

Evaluation of Feasibility of Fruit and Vegetable Crops Using Market Window Analysis*

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Abstract

Fruits and vegetables have been identified as potential production alternatives to use available farm resources. Several "market window" studies have been undertaken to evaluate such feasibility. These state and regional studies are analyzed and compared to identify underlying assumptions and methodologies. Recommendations of the studies are evaluated on an aggregate basis and limitations of the market window technique are identified and discussed. The technique was judged to be useful in planning because it involves consideration of potential costs to be incurred, markets to be evaluated, and price expectations for the various commodities considered.

Introduction

Recent economic conditions in agriculture have led to a decrease in farm income and increased stress on many farm families. As a result, farmers have considered alternative means to improve their economic plight. One alternative receiving much attention has been

the intensive production of fruits and vegetables.

A problem confronting farmers considering fruit and vegetable enterprises involves effective estimation of the potential of these products for the commercial market. To help farmers determine which crops to produce and to identify feasible market outlets and time periods, several state and regional studies have been initiated to analyze fruit and vegetable production and marketing potential (Collete and Wall; Hinson and Lanclos [a, b, c], Love et al.; Mizelle; Mook and Anthony; Narrie and Free; O'Rourke [1984]; Task Force; Venturella et al.; Zwingli et al.). Most of these studies used the "market window" approach. Several definitions of a market window have been developed including: the period when the price of the product in a given market is above the cost of producing, packaging, transporting, and marketing the product in that market (Narrie and Free); a time when produce volume declines or when prices strengthen in a market (Mizelle); when market price for a commodity is greater than the suppliers' delivery costs for a long

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enough period to justify a reasonable production scale (O'Rourke); or a particular period of time during which a commodity can be sold, at a profit, on an existing market (Venturella et al.).

From these definitions, one can observe that the theoretical underpinnings of this approach are basic. That is, if a quality product can be efficiently produced and distributed by producers and the price of that product in a target market exceeds the sum of the per unit cost of production plus the per unit costs incurred in accessing that market, a "market window" exists. While the concept is simple, effective application of the rationale involved can be rather detailed and time consuming. Evaluations using this approach can vary from cursory comparisons of per unit prices with per unit production and marketing costs to detailed studies of these items and their variation plus the levels and variation in their constituent parts.

This paper provides a discussion of the nature of the technique with emphasis given to the requirements for undertaking such analyses and caveats in using this approach. Approaches used in seven studies and results for two enterprises (broccoli and squash) are evaluated in isolation and in the aggregate to analyze potential impacts on the industry if recommendations are implemented.

Overview of Market Window Methodology

In a planning context, market window analysis represents the basics in evaluating feasibility of production of fresh fruit and vegetable enterprises for the market. This is clear when the feasibility criterion is analyzed:

(1) Market level -

$$\text{Price per unit at target market} > \text{Production cost per unit} + \frac{(\text{Transportation} + \text{marketing costs to target market})}{\text{unit}}$$

or

(2) Farm level -

$$\text{Price per unit at target market} - \frac{(\text{Transportation} + \text{marketing costs to target market})}{\text{unit}} > \text{Production cost per unit}$$

If equation (1) or (2) is affirmative, a market window is assumed to exist. Note the implicit role that components of this formulation play; that is, opportunity for feasibility is enhanced through operational efficiency if production and marketing costs are minimized and

yields are maximized. Inherent in the market side of the relationship are product flow and competition in a particular market. If flows are low from the region and relatively high from more distant suppliers, greater opportunity tends to exist in a market. Conversely, if shipments are high and prices are low, there is probably little opportunity for market development.

The market window technique is considered to be a simple, inexpensive, and reliable screening device for those investigating the market potential for different crops. It also aids in determining what changes in production costs, yields, transportation costs, or other factors may be needed to enter a market (O'Rourke). The evaluation process consists of seven steps or components:

- 1) identification of feasible commodities,
- 2) identification of potential target markets,
- 3) establishment of price expectations,
- 4) development of production cost estimates (cost expectations),
- 5) estimation of marketing and transportation costs,
- 6) analysis of market alternatives, and
- 7) identification of feasible markets and market periods.

Consideration of these components can vary substantially among different individuals and studies. Research involving market window analysis has used techniques ranging from simple visual analysis of price and volume trends to more complicated empirical programming models (Mook). (See Table 1 for details of particular studies.)

In identifying feasible commodities for evaluation, factors such as production history of the area; resource, market, and infrastructure availability; capability and commitment of producers; and competition from other areas are important. Advice from production and horticultural specialists can also be beneficial in terms of defining soil, water, disease, pest, plant, and other agronomic considerations.

Fruit and vegetable production for commercial markets is intensive and requires a high degree of management acumen. Areas having producers with experience who produce high valued crops and who understand the risks and

Table 1. Nature of Market Window Studies Conducted for Fresh Fruits and Vegetables in Various States and Areas, United States, 1978-87

Study	Components of Market Window Analysis					
	Identify feasible commodities	Define target markets	Establish price expectations	Develop production cost estimates	Estimate marketing costs	Define feasible marketing periods
Georgia	Evaluation of Georgia's competitiveness and the nature of demand for particular products by University personnel	Atlanta, Boston, Detroit, Dallas, Birmingham, Cincinnati, Cleveland, New York City, Memphis, Columbia, S.C., St. Louis, Chicago, Miami, Louisville, Philadelphia, New Orleans, Pittsburgh, Toronto, Montreal	Average seasonal price data for 1978-81 or 1978-82	From budgets developed by University personnel	Estimated from USDA Fruit and Vegetable Truck Rate Reports	When price strengthens and volume declines in a market and produce is available from the Georgia area
Kentucky	University personnel identified fruit and vegetable crops being produced or which could be produced commercially	Atlanta, Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Louisville, Memphis, Nashville, Pittsburgh, St. Louis	Average weekly prices for 1971-84 and 1980-84 with consideration of high and low prices	Based on budgets developed by Cooperative Extension Service and University personnel	Not identified	Comparison of average weekly price with cost of production
Louisiana	By University personnel	Chicago, St. Louis, Dallas, Atlanta, New Orleans	Average weekly prices for 1980-86 period; one standard deviation used to evaluate price risk	Derived from budgets which include varying assumption about machinery size; yields are 50% & 75% of levels assumed for a small farm	15% of wholesale price	Comparing average weekly price by crop and market with cost of production

Table 1 continued.

Study	Components of Market Window Analysis					
	Identify feasible commodities	Define target markets	Establish price expectations	Develop production cost estimates	Estimate marketing costs	Define feasible marketing periods
Mississippi	By University personnel	Chicago, New York, New Orleans, Birmingham, Atlanta, St. Louis, Dallas	Average monthly FOB prices for 1980-84 plus shipping costs	From budgets developed excluding irrigation but yields are based on irrigation being present	Initially estimated on a truckload basis and then converted to a per unit basis	When competing shipping price plus cost of marketing and distribution is sufficiently higher than potential supplier's break-even production cost plus marketing cost
North Florida	By University personnel	Atlanta	Average weekly farm level prices for 1969-76 with coefficient of variation and first and second differences used to reflect risk	Not explicitly evaluated	Not explicitly evaluated	Length of market window was determined as the period in which the weekly average price is consistently above the seasonal average price
South Mountain Alabama	By Cooperative Extension Service and Experiment Station personnel	Atlanta, Cincinnati, St. Louis, Baltimore, Chicago, New Orleans	Average weekly wholesale prices for 1979-83 reduced by 15% to reflect marketing service charges	From budgets developed for the area based on recommended practices and varieties with irrigation; 70% & 100% yield levels evaluated	15% of wholesale price	When price less one standard deviation was greater than "at market" cost
South Carolina	Evaluation by University personnel	Atlanta, Boston, Buffalo, Baltimore/Washington, Chicago, Detroit, Montreal, New York, Ottawa	FOB shipping point prices for 1973-84 with the variance and coefficient of variation used to reflect risk	Based on budgets developed in Department of Agricultural Economics with yield expectations based on research findings	USDA shipment data were used to determine flows into markets	Evaluated returns above variable cost, coefficient of variation for FOB prices, and shipment and arrival data

Table 1 continued.

Components of Market Window Analysis						
Study	Identify feasible commodities	Define target markets	Establish price expectations	Develop production cost estimates	Estimate marketing costs	Define feasible marketing periods
South-eastern Oklahoma	By research personnel based on potential for commercial production and producer interest	Chicago, Dallas, Los Angeles, St. Louis	Average weekly high and low price data for 1980-84	Oklahoma State budgets were customized to the area	15% of wholesale price	When production plus packaging, marketing, and transportation costs exceeded the price
South Virginia	By University personnel	Atlanta, Baltimore/Washington	Median weekly and monthly price data for 1977-81 along with highs and lows specialists	Based on budgets developed by Cooperative Extension Service	15% of wholesale price	When production plus transportation costs exceed low price in the market
Tennessee River Valley	University personnel identified fruit and vegetable crops being produced commercially	Atlanta, Chicago Cincinnati, Cleveland, Detroit, Indianapolis, Louisville, Memphis, Nashville, Pittsburgh, St. Louis	Average weekly prices for 1971-84 or 1980-84 with consideration of high and low prices	Based on budgets developed by University Cooperative Extension Service personnel	Not identified	Comparison of average weekly price with cost of production
Washington	Those currently grown or potentially adaptable to Washington conditions and with weekly price data and potential in L. A. market	Los Angeles	Average weekly prices for 1978-81	Derived from various cost studies	Transportation cost estimates were obtained from USDA, AMS	Compared market prices with break-even cost/price

management requirements of such production are likely to access markets successfully if they also have a favorable resource base and infrastructure. Quality management, sufficient resources, and proper facilities play an important role in influencing the yield and quality of the product. Ultimately, if a high quality product that has low production and distribution costs is offered to the market, chances for success are enhanced.

Accessibility to markets and competitive status with other producing areas are key factors affecting identification of target markets. Analyses of volume, price, and sources of produce in a particular market over time can provide clues as to potential. If low volume in a market comes at a time when production and access to the market are favorable for an area, the first major step in identifying feasibility is complete. That is, feasibility from the supply side of the market seems positive. However, high quality data for some markets are often lacking and such evaluation is thus frequently limited.

Establishment of price expectations over a period of time for particular products and markets is one of the most difficult tasks in market window analysis. Historically, farmers have used rather basic price expectation processes in planning, such as last year's price, the price at planting, or the price at planting adjusted for experiences and expectations of the producers. While these may sometimes be reasonably correct, prices for fresh fruits and vegetables are quite volatile and thus such estimates may be insufficient. Given this, how should price expectations be formulated? Which prices should be used--daily, weekly, or monthly; how should price be represented--average, medium, high, low, or some forecasted level for some base period--3, 5, 7, etc. years? What level of the market should be used--wholesale, FOB shipping point, wholesale adjusted for marketing and transportation costs, etc.?

Even before these issues are settled, if the market is somewhat thin, the analyst must gauge whether volume is sufficient to make a price expectation "reasonable." Also, what price should producers who are outside traditional supply areas expect? Since prices are highly volatile, consideration should be given to variation in price as well as level so that price risks can be evaluated. Alternatives may include the variance, standard deviation, coefficient of variation, etc. While this entails a higher degree of sophistication, it also requires more involve-

ment. Alternative approaches for addressing these questions and issues are presented as a part of the discussion of studies which have been completed.

Cost and return budgets may be used to derive cost expectations (break-even price) or cost per unit for the area under study. Budgeting can be a complex process that involves numerous assumptions about prices, costs, equipment complements, appropriate levels of technology, yields, size of operation, etc. If a market window analysis is being conducted for an area that is outside traditional supply sources, what are reasonable assumptions about these items? Should budgets for inexperienced fruit and vegetable producers reflect lower yields and higher costs per unit and, if so, by how much? That is, what is a reasonable level of yield risk--a 10 percent, 30 percent, 50 percent, etc. reduction of "standard" yields? Certainly, this depends somewhat on the nature of the area being evaluated and its producers.

Also, how much effort should be devoted to making budgets sensitive to higher production costs and lower yields that are typically incurred as the production season progresses? That is, are changes in irrigation, insecticide, herbicide, fungicide, etc. costs with the progression of the production season sufficient to alter cost expectations? Since feasibility can be greatly influenced by assumptions about yields and costs, careful attention should be given to this area.

To evaluate market feasibility effectively either for a market or between markets, an estimate of marketing cost is needed. This can be accomplished by establishing a flat rate (percentage of price such as 9, 12, 15, etc.) to reflect transportation, marketing, etc. costs. Or, a marketing cost per unit can be derived by collecting data for brokerage fees, handling costs, transportation rates, etc. and weighting the aggregation of these costs by units handled. This approach has the advantage of being more representative because marketing cost differentials among commodities can be addressed in evaluation of market potential. However, it can be more complex and time consuming because of data and analysis requirements.

Once all data are available, the final two steps of the market window procedure involve an analysis of market alternatives and definition of feasible markets and market periods. While the criterion for feasibility is simple and straightforward, its application can be much less clear. For example, is simply having the price

expectation (say the average weekly price for the last three years) above expected cost sufficient to define feasibility of a market window? Or, should feasibility be defined as periods when price less one standard deviation exceeds the expected cost? That is, how should the issue of price variability be addressed? And, if feasibility is defined for a week, what number of feasible weeks justifies attempts to exploit that market. Or, giving consideration to the buying side of the market, how long must you be able to supply produce to a market for purchasing firms to be willing to abandon "traditional" suppliers and supply areas to buy from you? Obviously, there is much room for judgment in this process.

As indicated earlier, market window analysis represents the basics in planning. Detailed application of this technique forces the producer to evaluate factors which will ultimately determine profitability, i.e., efficiency in production and marketing. Major shortcomings involve assumptions that firms can produce sufficient volumes of quality product to access "commercial" outlets and that these markets *can* be accessed by the producing units. Neither of these is assured, especially for producers in areas that are outside "traditional" supply regions.

Examples of Results from Market Window Analyses

Results of market window studies undertaken in Alabama-AL (Zwingli et al.), Georgia-GA (Mizelle), Kentucky-KY (Love et al.), Louisiana-LA (Hinson and Lanclos, a, b and c), Mississippi-MS (Task Force), Oklahoma-OK (Mook and Anthony), South Carolina-SC (Venturella et al.), and Virginia-VA (Runyan) are presented in Tables 2 and 3. With the exception of the Louisiana and Oklahoma studies, spring and/or fall market windows were identified for each enterprise. The spring window for broccoli generally spanned a period from early April through June while the fall season ranged from late August or early September to early December. Similarly, for squash, the spring season started in June and extended into July while the fall window was primarily in September and early October. Thus, on a state-by-state basis, implications are for producers to increase the acreage of broccoli and squash.

However, when results of the alternative studies are evaluated in the aggregate, difficulties with these recommendations become apparent, especially for broccoli. With

California being the dominant supplier of broccoli and market prices being highly sensitive to additional quantities in the market, additional production by one or several of the areas could depress market prices and adversely influence feasibility. That is, viability of the approach depends to a degree on structural stability of markets. Somewhat offsetting this concern is the fact that the various studies evaluated several different markets, and feasible marketing periods vary due to weather conditions.

Summary, Implications, and Recommendations

The ability to produce and market fruits and vegetables is greater in some areas than in others. However, fruit and vegetable production in each "non-traditional" producing area requires consideration of many factors. The studies evaluated recommended several actions that must be implemented for these areas to produce profitably. "Non-traditional" area producers should also be aware of competing regions' shipment periods to the market in order to fill the "slack" periods when prices would be more favorable. If feasible, development of storage capability could allow producers some flexibility in entering markets for certain commodities. This should be evaluated cautiously, especially for early season producing areas which face strong competition from other areas as the season progresses.

For the production of fruits and vegetables to be feasible, producers in the "non-traditional" supply areas must obtain high yields and provide high quality shipments to the market. High yields result in lower per unit costs and high quality makes the product more desirable in the marketplace. Since fresh produce buyers may be reluctant to purchase from non-traditional supply areas, these factors can enhance the opportunity for market entry. Producers must be conscious of quality enhancement and maintenance factors at the production, harvest, and marketing stages.

To enhance feasibility, producers should attempt to extend their traditional marketing periods by such means as alternative varieties and technologies. For example, use of early maturing varieties or plastic can allow the producer to enter markets when prices are often more favorable. Also, early and late plantings can be beneficial. However, these alternatives generally entail higher risks and should be evaluated cautiously.

Table 2. Summary of Potential Market Window for Broccoli as Derived from Selected Studies in Various States and Areas, 1978-87^a.

Month and Week	State or Area							
	AL	GA	KY	LA ^b	MS	OK	SC	VA
Jan 1								
2								
3								
4								
Feb 5								
6								
7								
8								
Mar 9								
10								
11								
12								
Apr 13								
14								
15								
16								
17								
May 18								
19								
20								
21								
Jun 22								
23								
24								
25								
Jul 26								
27								
28								
29								
30								
Aug 31								
32								
33								
34								
Sep 35								
36								
37								
38								
39								
Oct 40								
41								
42								
43								
Nov 44								
45								
46								
47								
Dec 48								
49								
50								
51								
52								

^aSeveral studies evaluated multiple alternative markets. Results presented are for the most feasible market.

^bThe market window ranges from week 36 to week 26 of the following year.

Table 3

Summary of Potential Market Windows for Squash
 As Derived from Selected Market Window Studies in Various States and Areas, 1978-87^a

Month and Week	State or Area							
	AL	GA	KY	LA	MS	OK	SC	VA
May 18								
19								
20								
21								
Jun 22								
23								
24								
25								
Jul 26								
27								
28								
29								
30								
Aug 31								
32								
33								
34								
Sep 35								
36								
37								
38								
39								
Oct 40								
41								
42								
43								
Nov 44								
45								
46								
47								

^aSeveral studies evaluated multiple alternative markets. Results presented are for the most feasible market.

While the market window technique is relatively simple and is quite useful for planning purposes, it is not without limitations. In some of the studies analyzed, volume movements of a particular commodity through specific terminal markets were difficult to obtain. This is important because volume data are needed to assess effectively whether a potential market window is present since the producer would want to enter into a market when there is sufficient demand for the product at a price favorably compared to the costs incurred in production. However, potential as defined by the market window approach does not guarantee market entry.

Most market window studies are based on supply and demand factors which affect the volatility of fruit and vegetable prices. These factors are highly influenced by conditions that the market window technique does not take into account, such as climate and other producing areas entering into the market. This is an important limitation since prices of many commodities are highly responsive to volume changes and a relatively small increase in production and supply could alter the profitability of a commodity. Thus, some knowledge of price-quantity relationships for a market could help define the responsiveness of price to changes in volume in that market.

The expected market price also cannot be determined exactly. However, after a period of years in most markets, price trends can be observed and, as long as there is no significant change in the production areas supplying a particular product to the market or other major structural changes, prices should remain fairly reflective of market conditions. Other problems exist with obtaining transportation and marketing costs data. Probably the most important limitation of market window studies is the fact that no cost data exist for a commodity in the precise growing conditions confronted by a new producer or production area. Thus, researchers for most market window studies have based much of their cost and some price and volume data on information reported in the most recent comparable studies. This practice can lead to inappropriate conclusions and recommendations because the data are derived by "considering" historical relationships rather than current conditions.

Even with these shortfalls, the "market window" technique appears to be a simple and inexpensive device for evaluating market potential of a variety of crops and is also helpful in determining what changes in produc-

tion costs, transportation costs, yields, and other factors are necessary for a crop to enter into a particular market. Further research and more efficient use of market window techniques are needed to make sure the conclusions are justified. Primary data such as direct producer and buyer surveys and interviews can be used to substantiate analytical results. While market window analysis has its shortcomings and thus basically reflects a "first analysis" of feasibility, it is extremely useful in planning because the analysis involves consideration of potential costs to be incurred, markets to be evaluated, and price expectations for the various commodities considered.

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