and effectively interpret results. ARMA models also make sense from an economic perspective based on the assumption that farmers will market their produce based on previous sales prices.

Autoregressive moving average models (ARMA) and Autoregressive integrated moving averages (ARIMA) were then created. ARIMA models are similar to ARMA models, but are used for time series data displaying trends. ARMA models for the forecast are indentified by the form ARMA \((p,q)\) where \(p\) is the highest lagged used in autoregressive (AR) term, and \(q\) is the highest lagged moving average (MA) term. AR terms are a weighted sum of the previous values with the lag \(p\) having a direct effect on the estimated coefficient. MA terms are a weighted sum of errors with the lag \(q\) having a direct effect on the estimated coefficient. ARIMA models take the form ARIMA \((p,d,q)\) where \(d\) is the level of difference taken to offset any trends, seasonalities, or cycles and \(p\) and \(q\) have the same meaning as described in the ARMA model. Differencing is described as finding the difference between an observation and a later observation specified by the level of difference, so a difference of one means the use of the immediately following observation. For example, if the model for green peppers is ARMA \((1,1,1)\), it has an AR of one lag, one difference was taken, and an MA of 1 of lag. The prediction equation is specified in equation 1 below.
\hat{X} = \mu + X(t - 1) + \phi_1(X(t - 1) - X(t - 2)) - \theta_1(X(t - 1)) \\

ARMA (1,1) models looks similar to ARIMA except d is dropped and is specified in equation 2 below.

\hat{X} = \mu + \phi_1(X(t - 1) - X(t - 2)) - \theta_1(X(t - 1)) \\

Where \hat{X} is the predicted forecast, \mu is constant, \phi is the estimated coefficient on the AR terms and \theta is the estimated coefficient for MA terms. The term X(t - 1) represents the price recorded from the previous time period (Brockwell and Davis 1996). ARMA and ARIMA was selected over other methods as it is readily usable with small data sets and easy for producers to interpret. Both models also make sense from an economic perspective based on the assumption that farmers' will market their produce based on the most recent prices and the prices they have received throughout the season.
Chapter 4

Pricing Results

Differing ARMA and ARIMA models were used as the overall fit of the model and descriptive statistics were used to determine specification. The produce items chosen also have varying production capabilities, consumer usage and expectations that were also considered.

Table 4.1 ARMA and ARIMA Model Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
<th>Adjusted R-Squared</th>
<th>S.E. of regression</th>
<th>SSR</th>
<th>Log Likelihood</th>
<th>F-statistic</th>
<th>Prob (F-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Squash</td>
<td>ARIMA (0,1,1)</td>
<td>C</td>
<td>0.006101</td>
<td>0.0083</td>
<td>0.73828</td>
<td>0.4725</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.233877</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>-0.878383</td>
<td>0.109</td>
<td>-8.0562</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.057711</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>ARIMA (0,1,2)</td>
<td>C</td>
<td>-0.048466</td>
<td>0.0471</td>
<td>-1.0295</td>
<td>0.3162</td>
<td></td>
<td></td>
<td>0.367605</td>
<td>0.301037</td>
<td>0.959637</td>
<td>17.497</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>-0.143354</td>
<td>0.153</td>
<td>-0.9371</td>
<td>0.3605</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.012864</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>ARIMA (2,1,0)</td>
<td>C</td>
<td>0.071833</td>
<td>0.0923</td>
<td>0.77819</td>
<td>0.4545</td>
<td></td>
<td></td>
<td>0.487712</td>
<td>0.334025</td>
<td>0.416358</td>
<td>1.7335 -5.2429 3.17342</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AR(1)</td>
<td>-0.711741</td>
<td>0.2651</td>
<td>-2.6848</td>
<td>0.0229</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.072172</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AR(2)</td>
<td>-0.528986</td>
<td>0.2365</td>
<td>-2.2367</td>
<td>0.0493</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>0.887108</td>
<td>0.1519</td>
<td>5.83964</td>
<td>0.0002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0002</td>
</tr>
<tr>
<td>Potatoes</td>
<td>ARMA (1,0,0)</td>
<td>C</td>
<td>0.020307</td>
<td>0.0424</td>
<td>0.47843</td>
<td>0.6397</td>
<td></td>
<td></td>
<td>0.361326</td>
<td>0.315707</td>
<td>0.27173 1.0337 -0.7876 7.92042</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AR(1)</td>
<td>-0.600535</td>
<td>0.2134</td>
<td>-2.8143</td>
<td>0.0138</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.013786</td>
</tr>
<tr>
<td>Herbs</td>
<td>ARMA (1,0,1)</td>
<td>C</td>
<td>2.223097</td>
<td>0.0248</td>
<td>98.7123</td>
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<td></td>
<td></td>
<td>0.451844</td>
<td>0.367513</td>
<td>0.181099</td>
<td>0.4264 6.29745 5.35794</td>
</tr>
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<td></td>
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<td>AR(1)</td>
<td>0.535974</td>
<td>0.123</td>
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<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>-0.912989</td>
<td>0.1073</td>
<td>-8.5125</td>
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<td></td>
<td></td>
<td></td>
<td>0.0002</td>
</tr>
<tr>
<td>Greens</td>
<td>ARMA (2,0,2)</td>
<td>C</td>
<td>3.52361</td>
<td>0.2259</td>
<td>15.5974</td>
<td>0</td>
<td></td>
<td></td>
<td>0.454736</td>
<td>0.31842 0.703045 7.9084 -19.544 3.3359 0.036239</td>
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<tr>
<td></td>
<td></td>
<td>AR(1)</td>
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<td>0.225</td>
<td>-4.1002</td>
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<td>0.036239</td>
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<td>ARMA (2,0,1)</td>
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<td>0.0923</td>
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<td></td>
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<td>0.0002</td>
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<tr>
<td>Green Peppers</td>
<td>ARMA (2,0,1)</td>
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<td>72.1737</td>
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<td></td>
<td>0.175673</td>
<td>-0.03041 0.289231 1.0039 -0.5531 0.85245 0.49176</td>
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<tr>
<td></td>
<td></td>
<td>AR(1)</td>
<td>0.485936</td>
<td>0.4491</td>
<td>1.08207</td>
<td>0.3005</td>
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<td></td>
<td></td>
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<td></td>
<td>0.49176</td>
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<td></td>
<td>AR(2)</td>
<td>-0.567763</td>
<td>0.4955</td>
<td>-1.1459</td>
<td>0.2742</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>0.2742</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>-0.862393</td>
<td>0.2973</td>
<td>-2.9009</td>
<td>0.0133</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0133</td>
</tr>
</tbody>
</table>
**Tomatoes**

A commonly found product in direct markets, tomatoes are also used in seasonality pricing and high tunnel production studies (Huang and Lin 2006 and Donell et al. 2011), the forecast shows early season forecasted prices as high as $6.50/lb. and then prices slowly decrease to under $3/lb. (see Figure 4.1). The results are expected as other studies have shown tomato prices to decrease when in season (Huang and Lin 2006).

**Figure 4.1 Tomato Prices (Actual and Forecasted)**

![Graph showing tomato prices over the months from June to December. The actual prices start high in June and decrease over the season, while the forecasted prices also start high in June but decrease more sharply.]

**Cucumbers**

Cucumbers, forecasted as high as $2/lb. in June, are expected to steadily decrease as the season continues. Although cucumbers and tomatoes are both warm season crops, the steeper decrease could be attributed to consumer perceptions, the large increase in supply and the potential decreases in quality (see Figure 4.2).
Summer Squash

Another warm season crop item considered for high tunnels (Donnell et al. 2011), the forecasted summer squash prices unexpectedly increase throughout the season from $.71 to $.85 each. The small change when compared to cucumbers and tomatoes may suggest a decrease in supply as the season continues, especially considering that summer squash can be harvested continuously and at a range of sizes (see Figure 4.3).
Potatoes

In contrast to Goodwin et al. (1988) who finds that potato prices decrease at harvest, the forecast predicts potato price per pound to increase 25% from the beginning of the season to the end of December. This is especially surprising considering that potatoes can be harvested throughout the later stages of the growing season and can be readily stored (see Figure 4.4).
Carrots

Unlike the items mentioned so far, carrots are sold almost exclusively per bunch at direct markets. Hence producers do their own packaging and potential problems may arise when comparing prices. Further, pricing concerns arise as carrots can be harvested at various sizes throughout the marketing season. Although these attributes can create issues in providing forecasts for a like product, it still provides marketing insight for producers and had an approximate 40% response rate among producers and market managers for being offered in an extended season (see Figure 3.1). Typically a late summer and fall crop, we would expect prices to decrease as the season continues, but the forecasted increase may be due to the increase in carrot size and/or bundle size (see Figure 4.5).
Green Peppers

Forecasts show green peppers at a near constant price throughout the season. Typically considered a warm season crop, seasonality in price was expected. Although the constant in the model had a high t-statistic of 72.2, confirming a near constant price, the $R^2$ for the model was relatively low (.18) and suggests prices may be difficult to forecast (see Figure 4.6).
Herbs

Forecasting herb prices present a challenge as there are many different types of herbs and primarily sold on a per bunch basis. They were primarily considered for analysis as approximately 50% (see Figure 3.1) of market managers and producers responded herbs could be offered in an extended season. The increasing then stable herb prices are explained by a few factors. Considering herbs are one of the few products available early in the marketing season, the early low prices may be a result of the number of producers offering herbs, as well as a smaller bundle size. The stable prices throughout the rest of the season suggest a constant supply, similar packaging size amongst producers, and consistent consumer expectations (see Figure 4.7).
Greens

Exhibiting the same concerns as carrots and herbs, greens represents an uncertain product. Greens include many varieties that have different uses like spinach or cabbage and are typically sold packaged or by whole heads. For analysis, only packaged greens were considered. Also like carrots and herbs, greens received high response rates from market managers and producer for their potential in an extended season (see Figure 3.1). The forecast shows high variability in the beginning months then stable prices throughout the rest of the season. Typically offered throughout the season the variation in prices in the early months were unexpected but may be a reflection the inconsistency of package size and variety.
Conclusion

The forecasts show that the items have varying prices. While it was expected that prices would change throughout the season, many of the items changed in an unexpected manner. Potatoes, carrots, summer squash increased in price as the season continued, while herbs increased for a short time then leveled off for the remainder of season, greens level off in a similar manner, but had early season variability. The forecast for green peppers is unique as the prices are near constant for the whole of the season. Tomatoes and cucumbers behave as expected, as price drops as the season continues.

Forecasted price premiums cover a wide range from tomatoes and cucumbers showing premiums up to $3/lb. and $1.5/ea. respectively, while potatoes show only a $.50/lb. premium and summer squash a $.14/lb. premium. Packaged goods such as
carrots and herbs have a $2/bundle and $.5/bunch increase from the early season, but insights in package size are needed to determine if the change represents a premium. The variability in greens pricing makes it hard to determine a consistent premium, but produce can expect to price their greens at around $3.50/package. The green pepper forecast provide similar insights and producers in the region should base their prices off the $2.40/lb. estimate.
Chapter 5

Conclusion and Summary

As stated in the introduction the objective of the study was to address two main factors; to determine marketing realities and the likelihood of an extended marketing season and secondly, to provide insight into what product could be offered in an extended season and at what price.

1. Likelihood of Extension and Marketing Realities

Producers in the region present themselves as good candidates for market extension as 60% of producer participants had three or more years of experience, have adopted some season extension techniques, and receive low revenues under a short marketing season. Obstacles for producers include narrow marketing efforts, underutilization of high tunnels, increasing costs and potential consumer expectations.

As 91% of producers in the survey utilized farmers’ markets and 39% relied on a single farmer’s market, extending farmer’s markets may be the simplest method for direct marketers, but also exposes them to risk of a currently unknown market. The incorporation of new marketing and production strategies should be considered to offset this risk, with grower’s production capabilities and time constraints in mind. As Hardesty and Leff (2010) find, producers might even consider changing primary markets (such as CSA’s and farm standing) and using the farmers’ markets and it’s extended season as risk management tool. Producers should also consider organic and state branding as only 23% and 28% of producers use these labels respectfully, while 61% of market managers reported consumers would pay premiums for each. Recent studies support
this as Huang and Lin 2006) finds premiums for organic tomatoes and Nganje et al. (2011) finds premiums for state branded spinach and carrots. Producers and markets can also benefit from branching out from fresh produce. This represents a large potential for producers as 68% don’t process products, and only 5% offer beef, while 2% offer lamb and pork each.

High tunnels are likely to be a key part of market extension considering that 25% of producers used high tunnels and 27% of producers were able to market for 6 months or longer. Inexpensive versions of high tunnels such as Drost et al.’s (2008) are likely to be a key model for producers considering that cost was their chief objection. The increased adoption of high tunnels has multiple benefits as not only yields increase and producers are able to market for longer, but it strengthens farmers’ market as a whole through increased total offerings. University Extension education efforts on how to construct, manage, and the benefits of high tunnels can be catalyst for increased adoption.

Additional challenges arise when considering what may need to happen for markets to extend. With 61% of market managers reporting their consumers would prefer an indoor setting in an extended season and 44% citing it as requirement, only 28% have a suitable place identified. Profitability during an extended season may decrease as only 22% of market managers said their attendants would be willing to pay higher prices but 67% reported a significant cost involved and it is expected producers will have increased costs above regular costs stemming from extended production. Vendor fees, common in farmer’s markets may have to be renegotiated to encourage
extended season markets while potential additional advertising costs to encourage both producer and consumer attendance in the extended season will have to be managed.

2. Produce Offered and Pricing

Survey results from market managers and producers involving potential produce offered in an extended showed some mixed results. Items like herbs and greens had relatively high response rates from both market managers and producers, tomatoes had a low response rate from market managers and a high rate from producers. Green peppers, a crop that requires similar growing conditions to tomatoes, had the exact opposite response. The results show a need for extension education work focusing on extended season produce.

The ARMA and ARIMA results show seasonality in pricing even though responses from market managers and producers showed mixed indication of available premiums. Providing insight for producers, the results find that premiums exist for different goods at different times. Tomatoes and cucumbers have premiums in the early season, while summer squash, potatoes and carrot prices are forecasted to be higher in the late season, while green pepper prices are expected to be the same throughout the season at around $2.40/lb. It should be noted that carrot prices may be more related to change in bundle and carrot size than seasonality. Herbs exhibit low prices in the early season then level off for the remainder of the season at approximately $2.25/bunch. Greens show volatility in the early months then level off at $3.50/package. Carrots, herbs and greens can represent a changing product but the constant prices suggest consumers and marketers have found a common ground on price and packaging
regardless of variety. Although these numbers may show when to market individual items to increase revenue, cost structure, yields, time constraints, and marketing plans need to be considered for overall profitability. Ward et al. (2011) stresses profitability is dependent on market and crop selection and Conner (2011) argues variety plays a key part in firm performance. Producers may also have obligations to other markets, or better profit margins elsewhere. Further studies focusing on supply or availability and quantity sold at farmers’ markets with respect to price would offer important strategic insights.

Summary

This study successfully determined the likelihood of season extension and market realities by identifying potential issues and concerns for effective season extension. Survey results show uncertainty amongst producers and market managers in what could be offered in an extended season situation but the analyzed produce prices offer insight into what prices to expect.

The two research questions were answered by conducting surveys with farmers’ market managers and producers in the region. ARMA and ARIMA methods were used to analyze the collected prices for produce found at farmers’ markets which to determine seasonality.

The survey results show that although the producers in the region could benefit from market season extension, are experienced direct marketers, and have adopted some extension techniques, the market manager surveys show difficulties including increased costs, producers possibly unwilling to attend, little or no premiums and the
potential need to move indoors. Producer participation in alternate outlets and additional farmers’ markets, currently underused amongst producer respondents can both increase revenue and act as a risk management tool. Additional costs and benefits from production and marketing efforts will need analyzing from both market managers and producers.

Diversity in offerings is a weakness of producers in the region as few utilize certified organic or offer processed products or meats. Improvement in this area would increase offerings at markets, capture premiums and encourage market attendance.

The pricing models forecast that prices change throughout the season for most produce analyzed and provides insight to farmers for marketing and production strategies. Cooperative Extension can play an important part in educating producers about low cost high tunnels and crop selection, while further studies closely tracking supply and pricing at farmers’ market will greatly aid producers in production and marketing decisions.
Chapter 6

Self Reflection

While as an undergraduate student at Brigham Young University-Idaho, Dr. Stephen McGary gave me the opportunity to develop a program where students would grow and sell produce at the local farmers’ market. It was a truly special opportunity where I was given a lot of responsibility, and learned a great deal. At the time I wondered what impact this experience would have and certainly didn’t relate it to a future dissertation.

Writing my dissertation greatly improved my knowledge on the topic, research methods skills, and economic theory. I have also become better prepared for the workforce through improved communication skills and learning from my advisors from a different perspective than an undergraduate student would typically receive. Writing this paper has greatly increased my professional writing and analytical skills.

My hope is that this research will benefit producers in the region to make more informed production and marketing decisions and to hopefully extend their marketing season. Maintaining agriculture in the U.S. is very important to me and I feel these producers will play an important part in not only production but maintaining consumer interest and trust for all producers in the U.S.

I hope you found this dissertation both informative and enjoyable. I have found a lot of joy in the journey and would readily recommend this experience.
References


Gent, M.P.N. (1991) High tunnels extend tomato and pepper production' (Bulletin - Connecticut Agricultural Experiment Station, New Haven, 893)


[Date accessed 28.1.12]
## Appendix A: Pricing Sheet

Name: ____________________    Location: ________________    Date: _______________

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Price</th>
<th>Units</th>
<th>Variety/Color Description</th>
<th>Special Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Cucumbers</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Squash</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Green peppers</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Greens (lettuce, etc.)</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
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<td>Potatoes</td>
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<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Herbs</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Corn</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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<tr>
<td>Melons</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Peaches</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Sweet cherries</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Apples</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Raspberries</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
<tr>
<td>Strawberries</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
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</tr>
<tr>
<td>Blackberries</td>
<td>______</td>
<td>(pound, each, bushel, package ____ other ____ )</td>
<td>(organic, local, other: _____)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Name</th>
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<th>Units</th>
<th>Cut/Size Description</th>
<th>Special Labels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>______</td>
<td>(pound, each, package ____ other ____ )</td>
<td>(grass-fed, natural, organic, local, other: ____ )</td>
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</tr>
<tr>
<td>Pork</td>
<td>______</td>
<td>(pound, each, package ____ other ____ )</td>
<td>(grass-fed, natural, organic, local, other: ____ )</td>
<td></td>
</tr>
<tr>
<td>Lamb</td>
<td>______</td>
<td>(pound, each, package ____ other ____ )</td>
<td>(grass-fed, natural, organic, local, other: ____ )</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td>______</td>
<td>(pound, each, package ____ other ____ )</td>
<td>(grass-fed, natural, organic, local, other: ____ )</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>______</td>
<td>(carton ____ other ____ )</td>
<td>(free-range/cage-free, local, organic, other: ____ )</td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>______</td>
<td>(pound, package ____ other ____ )</td>
<td>(natural, organic, local, other: ____ )</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B: Producer Survey

Producer Survey

The Department of Applied Economics at the Utah State University is conducting a study to evaluate the potential for extending farmers market seasons in the Intermountain West/Great Basin, as well as the profit potential for season extension production techniques such as hoop houses. We are asking for your participation in this study. Your participation is voluntary and you may choose not to answer any of the survey questions. All information collected is confidential and the survey data will be securely stored on the USU campus. The survey should take approximately 10 minutes to complete.

Thank you for your time!

1. What is the location of your farm (county, state)?

2. What is the approximate size of your farm in acreage? (Check only one)
   - 1/4 acre or less
   - 1/4 to 1 acre
   - 2 to 5 acres
   - 6 to 10 acres
   - 11 to 50 acres
   - More than 50 acres

3. Which of the following products do you produce? (Check all that apply)
   - Fruits
   - Vegetables
   - Grains
   - Flowers
   - Beef
   - Lamb
   - Pork
   - Other (please specify)

   Other

4. What were your farm 2010 gross annual revenues? (Check only one)
   - Less than $1,000
   - $1,000-$4,999
   - $5,000-$9,999
   - $10,000-$19,999
   - $20,000-$39,999
   - $40,000-$59,999
   - $60,000-$99,999
   - $100,000-$249,999
   - $250,000-$499,999
   - $500,000 or more
Producer Survey

5. Which of the following best describes your level of farming experience? (Check only one)
   ○ New Farmer: Less than 1 year farming/ ranching or intern/apprentice level experience.
   ○ Intermediate Farmer: Production/marketing manager or primary operator with 1 to 3 years experience.
   ○ Experienced Farmer: Production/marketing manager or primary operator with more than 3 years experience.

6. Which of the following sales outlets do you use? (Check all that apply)
   ○ Farmers’ Market
   ○ CSA (Community Supported Agriculture)
   ○ Grocery Store
   ○ Farm Stand
   ○ You Pick Operation
   ○ Wholesale
   ○ Co-op
   ○ Other (please specify)

Other

7. If you sell at local farmers’ markets please list your top three markets (city, state).

Other

8. Which of the following labels or production techniques do you use? (Check all that apply)
   ○ Organic
   ○ Naturally Grown
   ○ Local Label (Utah’s Own, NevadaGrown, etc.)
   ○ Grass-Fed
   ○ Other (please specify)
   ○ None

Other
Producer Survey

9. Which of the following season extension techniques do you use? (Check all that apply)

- High Tunnels (Hoop Houses)
- Low Tunnels
- Raised Bed
- Plastic Cover
- Frost Cloth
- Heating
- Other (please specify)
- None

Other:

10. If you are not currently using season extension techniques, would you consider using them in the future?

- Yes
- No

11. If you are not currently using nor plan to use season extension techniques, rank the following potential reasons from 1 to 4, where 1 is the primary reason.

<table>
<thead>
<tr>
<th>Reason</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>Cost of supplies/equipment</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of information</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Supplier unknown</td>
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<td></td>
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<tr>
<td>Previous experience</td>
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</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other:

12. If you are currently using or plan to use season extension techniques, rank the following potential reasons from 1 to 4, where 1 is the primary reason.

<table>
<thead>
<tr>
<th>Reason</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Yields</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Higher Quality</td>
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</tr>
<tr>
<td>Extended Sales Season</td>
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</tr>
<tr>
<td>Other (please specify)</td>
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</tr>
</tbody>
</table>

Other:

13. Do you process any of your products (jams, jellies, bread, etc) to sell in the off season?

- Yes
- No
### Producer Survey

14. When do you normally start selling produce? (Check month and corresponding week)

- March
- April
- May
- June
- 1st Week
- 2nd Week
- 3rd Week
- 4th Week

15. When do you normally stop selling produce? (Check month and corresponding week)

- September
- October
- November
- December
- 1st Week
- 2nd Week
- 3rd Week
- 4th Week

16. Have you received higher prices (premiums) for produce by providing it when normally not available?

- Yes
- No

Approximate premium %

17. Please check the produce items you feel could be provided during an extended season.

- Apples
- Blackberries
- Beets
- Broccoli/Cauliflower
- Carrots
- Cucumbers
- Green Beans
- Herbs
- Lettuce/Greens
- Melons
- Onions
- Peas
- Peppers
- Potatoe
- Pumpkins
- Raspberries
- Strawberries
- Summer Squash
- Sweet Cherries
- Sweet Corn
- Tomatoes
- Value-added Products
- Winter Squash

Other (please specify)
Appendix C: Farmers’ Market Manager Survey

Farmers’ Market Manager Survey

The Department of Applied Economics at the Utah State University is conducting a study to evaluate the potential for extending farmers market seasons in the Intermountain West/Great Basin, as well as the profit potential for season extension production techniques. We are asking for your participation in this study. Your participation is voluntary and you may choose not to answer any of the survey questions. All information collected is confidential and the survey data will be securely stored on the USU campus. The survey should take approximately 10 minutes to complete. If you are a farmers market manager and manage more than one market, we ask that you fill out a survey for each market.

Thank you for your time!

1. Location (city/state) of the farmers’ market you manage.

2. What is your normal farmers’ market season start date (month/week)?

3. What is your normal farmers’ market season end date (month/week)?

4. How many vendors do you have participating in your farmers’ market this year? (Check only one)
   - Less than 20
   - 20-50
   - 51-100
   - 101-200
   - More than 200

5. What percentage of those vendors primarily sell fruits, vegetables, and herbs? (Check only one)
   - Less than 20%
   - 20-40%
   - 41-60%
   - 61-80%
   - More than 80%
Farmers’ Market Manager Survey

6. Do you think your produce vendors would want their products through your market for an extended season (either before the current start date and/or beyond the current end date)?

☐ Yes  ☐ No

7. Do you think customers would prefer to have the extended season outdoors or indoors?

☐ Outdoors  ☐ Indoors

8. Do you think vendors would prefer to have the extended season outdoors or indoors?

☐ Outdoors  ☐ Indoors

9. Are you considering extending your farmers' market season?

☐ Yes  ☐ No

If not, why?

10. If yes, what would be the new start and end dates?

☐

11. Will extending your season require moving your market indoors during part of the season?

☐ Yes  ☐ No

12. If yes, do you have a suitable location identified?

☐ Yes  ☐ No

13. Would there be a significant expense in securing the indoor site?

☐ Yes  ☐ No

14. Do you feel your customers would be willing to pay higher prices for produce in the extended season over what they are now paying in the regular season?

☐ Yes  ☐ No
### Farmers' Market Manager Survey

15. Which produce attributes do you feel your customers would be willing to pay more for during the extended season? (Rank from 1-5, with 1 as the highest and 5 the lowest.)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Availability</td>
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</tr>
<tr>
<td>Grown Locally</td>
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</tr>
<tr>
<td>Naturally Produced</td>
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<tr>
<td>Organically Grown</td>
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<tr>
<td>Other</td>
<td></td>
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</tr>
</tbody>
</table>

Other (please specify)

16. Please check the produce items you feel producer vendors could provide during the extended season.

- Apples
- Blackberries
- Broccoli/Cauliflower
- Carrots
- Cucumbers
- Green Beans
- Herbs
- Lettuce/Greens
- Melons
- Onions
- Peas
- Peppers
- Potatoes
- Pumpkins
- Raspberries
- Strawberries
- Summer Squash
- Sweet Cherries
- Sweet Corn
- Tomatoes
- Value-Added Products
- Winter Squash

Other (please specify)

17. Would you like information or educational workshops on the following topics? (Check all that apply)

- Market promotional methods
- Signage or graphics
- Vendor recruitment/benefits
- Vendor management
- Consumer recruitment/promotions
- Market regulations/regulation enforcement
- Electronic payment possibilities/potential
- Collecting customer feedback/conducting surveys

Other (please specify)