The Process for Evaluating Agricultural Alternatives: An Eastern Shore Example

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INTRODUCTION

Virginia agriculture is constantly changing. New enterprises are introduced as producers seek to add diversity to their operations or to fill niche markets. Shittake mushrooms, broccoli, and ostriches are among alternatives that have been explored by Virginia producers. With modern technology, the number of agricultural products that can *physically* be produced in Virginia is virtually unlimited.

With so many potential alternatives, the crucial question is: which products or practices can *economically and competitively* be produced in Virginia? The answer is important for individual producers to maintain a profitable mix of enterprises. It is also important for state-level agricultural policy and for decisions on how research and education dollars should be allocated among competing agricultural enterprises.

A straightforward, easily followed procedure is needed to evaluate the potential of new enterprises or the potential of production changes in existing enterprises. This report outlines such a procedure or process and then details an example from Virginia's Eastern Shore. Information for the illustrative example was obtained from research evaluating the potential of several new vegetable crops.

The evaluation procedure combines information on production, economics, and marketing considerations: *Information from all three areas is necessary to evaluate adequately possible production alternatives and to minimize the risk that a new enterprise will not succeed.* Many of the questions raised about potential new enterprises can be answered by the farmer alone or in consultation with Virginia Cooperative Extension personnel. To do so, however, *a farmer considering the new enterprise will have to do a substantial amount of work and get directly involved in the analysis.*

EVALUATING A NEW ENTERPRISE

There are five basic steps in evaluating any new enterprise:

Step 1: **Production Potential**
An evaluation of the physical production potential of the alternative(s), including consideration of interactions with other existing enterprises.

Step 2: **Production Cost Analysis**
An estimation of the total *and* per unit costs of production. Expected yields are an essential component of the estimation. A cost-sensitivity analysis is also necessary.

Step 3: **Market Potential**
An evaluation of marketing alternatives that includes market location, prices, and any potential competitive advantages or disadvantages.

Step 4: **Profitability**
A comparison of the potential profitability of each individual alternative, including impacts on the whole-farm situation when new enterprises are introduced.

Step 5: **Sensitivity and Economic Risk**
An analysis of changing returns given changes in costs, yields, or prices, and an estimation of the likelihood of those changes. This step in the process looks at how susceptible the measure of competitiveness or profitability is to (even small) changes in production costs or selling prices.

The example presented here is an evaluation of vegetable crop alternatives for a group of producers on Virginia's Eastern Shore. These producers were interested in possible alternatives for diversifying their vegetable crop operations.

Step 1: Production Potential

Typical questions in determining the production potential of the enterprise would be the following:

- Can the proposed enterprise physically be produced in Virginia, or in the particular part of Virginia in question? Three climatic areas in Virginia—Coastal, Piedmont, and Ridge and Valley—should be considered.
- Does the area considered for production have suitable soils?
- Is adequate moisture available, either through rainfall or through irrigation?
- Will pest problems limit the production, or can they be controlled?
- What new management skills are required to undertake the new enterprise?[1]

Eastern Shore Production Feasibility

For the Eastern Shore vegetable growers who participated in this study, the first step involved identifying which alternative crops would fit physically with Eastern Shore conditions and cropping practices. Four vegetable crops, those currently used in Eastern Shore rotations, were identified as being the "traditional" commodities: cucumbers, snap beans, potatoes, and fall peppers. Five additional vegetable crops were identified as possible "alternative" crops: spring peppers, western melons, watermelons, lettuce, broccoli, and strawberries grown as an annual crop. Selection of alternative crops was based on physical production needs of the crops, farm conditions and practices, and what the growers thought they could manage given these circumstances. The crops were selected and rotations established during a series of meetings among researchers, growers, and personnel from Virginia Cooperative Extension (VCE) and the Virginia Department of Agriculture and Consumer Services (VDACS).

Rotations

The second part of evaluating production potential was to establish rotation patterns involving the alternative crops. Current crop rotations were documented, including traditional vegetable crops and traditional non-vegetable crops. Next, planting and harvesting patterns of the alternative crops were identified for the Eastern Shore. Finally, 153 possible new rotations were devised by introducing the alternative crops into current rotation patterns, using best management agronomic practices. These rotations included all reasonable combinations of traditional vegetable, traditional non-vegetable, and alternative crops. Best management practices to limit disease/pest problems dictate that watermelons be planted in the same field only once every five years, with no other cucurbits in the rotation. This type of restraint or best management practice was applied to all of the alternative crops.

Step 2: Production Cost

Once an enterprise has been identified as a viable production alternative, the second step in the evaluation process is determining the cost of production. This determination is directly linked to step one. For example, if broccoli were being considered as an alternative, it might be produced for processing or for the fresh market. The production processes would vary and so would the costs. This variation is true for most alternatives: production costs can vary widely depending on the production process.

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[1]For an individual farm-level decision, one must also evaluate whether a proposed new enterprise will physically fit in with the total farm plan. This is considered under Step 4, evaluating the effect on whole-farm productivity.

To develop production cost estimates, at least the following questions must be considered:

- What are the steps in the production process?
- How much labor and machinery will be required for each step?
- What other resources will be required for each step?
- How much will all the factors used in each step of the production process cost per unit of product?

The process we recommend is the use of a *production budget*.[2] The Eastern Shore example in Table 1 will show, in detail, the use of production budgets, but first the general guidelines for all production budgets are presented:

- Accurate production budgets must be developed for each alternative being considered, as well as for crops currently being grown in rotation.
- A complete budget consists of three sections: 1) estimates of machinery costs; 2) the production budget; and 3) a sensitivity analysis of land costs, yields, and prices.
- Budgets should include costs from planting through harvest and include any post-harvest costs such as packing, cooling, and transportation to the shipping point (i.e. to the packing shed or loading platform) that are incurred by the farmer.
- Published budgets, such as those in this report are available at VCE offices, should not be taken as the actual cost of production for any one individual. *Each farm will have its own unique features (soil type, rainfall, topography, etc.) that will affect the cost of production.*
- Given the wide variation in costs faced by individuals, they must carefully adjust available budgets in order to make them representative of the individuals' situation.

Eastern Shore Production Cost Analysis

Production budgets were developed for both the traditional vegetable crops (potatoes, snap beans, cucumbers, and fall peppers) and selected alternative crops (broccoli, watermelon, western melons, Boston and Romaine lettuce, and spring peppers). The current budgets developed by VCE for wheat, barley, and soybeans in Eastern Virginia were modified to reflect prevalent costs on the Eastern Shore. The cost of many items varies widely, so typical values were chosen for the Eastern Shore example. For example, many factors influence land rental, and rental prices can range from $30 per acre to over $100 per acre. A rental of $60 per acre was selected and used in the budgets developed in this report.

Estimates of pesticide costs were based on commonly used pesticide programs and the Commercial Vegetable Production Recommendations (see Virginia Cooperative Extension Publication 456-420), but specific chemicals are not listed. The actual cost of pesticide treatment will vary depending upon pest pressure, the chemicals used, their cost, and the number of applications needed to maintain marketable quality.

The Eastern Shore example budgets in this report all follow the same two-section format: fixed and variable cost estimates are presented, followed by a cost-sensitivity analysis. The following discussion explains the specific components of the budgets, using Eastern Shore spring cucumbers as an example (Tables 1 and 2). Budgets for other Eastern Shore crops are in Appendix A.

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[2] Virginia Cooperative Extension personnel, particularly area farm management agents, can help with production cost analysis and preparation of production budgets.

Total Cost Estimates for Production

The total variable and fixed costs were estimated for each crop, as of 1993 (see Table 1 for spring cucumbers). The variable costs were divided into production and harvest expenses. For spring cucumbers, the per acre, variable production costs included seed ($64.50), fertilizer ($73.95), spray materials ($31.22), irrigation ($30.00), production machinery ($22.75), miscellaneous ($45.00),[3] and interest on operating capital ($12.03). Variable harvest costs included supplies ($20.00), custom harvest labor ($327.00), harvest machinery ($5.73), hauling to the packing shed ($16.80), and production and harvesting labor ($53.65). The total variable costs for spring cucumbers equaled $702.63 per acre.

Fixed costs (lower part of Table 1) included annual payments, interest on salvage value, insurance, taxes and housing the irrigation equipment ($67.42), production and harvesting machinery ($27.08 + $7.95 or $35.03), and trucks ($14.40). A land rental fee of $60.00 per acre was also included in fixed costs. Because spring cucumbers usually are followed by a fall crop, only one-half of the land rent and irrigation equipment was charged to the cucumber crop. Total fixed costs for spring cucumbers equaled $146.85 per acre. The total costs, then, equaled $849.48 per acre.

The last column on the right of the production budget is blank and is labeled "your farm." *In order to be able to assess the viability of the alternatives for their operation, individual growers need to enter their own cost estimates in that column and calculate the total production cost for the enterprise for their unique set of farm-level conditions.*

Per Unit Cost Analysis

Fixed costs vary tremendously from farmer to farmer, so alternative enterprises should be compared on the basis of variable costs. The most instructive measure is the *variable cost per unit of production*. To calculate the cost *per unit*, an estimated yield per acre is needed for each crop. The estimate should reflect the average yield over several years. Harvesting costs are based upon the total crop yield, of which a portion will not be of saleable quality, but per unit cost analyses and sensitivity analyses are based upon the *marketable product only*. For new or alternative crops, conservative yield estimates are preferred so that the per unit cost estimates have some “safety factor.”

[3]Any cost specific to the particular crop should be included as a miscellaneous expense. Because bees are needed for pollination of cucumbers, the miscellaneous cost in this example includes bee hive rental.

Table 1. Per acre production budget for 1993 spring market cucumbers, with overhead irrigation.

Item Receipts	Marketable Yield 175 cartons	Unit Cost	Total	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	1.50	43.00	$64.50	.....
Nitrogen, lb.	100.00	0.26	$26.00	.....
P205, lb.	100.00	0.22	$22.00	.....
K20, lb.	100.00	0.15	$15.00	.....
Spreading/Ac	1.00	5.00	$5.00	.....
Lime, ton[a]	0.17	35.00	$5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Publication 456-420)				
Nematicides			$0.00	.....
Fumigation			$0.00	.....
Herbicides			$3.02	.....
Insecticides			$11.70	.....
Fungicides			$16.50	.....
Plastic mulch			$0.00	.....
Machinery - Production				
Irrigation, per acre-inch	2.50	12.00	$30.00	.....
Production machinery repairs			$14.03	.....
Fuel, oil			$8.72	.....
Miscellaneous, bees			$45.00	.....
Interest	267.42	4.50%	$12.03	.....
HARVEST COSTS				
Supplies			$20.00	.....
Harvest containers	0.00	0.00	$0.00	.....
Custom harvest labor[b,c]	240.00	1.30	$327.00	.....
Custom sort/grade/box			$0.00	.....
Harvest machinery repairs			$3.07	.....
Fuel, oil			$2.66	.....
Haul to packing shed	240.00	0.07	$16.80	.....
Labor - Production	6.30	$5.00	$31.50	.....
- Harvesting	4.43	$5.00	$22.15	.....
SUB TOTAL VARIABLE COSTS			$702.63	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			$27.08	.....
- Harvest			$7.95	.....
Truck depreciation	240.00	0.06	$14.40	.....
Land (double cropped)	0.50	60.00	$30.00	.....
Irrigation (double cropped)	0.50	134.83	$67.42	.....
SUB TOTAL FIXED COSTS			$146.85	.....
TOTAL COSTS			$849.48	.....
TOTAL COST PER UNIT EXC. LAND AND MANAGEMENT @175-56 LB. BU.			4.68	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @ 175-56 LB. BU.			4.85	.....

[a] Lime apportioned over three years, double cropped (6 crops total).
[b] Based upon labor cost of $1.30/bushel for 240 bushel/acre (total yield) + $15/acre labor crop costs.
[c] Of the 240 bushel/acre total yield, 175 bushel on average will be in grade "super." Crop transported to packing shed for grading.

For cucumbers, there is more than one marketable grade, but the large or "supers" is usually the predominant size. As seen in Table 2, the marketable yield estimate of super-size cucumbers is 175 cartons, each containing 56 lbs. of cucumbers. Alternative marketing opportunities may be available for other sizes.

Post-Harvest Cost Estimates

Once *production* costs are determined, one must still evaluate *post-harvest* costs. Post-harvest costs are added to the cost of production to calculate *total* cost per unit of the crop produced. Every farmer's production and marketing operation is unique and post-harvest costs vary substantially among individual farms as well as among shippers. For the Eastern Shore vegetable crops, post-harvest costs included packing, handling, and sales fees. These costs vary depending on how the crop is handled at harvest. For example, post-harvest costs include the shipping carton for cucumbers, Irish potatoes, peppers, and western melons because these crops are transported to a packing shed for packaging (Table 2). Because lettuce and broccoli are field-packed, containers are included with the production costs.[4] Watermelon budgets reflect the crop being sold in the field; therefore, post-harvest costs for watermelons consist only of clerical costs. Post-harvest costs for spring cucumbers equal $2.20 per bushel, which includes shipping cartons, handling, and sales.

Table 2. Estimated per unit costs for Eastern Shore vegetable crops.

				Costs per Unit		
Crop	Variable Cost per Acre	Total Cost per Acre	Estimated Yield	Post-Harvest	Production	Total[a]
	----------$----------			----------$----------		
Spring Cucumber	702.63	849.48	175 56-lb bushels	2.20	4.85	$7.05
Fall Cucumber	764.70	913.91	125 56-lb bushels	2.20	7.31	9.51
Spring Snap Beans	590.16	783.87	110 32-lb bushels	2.50	7.13	9.63
Fall Snap Beans	622.47	817.10	110 32-lb bushels	2.50	7.43	9.93
Irish Potato	632.56	868.42	150 hundredweights	3.30	5.79	9.09
Fall Peppers	1,142.87	1,289.16	250 28-lb bushels	2.50	5.16	7.66
Spring Peppers[b]	4,889.57	5,331.11	1,500 28-lb bushels	2.50	3.55	6.05
Western Melons[b]	2,401.94	2,746.93	670 40-lb boxes	3.15	4.10	7.25
Watermelons	881.37	1,037.87	30,000 pounds	0.01	.035	.045
Boston Lettuce[c]	1,648.56	1,814.51	500 10-13-lb crates	1.00	3.63	4.63
Romaine Lettuce[c]	2,201.56	2,373.51	700 20-25-lb crates	1.00	3.39	4.39
Broccoli[c]	1,575.95	1,789.48	350 21-lb cartons	1.00	5.11	6.11
Double-crop Soybeans	133.55	N/A	26 56-lb bushels	N/A	5.14	N/A
Full-season Soybeans	160.13	N/A	33 56-lb bushels	N/A	4.85	N/A
Wheat	148.59	N/A	60 58-lb bushels	N/A	2.48	N/A

[a] Total cost of production ÷ per acre yield, plus post harvest cost.
[b] Crops planted on plastic with drip irrigation.
[c] Packed in the field.

[4] Post-harvest cooling to remove field heat is critical to extend shelf life. Because the cost of cooling varies with each facility, cooling charges were not included in these studies except for broccoli. Cooling of broccoli is essential to maintain market quality.

Cost Sensitivity Analysis

The last part of the production cost analysis is a sensitivity analysis, which compares costs per unit and returns to land and management under different crop yields, prices, or land costs per acre. In the analysis of Eastern Shore spring cucumbers, yield varied from 125 bushels to 225 bushels per acre, land cost from $40 to $80 per acre, and selling price from $6.25 to $8.25 per bushel (Table 3). The estimated cost per bushel ranges from a high of $5.87, with $40 per acre land and a 125 bushel yield, to a low $4.20 per bushel, with $40 per acre land and a 225 bushel yield. With a 225 bushel yield, the cost for $80 per acre land is only $4.29. Because spring cucumbers are a half-year crop, only one-half of the land cost per acre is charged to spring cucumbers. Calculated returns to land and management vary from $67 per acre with a 125 bushel yield ($5.71 cost per bushel) and $6.25 per bushel selling price, to $931 per acre with a 225 bushel yield ($4.11 cost per bushel) and $8.25 per bushel selling price. Because returns are calculated to land and management, no land rental fees are included in the cost per bushel for the crop.

Table 3. Cost (3a) and returns (3b) sensitivity analysis for 1993 spring market cucumber production with overhead irrigation.

3a. Estimated cost per box with varying yields and land cost/rent per acre

Yield Per Acre (Box)	--- Land Cost per Acre ---				
	----------$----------				
	40.00	50.00	60.00	70.00	80.00
125	5.87	5.91	5.95	5.99	6.03
150	5.24	5.28	5.31	5.34	5.38
175	4.80	4.83	4.85	4.88	4.91
200	4.46	4.49	4.51	4.54	4.56
225	4.20	4.22	4.24	4.27	4.29

3b. Estimated per acre returns to land and management with varying yields and prices

Yield per Acre (Box)	Total Cost/Box	--- Selling Price ---				
		----------$----------				
		6.25	6.75	7.25	7.75	8.25
125	5.71	67	130	192	255	317
150	5.11	171	246	321	396	471
175	4.68	274	362	449	537	624
200	4.36	378	478	578	678	778
225	4.11	481	594	706	819	931

Step 3: Market Potential

The third step in the evaluation process addresses perhaps the single most difficult component: How will the product be marketed? More specifically, one might ask these questions:

- Where are the markets located, and if a market does not exist, can one be developed?
- Do the markets operate continually or are they open only certain times during the year?
- What prices are being offered, and do the prices vary widely on an annual or seasonal basis as well as historically?
- What quantities of product have been associated with these historical prices?
- If larger amounts of product enter the market, will the price levels fall dramatically, meaning the markets are saturated and there is no possibility to sell additional product?

Weekly prices are published for terminal or large centralized markets, but other marketing opportunities should also be considered. These opportunities include local retail stores, grocery chain stores, suppliers of lightly processed food, and various niche markets. Keep in mind, also, that terminal market reports deal with historical data and, therefore, may not adequately reflect future prices.

In addition to learning about potential markets, the producer must evaluate the *net* price that will be received for the product from that market. That is, the producer must subtract from the price received the cost of physical distribution of the product including promotion, processing, and storage if the producer is responsible for these costs. Additional costs for handling or commissions must also be considered. Typically, a 20 percent commission is charged for sales through the terminal markets and these commissions must be deducted to get the net selling price.

Finally, it is important to evaluate any market related advantages or disadvantages producers may have with this new enterprise. The following questions should be asked:

- Are there any strong existing preferences toward growing area by current buyers?
- Are some growers located in a position to deliver the product to the market at a lower cost than others?
- How will distance from market affect quality?
- Are there any other factors that provide a competitive advantage?
- How will any or all these factors affect the estimated market price?

Market Window Analysis

One of the key questions mentioned above is, do prices vary over time? When the price of a product does vary substantially throughout the year, it is a good idea to conduct a *market window analysis.* A market window analysis consists of comparing prices over several years with total per unit production costs (derived from recent production budgets). The market window analysis usually includes 12 monthly price points averaged over five years, unless the product is not marketed year round. The averaged market prices are used to graph the *optimistic, expected, and pessimistic pricing opportunities.*

An "open" market window occurs when the pessimistic per unit market price exceeds the total per unit production costs. A "closed" market window occurs when total unit cost exceeds the pessimistic unit price. If producers can time the production of their product so that it is available for sale during an open market window, then their chances of the new enterprise succeeding are increased and they should be able to make a profit. Even though the analysis can be timer consuming, a producer considering a new enterprise should gather as much historical price information as possible in order to assess the potential of the enterprise (if only one market will be used to sell the new product, then only information from that market need be obtained). *Time spent here may greatly reduce the chance of making a mistake.*

If there is not currently a market for the product, then the producer will have to develop a market. Market development can be a difficult and expensive task. Potential buyers of the product must be interviewed to assess the acceptance of the product. Even when it appears that a product will be accepted in the market and the rest of the analysis indicates that the alternative is viable, only *small scale production* and *test marketing* should be conducted at first. Production may then be expanded if the market appears capable of absorbing more quantity without major declines in price. A cautious approach is advocated here because

- A single producer may saturate a (small) market and prices could decline sharply.
- Prices that potential buyers indicated that they would be willing to pay may be quite different from what they will actually pay upon delivery of product.

- The volume that potential buyers say they will take may change when product delivery begins and the buyers attempt to pass the product on to a final consumer or user.

The following section will describe in detail a market window analysis, using the Eastern Shore vegetable example. The result of the analysis is a market window chart, showing how possible prices compare to costs of production and identifying open versus closed market windows. There are several important things to remember in using market-window charts. First, the production and marketing cost estimates are made using average, or typical, values. *Production costs for individual producers may be quite different from these average values.* It is critical for individual growers to work through the production budget section of this analysis (Step 2) to determine their actual cost estimates. An actual cost line might be higher or lower than published estimates.

Second, the potential profitability for each alternative depends on the ability of a grower to realize yields equal to those used to calculate per unit production costs (the values used in this study are shown in Table 2). If individual yields are higher, or lower, than those indicated, the cost estimates will need further adjustments.

Third, commercial production of new or alternative crops is generally limited. Estimates of production costs and periods of availability will probably be based upon this limited information and should be used only as a guide to assess potential opportunities.

Finally, as with all crop production, weather factors, efficiency of management, and the ability to supply a product of the quality demanded by the market will influence the profitability of a crop.

Eastern Shore Market Analysis

For the Eastern Shore vegetable crops, four viable terminal markets were identified: Philadelphia, New York, Boston, and Baltimore. (Atlanta was considered but was eliminated because Eastern Shore brokers felt that very little Virginia product was being moved or could be moved to this market.) A market window analysis was performed for the four terminal markets. Price estimates for these markets were collected from market news services or gathered from the trade (packers and other wholesale markets).

For this project, the market window periods considered were based on expected Eastern Shore harvest dates for specific crops. For example, spring cucumbers would be ready for market between the 24th and 28th weeks of the year (approximately June 15 to July 15), so this period was used to evaluate cucumber prices in the terminal markets. Other crops evaluated will have different market-window time periods.

In the first step of the market window analysis, published weekly maximum and minimum prices during the time period specific to each crop were obtained from each market for 1987 through 1991. A midpoint or median price for all four markets was calculated from these values. Table 4 shows price data across all crops considered, including spring cucumbers, and the average price across all markets using the midpoint prices.

The midpoint prices were then averaged over the five week harvest periods and across markets. This average is the *historical average market price* used in the analysis as is shown in Table 5, column 1. For spring cucumbers, for example, the average midpoint price over the five-week harvest period was $12.79 per bushel in Baltimore (Table 4). The historical average market price over all four markets is thus $13.29, as shown in Table 5.

Table 4. Historical average vegetable market prices over the period that they could be harvested on the Eastern Shore, 1987-1991.

		Market				
Crop		Baltimore	Boston	New York	Philadelphia	**Average Over All Four Markets**
Spring Cucumbers	maximum	13.72	15.62	15.36	13.71	**13.29**
	minimum	11.86	12.54	12.08	11.47	
	midpoint	12.79	14.08	13.72	12.59	
Fall Cucumbers	maximum	11.30	12.38	11.97	10.13	**10.07**
	minimum	8.63	8.83	8.57	8.70	
	midpoint	9.97	10.61	10.27	9.41	
Spring Snap Beans	maximum	15.98	18.72	19.32	16.25	**16.26**
	minimum	13.48	16.16	15.48	14.71	
	midpoint	14.73	17.44	17.40	15.48	
Fall Snap Beans	maximum	11.10	13.13	14.77	10.80	**10.94**
	minimum	7.70	10.58	10.10	9.27	
	midpoint	9.40	11.86	12.43	10.04	
Fall Peppers	maximum	11.29	10.80	11.61	9.47	**9.38**
	minimum	9.00	7.35	7.88	7.59	
	midpoint	10.15	9.07	9.75	8.53	
Spring Peppers	maximum	11.02	11.10	11.02	9.11	**9.52**
	minimum	9.51	8.99	7.54	7.83	
	midpoint	10.27	10.04	9.28	8.47	
Western Melon	maximum	11.56	11.80	12.37	11.85	**10.93**
	minimum	10.27	10.57	9.79	9.26	
	midpoint	10.92	11.19	11.08	10.55	
Watermelons	maximum	0.110	0.114	0.128	0.116	**0.0956**
	minimum	0.099	0.111	0.114	0.091	
	midpoint	0.104	0.112	0.121	0.103	
Spring Boston	maximum	8.63	9.63	10.38	8.38	**8.30**
Lettuce	minimum	7.68	7.93	7.00	6.71	
	midpoint	8.15	8.78	8.69	7.54	
Fall Boston Lettuce	maximum	9.25	10.10	10.90	7.14	**8.57**
	minimum	8.28	8.23	7.16	6.14	
	midpoint	8.77	9.17	9.03	7.30	
Spring Romaine	maximum	10.58	11.18	11.06	14.05	**10.36**
Lettuce	minimum	8.91	10.05	7.90	9.14	
	midpoint	9.74	10.62	9.48	11.60	
Fall Romaine	maximum	13.70	14.08	16.46	16.69	**13.71**
Lettuce	minimum	12.62	12.75	13.58	9.76	
	midpoint	13.16	13.42	15.02	13.23	
Broccoli	maximum	11.00	11.28	11.53	11.00	**10.58**
	minimum	9.98	10.12	9.50	10.25	
	midpoint	10.49	10.70	10.52	10.63	

Table 5. Adjusted average historical prices received by growers.

Crop	Midpoint Averaged Over Four Markets[a]	Brokerage Fee	Transportation Charge	**Adjusted Price**
Spring Cucumbers	13.29	20%	1.16	**9.47**
Fall Cucumbers	10.07	20%	1.16	**6.90**
Spring Snap Beans	16.26	20%	1.05	**11.96**
Fall Snap Beans	10.94	20%	1.05	**7.70**
Potato[b]	10.00	.50	0.00	**9.50**
Fall Peppers	9.38	20%	1.05	**6.45**
Spring Peppers	9.52	20%	1.05	**6.57**
Western Melons	10.93	20%	1.16	**7.58**
Watermelon[c]	0.0956	20%	0.022	**0.0546**
Spring Boston Lettuce	8.30	20%	1.05	**5.59**
Fall Boston Lettuce	8.57	20%	1.05	**5.81**
Spring Romaine Lettuce	10.36	20%	1.05	**7.24**
Fall Romaine Lettuce	13.71	20%	1.05	**9.92**
Broccoli	10.58	20%	1.16	**7.30**

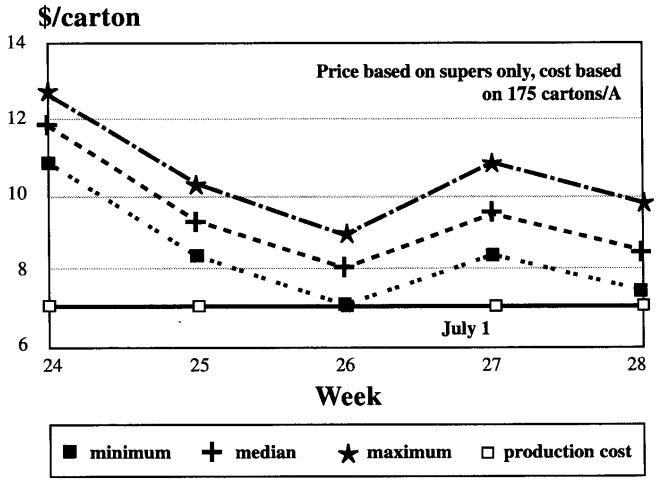
[a] From Table 4.
[b] Freight price on board.
[c] Average of three varieties, see the Appendix.

In the Eastern Shore case, several adjustments were made to the average historical market prices to reflect additional costs associated with selling vegetables through terminal markets. A brokerage fee was charged to cover marketing commissions and fees. There were also transportation charges involved with getting the product to the market. Both of these costs were subtracted from the average historical prices to calculate a net price that the grower would actually receive for the product and is shown as "adjusted price" in Table 5. The adjusted price for spring cucumbers was $9.47 per bushel.

To see the market window more clearly, adjusted prices are graphed along with the estimated cost of production. See Figure 1 for our spring cucumbers example. The weeks indicated are those during which Virginia producers could expect to be in the market. The adjusted cost of production (production budget cost per unit plus post-harvest costs) is $7.05, taken from Table 2. In this example, only in week 26 does the minimum price dip down to production costs. Thus, spring cucumbers may be an attractive enterprise, especially if growers can sell them at times other than week 26.

The production budgets and the market window analyses for the other vegetables in the Eastern Shore study are presented in the appendix. The need for additional pest management and/or irrigation in any particular year would increase the estimated cost of production as the harvest season progresses. For each commodity, the costs presented permit a comparison of an estimated cost of production with the minimum, median, and maximum terminal market prices offered during the target time periods. At times when pessimistic prices exceed production costs, an open market window exists. That is, a producer can profitably market the crop in that time period, and production should be planned so that marketing will take place during that window.

Figure 1. Market window for spring cucumbers, 4-market average



Unique Production and Marketing Factors

As with any study, there were factors in the Eastern Shore study that were unique to the production and marketing of specific crops. Those factors are listed below by crop.

- Cucumbers: Prices used are for "supers" or large cucumbers only. Marketing opportunities for other grades (select, large, and small) increase total revenue; however, there is not always a profitable marketing opportunity for all sizes.
- Snap Beans: Production costs reflect harvest by a one-row mechanical harvester, with beans belted afterward to remove pins, trash, and broken pods. Other types of machinery and other management practices are sometimes used.
- Irish Potatoes: Daily fresh market prices were available through the Market News Division of Virginia Department of Agriculture and Consumer Services. Weekly averages were computed using quotes for 50-lb. bags. Because the price of smaller-sized bags is often higher, actual revenue would depend upon the mix of sizes sold.
- Fall Peppers: Production budgets were based upon a transplanted crop using open- pollinated varieties on bare ground, with the fruit harvested and transported to a packing shed for grading and packing. An appreciable number of growers, however, are field-grading and field-packing peppers. The production budget for these growers would need to be adjusted to reflect the expense of the boxes, icing, and so forth, but post-harvest costs would be reduced by this amount. Development of marketing opportunities for red or novelty-colored (yellow, purple) peppers could increase profitability. Sales of small, misshapen fruit for processing may also be possible.
- Spring Peppers: Budgets were based on high-density plantings of transplants from hybrid seed on plastic mulch, with fruit harvested and transported to a packing shed for grading and packing. To spread the production cost, growers need to consider double-cropping the melons or peppers with a short-season fall crop. As with fall peppers, some growers may field-pack. For those growers, the production budget would need to reflect the cost of boxes and icing. Development of marketing opportunities for red or novelty-colored (yellow, purple) peppers could increase profitability. Sales of small, misshapen fruit for processing may also be possible.

- Western Melons[5]: Our analysis was for melons transplanted into plastic mulch with fruit harvested and transported to a packing shed. To spread the production costs, growers need to consider double-cropping the melons or peppers with a short-season fall crop. The market-window analysis reflects prices for 10-12 melons/cartons (average 4-lb./melon). The development of marketing opportunities for smaller melons through local sales, and through other forms of direct marketing, could improve profitability.
- Watermelons: Our analysis reflects watermelon sold in the field to a buyer/broker. In that case, the grower would not be responsible for transportation charges to the final destination.
- Lettuce: While the production budgets for Boston and Romaine lettuce vary between seasons, and the yield potential of Romaine is higher, sales may be dependent upon having both Boston and Romaine lettuce in the product mix. Our production cost estimates reflect field-packing.
- Broccoli: Our market-window analyses and production estimates were for a fall crop only, with the crop harvested and packed in the field. Icing was included in the production cost estimates because removal of field heat and temperature control is essential for maintaining product quality.

Step 4: Profitability

The fourth step in the evaluation process combines the information from the cost-of-production and market-potential analyses to evaluate the potential profit of a new enterprise. But when many enterprises--both traditional and new--are available, it is likely that more than one will potentially be profitable in the sense that the unit price will exceed the unit cost, at some time, as shown by the market-window analysis. The key question is which alternative or alternatives offer the most potential to the whole farm. Alternatives should be compared on some equivalent basis, for example, profit per acre by commodity. Some of the questions that need to be considered are as follows:

- How does an alternative enterprise affect income from other parts of the farm?
- Will resources used for the new enterprise compete with those used on an existing enterprise?
- What are the economic tradeoffs, if any, among existing and new enterprises?
- What constraints, such as equipment, labor, capital and so forth, are there to the adoption of this new enterprise?
- Are sufficient growing days available for the alternative crop, given existing rotations?
- Are there other factors that would limit the operation's ability to produce the new product, such as machinery or labor limitations?

How can one evaluate the relative profitability of alternative enterprises? When sophisticated computers are available, *mathematical programming models* can be constructed. In this process, the computer program simultaneously analyzes budget and market information, information on resource availability, and realistic constraints on the whole-farm operation. The results indicate which combination of enterprises will achieve some desired goal--usually profit maximization--within the constraints of available resources.

Without computers, however, how can a similar analysis be done? One way described here is the use of *resource calendars*. When only a few alternatives are being considered, these calendars will give a reasonably accurate answer. Resource calendars show when a farm's resources are being used for various production activities and where conflicts may occur among existing and new enterprises. The information that is assembled for use in resource calendars is the same as that needed to conduct a

[5] Western melons are smaller and firmer than eastern-type melons and therefore, are more easily shipped.

mathematical programming analysis on a computer and such information would have to be assembled if a farmer wanted to have someone else conduct a computer analysis.

Figure 2 is an example of a resource calendar. To produce such resource calendars, the farmer first identifies all the resources that are available or could be made available, such as machinery, labor, and land. Separate resource calendars are then developed by listing each resource and when it must be used throughout the year, first for the existing and then for the alternative enterprises. In the case illustrated in Figure 2, the resources are labor, tractors, and irrigation equipment, and the calendars show weeks when these resources are fully occupied (indicated by the dashed arrows).
After calendars have been compiled for all pertinent resources, the calendars are examined for conflicts between alternative and existing enterprises. As shown in Figure 2, during certain weeks *all* available labor, machinery, and irrigation is being used on one enterprise or another. During other times, however, only a portion of the labor and other resources may be occupied (partial use of available resources could also be indicated on the calendar).

Figure 2. Resource calendars for comparing a new and existing enterprise

Labor Calendar—Times When Available Labor is Fully Occupied																
Month	June				July				August				September			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Existing Enterprise	<---	------	------	--->							<->			<---	--->	
New Enterprise						<---	--->								<---	--->

Tractor Calendar—Times When the Tractor is Fully Occupied																
Month	June				July				August				September			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Existing Enterprise		<---	--->											<->		
New Enterprise						<---	--->								<->	

Irrigation Calendar—Times When Irrigation Equipment is Likely to be Fully Occupied																
Month	June				July				August				September			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Existing Enterprise						<---	--->									
New Enterprise												<---	--->			

Figure 2 shows sufficient tractor time and irrigation equipment for both enterprises throughout the season: no dashed arrows overlap. But there is a labor conflict between the two enterprises in the third week of September. When such conflicts arise, the decision on whether to maintain existing enterprises, have a mix of existing and alternative enterprises, or switch to the alternative enterprise should be based on a comparison of per-acre profitability, including whether or not it would be profitable to eliminate the conflicts in resource use. In the example here, the question would be, "Can and should more labor be hired?"

The manual process we have just described is similar to what is done on a computer by a mathematical programming analysis. The type of mathematical programming used in this study is called *linear programming* (LP). The LP analysis presented below for the Eastern Shore would be beyond the scope of some farmers. It was used to further evaluate the feasibility of producing the Eastern Shore vegetable

crops relative to each other. A computer analysis was necessary due to the large number of rotations being considered.

Eastern Shore Profitability Analysis

The objective of our computer analysis was to find the combination of existing and alternative crops, if any, that would maximize farm income. In the following discussion, we refer to that combination as the *solution* or the *profit maximizing combination*. As the factors put into the computer analysis are changed, the solution changes.

The analysis used the production costs and prices shown in Tables 1 through 3 above. The factors adjusted within the analysis were

- total amount of land available;
- the acreage of new crops that could be planted;
- irrigation water; and
- machinery use.

To give a realistic solution, the factors or variables considered in a computer analysis must have realistic boundaries. These are known as *restrictions* on the factors. The factors in this analysis were restricted as follows:

1. *Land Available*: Because this analysis was developed as a whole-farm model, the total amount of land was restricted to 200 acres, and the amount of land planted in vegetable crops was restricted to 100 acres (these were growers' best estimates of representative farm acreage).
2. *Acreage in New Crops*: Vegetable acreage was restricted as follows: lettuce-10 acres, broccoli-10 acres, spring peppers-5 acres, western melons-5 acres, watermelons-5 acres. Two factors were taken into consideration. First, the market prices for some of these crops (for example, lettuce) were generally considered to be based on fairly low and stable quantities, so a large influx of new product could break the markets and drive the price sharply downwards. Second, the growers felt that they would gradually add any new crops into their rotations. Vegetable crops are costly to establish and are very intensively managed. Because the risk is very high, the growers would tend to make production changes gradually.
3. *Water Use:* Water use was restricted based on the calculated irrigation available from one traveling gun system. This restriction could vary among individual situations given the water source and the delivery methods available. Again, however, this was considered the best representative amount.
4. *Tractor Use*: Tractor use was also restricted based on the number of hours each tractor could physically be used during the busiest periods.

Table 6 summarizes three cropping and marketing scenarios of factors tested by the computer program. The first scenario is that of existing conditions, done to test the validity of the model. Results for the test scenario were as follows: a profit-maximizing crop mixture of 70 acres of spring cucumbers, 98 acres of double-crop soybeans and wheat, and 7 acres of full-season soybeans; projected annual income of approximately $45,500 before accounting for the fixed costs associated with land and machinery; projected net annual income of $17,867 after accounting for fixed costs; and all available acreage and available irrigation water were used. This was considered an accurate representation of the current situation facing Eastern Shore vegetable growers, so it validated the computer programs, referred to as the "model." The model was then used to evaluate the potential of the five alternative vegetable crops (scenarios 2 and 3 in Table 6).

Under scenario 2, the alternative crops were added with midpoint prices available (as seen in Table 5 above). The resulting profit-maximizing combination of crops was 63 acres of spring cucumbers, 5 acres

of fall snap beans, 10 acres of spring lettuce, 10 acres of fall lettuce, 10 acres of broccoli, 5 acres of watermelons, 86 acres of double-crop soybeans, 20 acres of full-season soybeans, 10 acres of rye, and 91 acres of wheat. Projected annual income was increased to $89,491 before fixed costs and $56,860 after fixed costs were subtracted.

Scenario 3 in Table 6, where the average historical price was altered from the midpoint to the minimum price, is discussed as part of the following section on whole-farm sensitivity.

Table 6. Profitability tests of combinations of traditional and alternative crops on Virginia's Eastern Shore.

Model	Projected Annual Income	Est. Fixed Costs	Projected Net Income	Acres	Crops
Scenario 1					
Traditional Crops	$45,486	$27,619	$17,867	70	Spring Cucumbers
Midpoint Prices				98	Double-Crop Soybeans
				7	Full-Season Soybeans
				98	Wheat
Scenario 2					
Traditional Crops	$89,491	$32,631	$56,860	63	Spring Cucumbers
Diversification Crops				5	Fall Snap Beans
Midpoint Prices				10	Spring lettuce
Limit on new crop acreage				10	Fall Lettuce
				10	Broccoli
				5	Watermelon
				86	Double-Crop Soybeans
				20	Full-Season Soybeans
				10	Rye
				91	Wheat
Scenario 3					
Traditional Crops	$62,553	$31,890	$30,663	56	Spring Cucumbers
Diversification Crops				5	Fall Snap Beans
Midpoint Prices				10	Spring lettuce
Limit on new crop acreage				10	Fall Lettuce
				10	Broccoli
				5	Watermelon
				86	Double-Crop Soybeans
				27	Full-Season Soybeans
				10	Rye
				86	Wheat

Step 5: Whole-Farm Sensitivity and Economic Risk

The fifth and final step in the process of evaluating an alternate enterprise is often the most critical. It involves evaluating how sensitive a potentially profitable enterprise is to changes in crop prices and yields. Once an alternative enterprise has been identified as feasible *under certain conditions*, it is still necessary to analyze the conditions that could change and make the enterprise no longer viable. Some important questions are the following:

- How much can yields be reduced in a crop and still provide a positive return?
- How much death loss can be sustained in a livestock operation without causing a net loss to the enterprise?
- What happens if the availability of labor changes?

- What will happen if prices drop by 10 percent or 20 percent?
- What will happen if brokerage fees increase by 10 or 20 percent?

Risk or sensitivity analysis involves examining the chances of such changes occurring. While this could be a complicated statistical procedure, it need not be. For example, one could simply ask, "How often have crop failures occurred historically in other regions?" or "What are the lowest prices offered by the markets and how often have prices fallen to these levels?"

Eastern Shore Risk Analysis

For the Eastern Shore vegetable model, risk was tested by recalculating the profit-maximizing solution using *minimum* (most pessimistic) prices rather than the *midpoint* (expected) prices as determined in the market-window analysis (Step 3). The solution under this scenario--scenario 3 in Table 6--indicated that a very similar mix of crops would be used to maximize profit. The estimated annual acreage in spring cucumbers and wheat fell slightly, spring snap beans replaced fall snap beans, and full-season soybean acreage increased slightly. Income fell from $89,490 to $62,553 before accounting for fixed costs, with net income--after fixed costs were subtracted--estimated at $30,663 (down from $56,860). So, if a producer received only the minimum quoted price for all his crops, the most profitable combination of products would change only slightly but the net income would drop by over $26,000 or 46 percent.

Each vegetable crop in the solution was also evaluated separately for sensitivity to changes in prices and yield. Yields and prices were sequentially decreased until the vegetable was no longer profitable to grow. Tables 7 to 11 show how net annual income changed in response to lower prices, yields, or both. *While some producers will not have the computer capability to do this type of detailed analysis, the important point here is to gain an appreciation of the* ***sensitivity*** *of profits to expectable price or yield changes*.

Spring Cucumbers. The results for spring cucumbers are shown in Table 8. Either a 10-percent decrease in price or a 20-percent decrease in yield alone would result in less acreage of spring cucumbers being planted. For example, if the price decreased 10 percent, only 56 acres, rather than 63, would be the profit-maximizing acreage level. But, if only a 5-percent price decrease were combined with a 10-percent yield decrease, the optimal amount of spring cucumbers planted would decrease. If price dropped as much as 20 percent or if yield dropped as much as 30 percent, less than five acres of cucumbers would be called for to maximize profit. In this model, as the acreage planted in spring cucumbers gradually declined, it was replaced with fall peppers, spring snap beans, and full-season soybeans. Eventually, when spring cucumber acreage reached zero, spring peppers would also have been part of the optimal crop mix.

Table 7. The effects of cucumber prices and yields on income[a] and levels of cucumbers planted.

	Spring Cucumber Price [b]					
	13.29	12.63 (-5%)	11.96 (-10%)	11.30 (-15%)	10.63 (-20%)	9.97 (-25%)
Cucumber Yield	Annual Net Income for *All* Crops					
175 (expected)[c]	$89,491 63 acres[d]	$83,736 63 acres	$72,582 56 acres	$70,808 28 acres	$70,639 2 acres	$70,639 2 acres
158 (-10%)	$81,676 63 acres	$76,562 56 acres	$72,234 25 acres	$70,803 2 acres	$70,632 2 acres	$70,632 0 acres
140 (-20%)	$73,888 56 acres	$71,387 18 acres	$70,751 2 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres
131 (-25%)	$71,572 23 acres	$70,777 2 acres	$70,649 2 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres
123 (-30%)	$70,798 2 acres	$70,679 2 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres
105 (-40%)	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres	$70,632 0 acres

[a] Net returns to variable costs only.
[b] Historical average market price.
[c] Expected refers to expected cucumber yields, starting with a 0% decrease.
[d] Level of spring cucumber acreage planted to maximize net income, changing as price changes.

Watermelons. Watermelon acreage was more sensitive to changes in either prices or yields than the other vegetable crops (Table 8). Profits would be maximized without planting watermelons if either price fell by 15 percent or yields were reduced by 20 percent. Simultaneous 5- and 15- percent decreases in price and yield would also make it more profitable to eliminate watermelon. If no watermelon were planted, spring cucumbers, double-crop soybeans, and wheat acreage would increase and full-season soybean and rye acreage would decrease.

Table 8. The effects of watermelon prices and yields on income[a] and levels of watermelon planted.

	Watermelon Price			
	11.00	10.45 (-5%)	9.90 (-10%)	9.35 (-15%)
Watermelon Yield	Annual Net Income for *All* Crops			
300 (expected)[b]	$89,491 5 acres[c]	$78,911 5 acres	$78,251 5 acres	$77,939 0 acres
270 (-10%)	$78,731 5 acres	$78,137 5 acres	$77,939 0 acres	$77,939 0 acres
255 (-15%)	$78,311 5 acres	$77,939 0 acres	$77,939 0 acres	$77,939 0 acres
240 (-20%)	$77,939 0 acres	$77,939 0 acres	$77,939 0 acres	$77,939 0 acres

[a] Net returns to variable costs only.
[b] Expected refers to expected watermelon yields, starting with a 0% decrease.
[c] Level of watermelon acreage planted to maximize net income, changing as price changes.

Spring lettuce. Spring lettuce is actually a combination of two lettuce varieties, Romaine and Boston. In practice, these two varieties are planted as companion crops, so the computer model predicted that equal amounts of each variety would be planted whenever lettuce was chosen in the profit-maximizing solution. Each variety has its own price and yield estimates, which were adjusted equally in the sensitivity analysis. For example, a 25-percent change in price resulted in a decrease from $8.30 to $6.22 per crate for Boston lettuce and a decrease from $10.36 to $7.77 per crate for Romaine lettuce.

Spring lettuce remained a part of the optimal mix at the maximum allowable acreage (10 acres) even with relatively large decreases in either price or yield (Table 9). But once price decreased more than 30 percent, or yield fell more than 40 percent, spring lettuce was no longer profitable. Also, if price and yield simultaneously decreased 25 percent or more, spring lettuce became unprofitable. Under those conditions, spring lettuce acreage would probably be replaced with full-season soybean acreage.

Fall lettuce. Fall lettuce followed a pattern very similar to spring lettuce (Table 10). If price decreased by 46 percent, or if yield decreased by 56 percent, fall lettuce no longer was part of the optimal crop mixture. But, a price decrease of only 30 percent combined with a 35-percent decrease in yield would also reduce fall lettuce planting to zero. When fall lettuce was not planted, the acreage was replaced by soybeans double-cropped with wheat.

Table 9. The effects of spring lettuce and yields on income[a] and levels of spring lettuce planted.

	Spring Lettuce Price			
Boston Lettuce	8.30[b]	6.22	5.98	5.81
Romaine Lettuece	10.36[c]	7.77	7.46	7.25
		(-25%)	(-28%)	(-30%)
Yield	Annual Net Income for All Crops			
500[d] / 700[e]	$89,491	$78,079	$76,731	$75,978
(expected)[f]	10 acres[g]	10 acres	10 acres	0 acres
375 / 525	$81,164	$75,978	$75,978	$75,978
(-25%)	10 acres	0 acres	0 acres	0 acres
325 / 455	$77,833	$75,978	$75,978	$75,978
(-35%)	10 acres	0 acres	0 acres	0 acres
300 / 420	$75,978	$75,978	$75,978	$75,978
(-40%)	10 acres	0 acres	0 acres	0 acres

[a] Net returns to variable costs only.
[b] Spring Boston Lettuce price.
[c] Spring Romaine Lettuce price.
[d] Spring Boston Lettuce yield.
[e] Spring Romaine Lettuce yield.
[f] Expected refers to expected spring lettuce yields, starting with a 0% decrease.
[g] Level of spring lettuce acreage planted to maximize net income (split between Boston and Romaine), changing as price changes.

Table 10. The effects of fall lettuce prices and yields on income[a] and levels of fall lettuce planted.

	Fall Lettuce Price				
	8.57[b]	6.00	5.14	5.00	4.75
	13.71[c]	9.60	8.23	8.00	7.75
		(-30%)	(-40%)	(-42%)	(-46%)
Fall Lettuce Yield	Annual Net Income for All Crops				
500[d]	$89,491	$72,843	$67,287	$66,363	$65,661
700[e]	10 acres[g]	10 acres	10 acres	10 acres	0 acres
(expected)[f]					
375	$78,684	$66,198	$65,661	$65,661	$65,661
525	10 acres	10 acres	0 acres	0 acres	0 acres
(-25%)					
325	$74,361	$65,661	$65,661	$65,661	$65,661
455	10 acres	0 acres	0 acres	0 acres	0 acres
(-35%)					
250	$67,877	$65,661	$65,661	$65,661	$65,661
350	10 acres	0 acres	0 acres	0 acres	0 acres
(-50%)					
220	$65,661	$65,661	$65,661	$65,661	$65,661
305	0 acres	0 acres	0 acres	0 acres	0 acres
(-56%)					

[a] Net returns to variable costs only.
[b] Fall Boston Lettuce price.
[c] Fall Romaine Lettuce price.
[d] Fall Boston Lettuce yield.
[e] Fall Romaine Lettuce yield.
[f] Expected refers to expected fall lettuce yields, starting with a 0% decrease.
[g] Level of fall lettuce acreage planted to maximize net income, changing as price changes.

Broccoli. Broccoli acreage also stayed in the optimal crop mix even with relatively large decreases in price or yield (Table 11). The maximum amount of broccoli (10 acres) was planted with either a 20-percent drop in price or a 25-percent drop in yield. At 22- and 30-percent changes in price and yield, respectively, broccoli was no longer profitable. Broccoli also became unprofitable if price fell 10 percent and yield simultaneously fell 25 percent, or if price fell 20 percent and yield simultaneously fell 15 percent. Broccoli acreage was replaced with increases in soybeans that were double cropped with wheat.

Table 11. The effects of broccoli prices and yields on income[a] and levels of broccoli planted.

	Broccoli Price			
	10.58	9.52	8.46	8.25
		(-10%)	(-20%)	(-22%)
Broccoli Yield	Annual Net Income for All Crops			
350	$89,491	$76,603	$73,635	$73,276
(expected)[b]	10 acres[c]	10 acres	10 acres	0 acres
298	$76,293	$73,766	$73,276	$73,276
(-15%)	10 acres	10 acres	0 acres	0 acres
263	$74,087	$73,276	$73,276	$73,276
(-25%)	10 acres	0 acres	0 acres	0 acres
245	$73,276	$73,276	$73,276	$73,276
(-30%)	0 acres	0 acres	0 acres	0 acres

[a] Net returns to variable costs only.
[b] Expected refers to expected broccoli yields, starting with a 0% decrease.
[c] Level of broccoli acreage planted to maximize net income, changing as price changes.

Summary of the Sensitivity and Economic Risk Analysis

The likelihood of price decreases for the Eastern Shore vegetable crops (spring cucumbers, fall lettuce, spring lettuce, broccoli) were evaluated using published price data (Table 12). Prices are shown for each crop with the chance of prices below that level shown in ( )s for each price. For spring cucumbers, there was a 65-percent chance that the price would fall below $11.96 per bushel and, consequently, that profit would be maximized by planting fewer acres of cucumbers. There was a 40-percent chance that the price would fall below $11.30 per bushel and that profit would be maximized by planting less than one-half as many cucumbers. There was a 25-percent chance that the price would fall below $10.63 per bushel and that profit would be maximized by not planting any spring cucumbers.

Similar calculations were made for the other crops. The chance of price changes were calculated separately for Boston and Romaine lettuce in both the spring and fall since the crops are marketed separately. There was only a 4-percent chance that the price of fall Boston lettuce would fall below $4.75 per crate and that profit would be maximized by not planting lettuce. There was a 0-percent chance that the price of fall Romaine lettuce would drop below $7.75 per crate and take lettuce out of the optimal solution. There was a much higher chance of Romaine lettuce price dropping in the spring. The chance of Boston lettuce prices changing and becoming unprofitable remained relatively low in the spring. There was only a 4-percent chance that price would fall below $5.81 per crate and that Boston lettuce would be taken out of the optimal solution.

Large changes in broccoli prices were more frequent than changes in the lettuce prices, but less frequent than those in the spring cucumber prices. Broccoli price fell below $9.52 per carton 35 percent of the time. Unless yields simultaneously fall by 25 percent, it would still be profitable to plant 10 acres of broccoli. Only 2 percent of the time did the broccoli price fall below $8.25 per carton, at which time the profit-maximizing solution would be to produce no broccoli.

There was a much higher chance of watermelon prices falling below the midpoint level. Prices dropped below $10.45 per cwt. ($0.1045 per lb.) 54 percent of the time and below $9.90 per cwt. 43 percent of the time. When the price falls below $9.40 per cwt., profit would be maximized by substituting another crop for watermelons. Historically, prices fell this low 21 percent of the time.

Table 12. Likelihood of price decreases from the historical average market price in spring cucumbers, watermelons, spring lettuce, fall lettuce, and broccoli

Crop						
Spring	Price	12.63	11.96	11.30	10.63	9.97
Cucumbers	% Chance of Price					
	Falling Below	65.0%	65.0%	40.0%	25.0%	10.0%
Watermelon	Price	10.45	9.90	9.35	B	b
	% Chance of Price					
	Falling Below	54.0%	43.0%	21.0%		
Spring Lettuce					B	b
Boston	Price	6.22	6.10	5.81		
	% Chance of Price					
	Falling Below	8.0%	4.0%	4.0%		
Romaine	Price	7.77	7.60	7.25	B	b
	% Chance of Price					
	Falling Below	29.0%	25.0%	21.0%		
Fall Lettuce						b
Boston	Price	6.00	5.14	5.00	4.75	
	% Chance of Price					
	Falling Below	8.0%	4.0%	4.0%	4.0%	
Romaine	Price	9.60	8.23	8.00	7.75	b
	% Chance of Price					
	Falling Below	17.0%	0.0%	0.0%	0.0%	
Broccoli	Price	9.52	8.46	8.25	8.00	b
	% Chance of Price					
	Falling Below	35.0%	6.0%	2.0%	2.0%	

[a] Calculated based on published minimum prices in 4 markets from 1987-1991.
[b] Crop no longer planted due to price decreases.

CONCLUSIONS

While industrial development is often cited as *the* way to revitalize rural communities, it should only be viewed as *one* revitalization mechanism. Agriculture has long been the backbone of many rural communities in Virginia and agriculture and agribusiness has the potential to remain a vital part of these communities if diversification into alternative enterprises is considered.

The big unknown is often *how* to diversify. No one answer to the implicit question on "how" will fit everyone contemplating an alternative enterprise. While traditional sources of new technical information, such as Cooperative Extension, can provide help in the diversification process, each individual will most likely have to complete his/her own analysis of any new alternatives. Each individual faces a unique set of farm-level resources and firm-level and/or environmental constraints.

Evaluating an alternative enterprise is a complex task, but it is not impossible. It is, however, a time-consuming endeavor. The five steps--production potential; production cost analysis; market potential; profitability; and whole-farm sensitivity and economic risk--must all be thoroughly evaluated. The evaluation must consider a wide range of factors from a whole-farm perspective in order to assess the viability of a new enterprise.

Because the resources--including the managerial ability--of individuals differ, each individual considering a new enterprise must carefully evaluate that enterprise *based on his/her own situation*. For example, the fact that one farm in a county has successfully adopted a new enterprise does not necessarily mean that a

neighboring farm, or for that matter any other farm in the county, could also successfully and profitably adopt the same enterprise.

An individual considering a new enterprise should seek as much information as possible about Step 3 of the process: marketing. Most individuals feel comfortable with the first two steps of the evaluation process: production potential and production cost. This is especially true if the innovator can experiment with the new enterprise on a small scale without incurring major added costs. Farmers frequently conduct small-scale experiments with conventional enterprises, and low-cost experiments on new enterprises are a natural extension of those practices. But, without Step 3, dealing with the market potential, Steps 1 and 2 are not very helpful.

The information from Steps 1 through 3 allows one to undertake the last two steps of the analysis: profitability, and whole farm sensitivity or risk analysis. By working through this five-step process, an individual can systematically assess the potential of a new enterprise and how it fits in with, or should replace, existing enterprises.

Finally, if the decision is made to undertake a new enterprise based on this analysis, the individual should start small and go slow. While some new enterprises may require a large operation to be profitable, many will not. No matter how thorough the analysis of the first five steps, some factors may have been overlooked or misinformation may have been received, so the "sixth step" should be starting on a small scale with limited financial risk. After such a trial effort or experiment, reevaluation of the analysis in the first five steps will be needed to answer such questions as:

- Can the product be produced in a form and at a time that it is suitable for the market?
- How much does it *really* cost to produce the product?
- Is the market *really* there, and what prices are received for the product?
- Is the product profitable, and how does its production affect the production of existing enterprises?
- How do output and prices for the product vary over time?

As a final point, remember that *with any new business venture, there will always be some risk, no matter how thoroughly the evaluation of the new enterprise has been carried out.* Results from this example study indicate four possible vegetable crop alternatives that Eastern Shore growers could introduce into their current rotations to increase profitability on their farms. *Fall lettuce, spring lettuce, broccoli, and watermelons* would all fit into current production systems and would result in higher net incomes. In fact, annual net income could almost double if the new alternative crops were added to the current rotations and the reasonable yields and prices used in this study were realized.

On the other hand, large costs are associated with starting and planting each of these crops. Furthermore, like all new alternatives, each crop involves different management techniques. Therefore, it is important to evaluate the relative risks and returns of these options.

When the potential impacts on net income were compared among the individual alternative crops for Eastern Shore conditions (Tables 7-13), fall lettuce was seen to contribute the most to the increased income. When fall lettuce was dropped completely from production, projected income fell from about $89,000 to approximately $66,000 (before accounting for fixed costs) with no changes in the prices or yields of other crops. This compared to income levels of $70,632, $75,978, $73,276, and $77,939 when spring cucumbers, spring lettuce, broccoli, and watermelon acreage, respectively, were eliminated.

The cost of growing lettuce is high relative to most other alternatives. The average cost of production per acre for the two types, Boston and Romaine, planted as companion crops is $1,925. The chance of fall lettuce becoming unprofitable due to price decreases is very small, however. There is only a 4-percent chance that the price of Boston lettuce would fall below $4.75 per crate, the level at which it becomes more profitable not to plant fall lettuce. Similarly, yield levels could decrease up to 56 percent, with no change in price, before a crop mix without fall lettuce would be more profitable than a crop mix with fall lettuce.

Similar comparisons indicate that, among the alternative crops, watermelons would contribute the least to increased annual income. Projected income falls to only $77,939 (before accounting for fixed costs) when watermelons are taken out of the rotation. On the other hand, the cost of production for watermelons is $882 per acre, less than any of the other new alternative crops. There is, however, a 21-percent chance that the price of watermelons will fall below breakeven levels at $9.40 per cwt., making it more profitable not to plant any watermelons. A 20-percent decrease in the yield, without any change in price, would also make it more profitable not to plant watermelons. Therefore, while watermelons will fit into the current rotations and increase net income under the projected price and yield situations considered in the analysis, the risk associated with their production is higher relative to the other alternative crops.

The other two alternative crops--spring lettuce and broccoli--fall between fall lettuce and watermelons in their potential risks and rewards. The analysis indicates that a grower who wished to incorporate changes gradually into the current situation would have the most potential profit, and face the least risk from price and yield changes, by adding fall lettuce. But all four of the alternatives identified here--fall lettuce, spring lettuce, broccoli, and watermelons--could add profitability to the crop rotations.

This study of a representative operation has identified four strong possibilities for diversification of Eastern Shore vegetable operations. But each Eastern Shore grower, and each grower in other regions, faces a different situation in his/her individual operation. Local information is needed to make individual production decisions, and particular circumstances on individual operations may change the potential profitability of alternatives.

Appendix A: Production Budgets, Per Unit Costs, and Estimates of Returns

Appendix A, Table 1. Fall market cucumbers, 1993 (overhead irrigation marketable yield, 125 bushels).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	1.50	43.00	64.50	.....
Nitrogen, lb.	100.00	0.26	26.00	.....
P_2O_5, lb.	100.00	0.22	22.00	.....
K_2O, lb_b.	100.00	0.15	15.00	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Pub 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			3.02	.....
Insecticides			23.40	.....
Fungicides			88.94	.....
Plastic Mulch			0.00	.....
Machinery - Production				
Irrigation, acre inch	2.50	12.00	30.00	.....
Production machinery repairs			16.14	.....
Fuel, oil			9.89	.....
Miscellaneous, bees			45.00	.....
Interest	354.84	4.50%	15.97	.....
HARVEST COSTS				
Supplies			20.00	.....
Harvest Containers	0.00	0.00	0.00	.....
Custom harvest labor[b,c]	228.00	1.30	296.40	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			2.83	.....
Fuel, oil			2.45	.....
Haul to packing shed	228.00	0.07	15.96	.....
Labor - Production	7.10	5.00	35.50	.....
- Harvesting	4.15	5.00	20.75	.....
SUB TOTAL VARIABLE COSTS			764.70	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			30.79	.....
- Harvest			7.32	.....
Truck Depreciation	228.00	0.06	13.68	.....
Land (double cropped)	0.50	60.00	30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			149.21	.....
TOTAL COSTS			913.91	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @125-56 LB. BUSHELS			7.07	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @125-56 LB. BUSHELS			7.31	.....

[a] Lime apportioned over three years, double cropped (6 crops total).
[b] Based upon labor cost of $1.30/bushel for 228 bushels/A (total yield) + $15/A labor camp costs.
[c] Of the 228 bushels/A total yield, 125 bushels on average will be graded as "super." Crop transported to packing shed for grading.

Appendix A, Table 2. Spring snap beans, 1993 (overhead irrigation, marketable yield 110 -32 lb. cartons).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	70.00	1.40	98.00	.....
Nitrogen, lb.	80.00	0.26	20.80	.....
P_2O_5, lb.	60.00	0.22	13.20	.....
K_2O, lb.	60.00	0.15	9.00	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Pub 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			3.02	.....
Insecticides			12.84	.....
Fungicides			28.77	.....
Plastic Mulch			0.00	.....
Machinery - Production				
Irrigation, acre inch	2.50	12.00	30.00	.....
Production machinery repairs			16.45	.....
Fuel, oil			10.07	.....
Miscellaneous, bees			20.00	.....
Interest	273.10	4.50%	12.29	.....
HARVEST COSTS				
Supplies			20.00	.....
Shipping Containers	125.00	1.50	187.50	.....
			$187.50	
Custom harvest labor			0.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			21.84 $21.84	.....
Fuel, oil			4.68	.....
Haul to packing shed	125.00	0.07	8.75	.....
Labor - Production	7.00	5.00	35.00	.....
- Harvesting	5.40	5.00	27.00	.....
SUB TOTAL VARIABLE COSTS			590.16	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			31.54	.....
- Harvest			49.75 $49.75	.....
Truck Depreciation	125.00	0.12	15.00	.....
Land (double cropped)			30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			193.71	.....
TOTAL COSTS			783.87	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @110-32 LB. CARTONS			6.85	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @110-32 LB. CARTONS			7.13	.....

[a] Lime apportioned over three years, double cropped (6 crops total).

Appendix A, Table 3. Fall snap beans, 1993 (overhead irrigation, marketable yield 110-32 lb. bushels).

Item Receipts	Quantity 110 bushels	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	70.00	1.40	98.00	.....
Nitrogen, lb.	80.00	0.26	20.80	.....
P_2O_5, lb.	60.00	0.22	13.20	.....
K_2O, lb..	60.00	0.15	9.00	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			3.02	.....
Insecticides			41.98	.....
Fungicides			28.77	.....
Plastic Mulch			0.00	.....
Machinery - Production				
Irrigation, acre inch	2.50	12.00	30.00	.....
Production machinery repairs			16.97	.....
Fuel, oil			10.37	.....
Miscellaneous, bees			20.00	.....
Interest	303.06	4.50%	13.64	.....
HARVEST COSTS				
Supplies			20.00	.....
Shipping Containers	125.00	1.50	187.50	.....
Custom harvest labor			0.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			21.84	.....
Fuel, oil			4.68	.....
Haul to packing shed	125.00	0.07	8.75	.....
Labor - Production	7.20	5.00	36.00	.....
- Harvesting	5.40	5.00	27.00	.....
SUB TOTAL VARIABLE COSTS			622.47	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			32.46	.....
- Harvest			49.75	.....
Truck Depreciation	125.00	0.12	15.00	.....
Land	0.50	60.00	30.00	.....
Irrigation	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			194.63	.....
TOTAL COSTS			817.10	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @110-32 LB. BU.			7.16	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @110-32 LB. BU.			7.43	.....

Appendix A, Table 4. Irish potatoes, 1993 (overhead irrigation, marketable yield 150 cwt.).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seedpieces, cwt.	14.00	8.00	112.00	.....
Nitrogen, lb.	150.00	0.26	39.00	.....
P_2O_5, lb.	150.00	0.22	33.00	.....
K_2O, lb.	150.00	0.15	22.50	.....
Spreading			0.00	.....
Lime, ton[a]	0.25	35.00	8.75	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			33.34	.....
Insecticides			120.37	.....
Fungicides			0.00	.....
Plastic Mulch			0.00	.....
Machinery - Production				
Irrigation	3.50	12.00	42.00	.....
Production machinery repairs			16.86	.....
Fuel, oil			10.00	.....
Miscellaneous			35.00	.....
Interest	472.82	6.00%	28.37	.....
HARVEST COSTS				
Supplies - boxes			20.00	.....
Bin rent			0.00	.....
Custom harvest labor			0.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			25.18	.....
Fuel, oil			5.14	.....
Haul to packing shed	165.00	0.07	11.55	.....
Labor - Production	7.90	5.00	39.50	.....
- Harvesting	6.00	5.00	30.00	.....
SUB TOTAL VARIABLE COSTS			632.56	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			41.19	.....
- Harvest			57.35	.....
Truck Depreciation	165.00	0.06	9.90	.....
Land			60.00	.....
Irrigation	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			235.86	.....
TOTAL COSTS			868.42	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @150 CWT			7.35	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @150 CWT			7.89	.....

Appendix A, Table 5. Fresh market fall green bell peppers , 1993 (overhead irrigation, marketable yield 250-28 lb bushels).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Plants, 1000	9.70	25.00	242.50	.....
Nitrogen, lb.	130.00	0.26	33.80	.....
P_2O_5, lb.	50.00	0.22	11.00	.....
K_2O lb.	130.00	0.15	19.50	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			23.25	.....
Insecticides			101.03	.....
Fungicides			111.00	.....
Plastic Mulch			0.00	.....
Machinery - Production				
Irrigation, acre inch	3.00	12.00	36.00	.....
Production machinery repairs			25.21	.....
Fuel, oil			18.82	.....
Miscellaneous			35.00	.....
Interest	668.06	4.50%	30.06	.....
HARVEST COSTS				
Supplies			20.00	.....
Custom harvest, bins[b]	17.00	20.00	340.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			0.00	.....
Fuel, oil			0.00	.....
Cooling			0.00	
Haul to packing shed			0.00	.....
Labor - Production	16.95	5.00	84.75	.....
- Harvesting	0.00	5.00	0.00	.....
SUB TOTAL VARIABLE COSTS			1,142.87	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			48.87	.....
- Harvest			0.00	.....
Truck Depreciation			0.00	.....
Land (double cropped)			30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			146.29	.....
TOTAL COSTS			1,289.162	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @250-28 LB. BUSHELS			5.04	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @250-28 LB. BUSHELS			5.16	.....

[a] Lime apportioned over three years, double cropped (6 crops total).
[b] Pallet boxes used, labor rate of $20/ pallet box.

Appendix A, Table 6. Fresh market spring green bell peppers, 1993 (trickle irrigation, marketable yield 1,500-28 lb. bushels).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Plants, 1000 (grown in 1.5 in. cells)	11.70	82.86	969.46	.....
Fert 10-12-20, lb.[a]	1,400.00	0.15	210.00	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton	0.80	40.00	32.00	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			140.40	.....
Herbicides			3.88	.....
Insecticides			91.31	.....
Fungicides			99.90	.....
Plastic Mulch - tubes			325.00	.....
Machinery - Production				
Irrigation, acre inch (trickle)	20.00	4.00	80.00	.....
Production machinery repairs			36.42	.....
Fuel, oil			23.32	.....
Miscellaneous, stakes & string			125.00	.....
Interest	2,141.69	4.50%	96.38	.....
HARVEST COSTS				
Supplies			20.00	.....
Custom harvest, bins[b]	113.00	20.00	2260 .00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			0.00	.....
Fuel, oil			0.00	.....
Clean-up			118.00	.....
Haul to packing			0.00	.....
Labor - Production	18.70	5.00	93.50	.....
- Harvesting	0.00	5.00	0.00	.....
- Staking	12.00	5.00	60.00	.....
- Irr. Maint.	20.00	5.00	100.00	.....
SUB TOTAL VARIABLE COSTS			4,889.57	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			72.54	.....
- Harvest			0.00	.....
Truck Depreciation			0.00	.....
Land (one crop/year)			60.00	.....
Irrigation (one crop/year)		309.00	309.00	.....
SUB TOTAL FIXED COSTS			441.54	.....
TOTAL COSTS			5331.11	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @1500-28 LB. BUSHELS			3.51	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @1500-28 LB. BUSHELS			3.55	.....

[A] Fertilizer is low-salt formulation.
[b] Pallet boxes used, labor rate of $20/pallet box.

Appendix A, Table 7. Western melons, 1993 (trickle irrigation, marketable yield 670-40 lb. boxes).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Plants	5,000.00	0.10	500.00	.....
Fert 10-12-20, lb.[a]	2,000.00	0.15	300.00	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton	0.80	40.00	32.00	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			140.40	.....
Herbicides			2.38	.....
Insecticides			17.55	.....
Fungicides			69.21	.....
Plastic Mulch - tubes			325.00	.....
Machinery - Production				
Irrigation, acre inch, trickle	12.00	4.00	48.00	.....
Production machinery repairs			37.07	.....
Fuel, oil			22.15	.....
Miscellaneous, bees			45.00	.....
Interest	1,543.76	4.50%	69.47	.....
HARVEST COSTS				
Supplies			20.00	.....
Harvest containers			0.00	.....
Custom harvest labor[b]	737.00	0.65	479.05	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			6.73	.....
Fuel, oil			5.84	.....
Clean-up			46.00	.....
Haul to packing shed	737.00	0.07	51.59	.....
Labor - Production	19.90	5.00	99.50	.....
- Harvesting	6.00	5.00	30.00	.....
- Irr. Maint.	10.00	5.00	50.00	.....
SUB TOTAL VARIABLE COSTS			2,401.94	.....
FIXED COST (Overhead or Ownership**,** consult Coop. Ext. Agent)				
Machinery - Production			68.82	.....
- Harvest			17.45	.....
Truck Depreciation	737.00	0.06	44.22	.....
Land (one crop/year)			60.00	.....
Irrigation (one crop/year)	0.50	309.00	154.50	.....
SUB TOTAL FIXED COSTS			344.99	.....
TOTAL COSTS			2,746.93	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @670-40 LB. BOXES			4.01	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @670 -40 LB. BOXES			4.10	.....

[a] Fertilizer is low-salt formulation.

[b] Based on harvest labor cost of $0.65/box for 737 boxes/A (total yield). Of the total, an average of 670 boxes of melons will be of marketable quality .

Appendix A, Table 8. Watermelons, 1993 (overhead irrigation, marketable yield 30,000 fruit).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seeds $/1000	2.5	14.90	37.25	.....
Nitrogen, lb.	200.00	0.26	52.00	.....
P_2O_5, lb.	100.00	0.22	22.00	.....
K_2O, lb.	150.00	0.15	22.50	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton	0.50	35.00	17.50	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			30.94	.....
Insecticides			17.72	.....
Fungicides			71.50	.....
Plastic Mulch - tubes			0.00	.....
Machinery - Production				
Irrigation, acre inch	2.50	12.00	30.00	.....
Production machinery repairs			14.53	.....
Fuel, oil			10.18	.....
Miscellaneous, bees			30.00	.....
Interest	361.12	4.50%	16.25	.....
HARVEST COSTS				
Supplies			20.00	.....
Harvest containers			0.00	.....
Custom harvest labor[a]	30,000.00	0.015	450.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			0.00	.....
Fuel, oil			0.00	.....
Haul to packing shed			0.00	.....
Labor - Production	6.80	5.00	34.00	.....
- Harvesting	0.00	5.00	0.00	.....
SUB TOTAL VARIABLE COSTS			881.37	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			29.08	.....
- Harvest			0.00	.....
Truck Depreciation			0.00	.....
Land (one crop per year)			60.00	.....
Irrigation (one crop per year)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			156.50	.....
TOTAL COSTS			1,037.87	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @30,000 FRUIT			0.033	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @30,000 FRUIT			0.035	.....

[a] Based on labor cost of $0.015/watermelon for 30,000 watermelons per acre

Appendix A, Table 9. Spring and fall Boston head lettuce, 1993 (overhead irrigation, marketable yield 500-13 lb. crates).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	0.50	160.00	80.00	.....
Nitrogen, lb.	95.00	0.26	24.70	.....
$P_2 0_5$, lb.	70.00	0.22	15.40	.....
K_2O, lb	70.00	0.15	10.50	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			46.78	.....
Insecticides			16.23	.....
Fungicides			63.00	.....
Custom thinning			50.00	.....
Machinery - Production				
Irrigation, acre inch	1.00	12.00	12.00	.....
Production machinery repairs			16.13	.....
Fuel, oil			12.97	.....
Miscellaneous			35.00	.....
Interest	393.66	4.50%	17.71	.....
HARVEST COSTS				
Supplies			20.00	.....
Crates	500.00	1.30	650.00	.....
Custom harvest labor[b]	500.00	0.90	450.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			8.08	.....
Fuel, oil			7.01	.....
Haul to shipping point	500.00	0.04	20.00	.....
Labor - Production	9.42	5.00	47.10	.....
- Harvesting	7.00	5.00	35.00	.....
SUB TOTAL VARIABLE COSTS			1,648.56	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			32.61	.....
- Harvest			20.92	.....
Truck Depreciation	500.00	0.03	15.00	.....
Land (double cropped)	0.50	60.00	30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			165.95	.....
TOTAL COSTS			1,814.51	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @500-13 LB. CRATES			3.57	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @500-13 LB. CRATES			3.63	.....

[a] Lime apportioned over four years.
[b] Crop harvested and packed into crates in the field; harvest labor cost $0.90 per crate.

Appendix A, Table 10. Spring and fall Romaine lettuce, 1993 (overhead irrigation, marketable yields 700-25 lb. crates).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	0.50	160.00	80.00	.....
Nitrogen, lb.	95.00	0.26	24.70	.....
P_2O_5, lb.	70.00	0.22	15.40	.....
K_2O, lb.	70.00	0.15	10.50	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			46.78	.....
Insecticides			16.23	.....
Fungicides			63.00	.....
Custom thinning			50.00	.....
Machinery - Production				
Irrigation, acre inch	1.00	12.00	12.00	.....
Production machinery repairs			16.13	.....
Fuel, oil			12.97	.....
Miscellaneous			35.00	.....
Interest	393.66	4.50%	17.71	.....
HARVEST COSTS				
Supplies			20.00	.....
Crates	700.00	1.45	1,015.00	.....
Custom harvest labor[b]	700.00	0.90	630.00	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			8.08	.....
Fuel, oil			7.01	.....
Haul to shipping point	700.00	0.04	28.00	.....
Labor - Production	9.42	5.00	47.10	.....
- Harvesting	7.00	5.00	35.00	.....
SUB TOTAL VARIABLE COSTS			2,201.56	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			32.61	.....
- Harvest			20.92	.....
Truck Depreciation	700.00	0.03	21.00	.....
Land (double cropped)	0.50	60.00	30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			171.95	.....
TOTAL COSTS			2,373.51	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @700-25 LB. CRATES			3.35	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @700-25 LB. CRATES			3.39	.....

[a] Lime apportioned over four years.
[b] Crop harvested and packed into crates in the field; harvest labor cost $0.90 per crate.

Appendix A, Table 11. Fresh market broccoli, 1993 (overhead irrigation marketable yields 350-21 lb. cartons).

Item Receipts	Number of Units	Unit Price ($)	Total ($)	Your Farm
OPERATING COSTS (VARIABLE)				
PRODUCTION COSTS				
Seed, lb.	1.00	160.00	160.00	.....
Nitrogen, lb.	145.00	0.26	37.70	.....
P_2O_5, lb.	100.00	0.22	22.00	.....
K_2O, lb.	145.00	0.15	21.75	.....
Spreading	1.00	5.00	5.00	.....
Lime, ton[a]	0.17	35.00	5.95	.....
Spray Materials, Chemicals (consult Coop. Ext. Agent and Va. Coop. Ext. Publication 456-420)				
Nematicides			0.00	.....
Fumigation			0.00	.....
Herbicides			29.06	.....
Insecticides			62.08	.....
Fungicides			8.25	.....
Machinery - Production				
Irrigation, acre inch	3.00	12.00	36.00	.....
Production machinery repairs			15.38	.....
Fuel, oil			12.01	.....
Miscellaneous			35.00	.....
Interest	450.18	4.50%	20.26	.....
HARVEST COSTS				
Supplies			20.00	.....
Boxes	350.00	1.00	350.00	.....
Custom harvest labor[b]	350.00	0.75	262.50	.....
Custom sort/grade/box			0.00	.....
Harvest machinery repairs			23.15	.....
Fuel, oil			18.70	.....
Cooling	350.00	0.85	297.50	.....
Haul to shipping point	350.00	0.07	24.50	.....
Labor - Production	9.07	5.00	45.35	.....
- Harvesting	13.00	5.00	65.00	.....
SUB TOTAL VARIABLE COSTS			1,577.14	.....
FIXED COST (Overhead or Ownership, consult Coop. Ext. Agent)				
Machinery - Production			31.11	.....
- Harvest			62.81	.....
Truck Depreciation	350.00	0.06	21.00	.....
Land (double cropped)	0.50	60.00	30.00	.....
Irrigation (double cropped)	0.50	134.83	67.42	.....
SUB TOTAL FIXED COSTS			212.34	.....
TOTAL COSTS			1,789.48	.....
COST PER UNIT EXC. LAND AND MANAGEMENT @350-21 LB. CARTONS			5.03	.....
TOTAL COST PER UNIT EXC. MANAGEMENT @350-21 LB. CARTONS			5.11	.....

[a] Lime apportioned over four years.
[b] Crop harvested and packed in the field; harvest labor cost $0.75 per carton.

Appendix A, Table 12a. Estimating cost per crate with varying yields and land cost/rent per acre: fall market cucumbers.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
75	$10.25	$10.32	$10.38	$10.45	$10.52
100	$8.36	$8.41	$8.46	$8.51	$8.56
125	$7.23	$7.27	$7.31	$7.35	$7.39
150	$6.48	$6.51	$6.54	$6.58	$6.61
175	$5.94	$5.97	$5.99	$6.02	$6.05

12b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.75	$4.25	$4.75	$5.25	$5.75
75	$9.98	-$468	-$430	-$393	-$355	-$318
100	$8.16	-$441	-$391	-$341	-$291	-$241
125	$7.07	-$415	-$353	-$290	-$228	-$165
150	$6.34	-$389	-$314	-$239	-$164	-$89
175	$5.82	-$363	-$275	-$188	-$100	-$13

Appendix A, Table 13 a. Estimating cost per crate with varying yields and land cost/rent per acre: spring snap beans.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
60	$11.06	$11.14	$11.23	$11.31	$11.39
85	$8.46	$8.51	$8.57	$8.63	$8.69
110	$7.04	$7.08	$7.13	$7.17	$7.22
135	$6.14	$6.18	$6.22	$6.25	$6.29
160	$5.53	$5.56	$5.59	$5.62	$5.65

13 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$8.50	$9.00	$9.50	$10.00	$10.50
60	10.73	-$134	-$104	-$74	-$44	-$14
85	8.22	$24	$66	$109	$151	$194
110	6.85	$18	$236	$291	$346	$401
135	5.99	$338	$406	$473	$541	$608
160	5.40	$496	$576	$656	$736	$816

Appendix A, Table 14 a. Estimating cost per crate with varying yields and land cost/rent per acre: fall snap beans.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
60	$11.61	$11.70	$11.78	$11.86	$11.95
85	$8.85	$8.90	$8.96	$9.02	$9.08
110	$7.34	$7.38	$7.43	$7.47	$7.52
135	$6.39	$6.42	$6.46	$6.50	$6.54
160	$5.73	$5.77	$5.80	$5.83	$5.86

14 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$4.25	$4.75	$5.25	$5.75	$6.25
60	11.28	-$422	-$392	-$362	-$332	-$302
85	8.61	-$371	-$328	-$286	-$243	-$201
110	7.16	-$320	-$265	-$210	-$155	-$100
135	6.24	-$269	-$201	-$134	-$66	$1
160	5.61	-$217	-$137	-$57	$23	$103

Appendix A, Table 15 a. Estimating cost per box with varying yields and land cost/rent per acre: Irish potatoes

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
100	$8.28	$8.38	$8.48	$8.58	$8.68
125	$6.70	$6.78	$6.86	$6.94	$7.02
150	$5.66	$5.72	$5.79	$5.86	$5.92
175	$4.91	$4.96	$5.02	$5.08	$5.14
200	$4.35	$4.40	$4.45	$4.50	$4.55

15 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$2.75	$3.75	$4.75	$5.75	$6.75
100	7.88	-$513	-$413	-$313	-$213	-$113
125	6.38	-$454	-$329	-$204	-$79	$46
150	5.39	-$396	-$246	-$96	$54	$204
175	4.68	-$337	-$162	$13	$188	$363
200	4.15	-$279	-$79	$121	$321	$521

Appendix A, Table 16 a. Estimating cost per box with varying yields and land cost/rent per acre: fresh market fall green bell peppers.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
50	$19.91	$20.01	$20.11	$20.21	$20.31
150	$7.60	$7.63	$7.66	$7.70	$7.73
250	$5.13	$5.15	$5.17	$5.19	$5.21
350	$4.08	$4.09	$4.11	$4.12	$4.14
450	$3.49	$3.50	$3.51	$3.53	$3.54

16 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.00	$3.50	$4.00	$4.50	$5.00
50	19.51	-$825	-$800	-$775	-$750	-$725
150	7.46	-$669	-$594	-$519	-$444	-$369
250	5.04	-$513	-$385	-$260	-$135	-$13
350	4.02	-$357	-$182	-$7	$168	$343
450	3.45	-$201	$24	$249	$474	$699

Appendix A, Table 17 a. Estimating cost per box with varying yields and land cost/rent per acre: fresh market spring green bell peppers

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
1300	$3.72	$3.73	$3.74	$3.74	$3.75
1400	$3.57	$3.58	$3.58	$3.59	$3.60
1500	$3.44	$3.44	$3.45	$3.46	$3.46
1600	$3.32	$3.33	$3.34	$3.34	$3.35
1700	$3.22	$3.23	$3.23	$3.24	$3.24

17 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.00	$3.50	$4.00	$4.50	$5.00
1300	3.69	-$897	-$247	$403	$1,053	$1,703
1400	3.54	-$757	-$57	$643	$1,343	$2,043
1500	3.51	-$765	-$15	$735	$1,485	$2,235
1600	3.30	-$476	$324	$1,124	$1,924	$2,724
1700	3.20	-$336	$514	$1,364	$1,053	$3,064

Appendix A, Table 18 a. Estimating cost per box with varying yields and land cost/rent per acre: western melons.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
470	$5.44	$5.47	$5.49	$5.51	$5.53
570	$4.64	$4.65	$4.67	$4.69	$4.71
670	$4.07	$4.08	$4.10	$4.11	$4.13
770	$3.65	$3.66	$3.68	$3.69	$3.70
870	$3.33	$3.34	$3.35	$3.36	$3.37

18 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.00	$3.50	$4.50	$5.00	$5.50
470	6.36	-$874	-$639	-$169	-$169	$66
570	4.57	-$608	-$323	$247	$247	$532
670	4.01	-$342	-$7	$663	$663	$998
770	3.60	-$76	$309	$1,079	$1,079	$1,464
870	3.28	$190	$625	$1,495	$1,495	$1,930

Appendix A, Table 19 a. Estimating cost per crate with varying yields and land cost/rent per acre: watermelons.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
28,000	$0.035	$0.036	$0.036	$0.036	$0.037
29,000	$0.035	$0.035	$0.035	$0.036	$0.036
30,000	$0.034	$0.034	$0.035	$0.035	$0.035
31,000	$0.033	$0.034	$0.034	$0.034	$0.035
32,000	$0.033	$0.033	$0.033	$0.034	$0.034

19 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$0.02	$0.03	$0.04	$0.05	$0.06
28,000	0.03	-$387	-$107	$173	$453	$733
29,000	0.03	-$382	-$92	$198	$488	$778
30,000	0.03	-$378	-$78	$222	$522	$822
31,000	0.03	-$374	-$64	$246	$556	$866
32,000	0.03	-$369	-$49	$271	$591	$911

Appendix A, Table 20 a. Estimating cost per box with varying yields and land cost/rent per acre: spring and fall Boston head lettuce

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
300	$4.47	$4.49	$4.51	$4.52	$4.54
400	$3.93	$3.95	$3.96	$3.97	$3.98
500	$3.61	$3.62	$3.63	$3.64	$3.65
600	$3.39	$3.40	$3.41	$3.42	$3.43
700	$3.24	$3.25	$3.25	$3.26	$3.27

20 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.75	$4.25	$4.75	$5.25	$5.75
300	4.41	-$197	-$47	$103	$253	$403
400	3.88	-$53	$147	$347	$547	$747
500	3.57	$90	$340	$590	$840	$1,090
600	3.36	$234	$534	$834	$1,134	$1,434
700	3.21	$378	$728	$1,078	$1,428	$1,778

Appendix A, Table 21a. Estimating cost per box with varying yields and land cost/rent per acre: spring and fall Romaine lettuce.

	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
500	$3.75	$3.76	$3.77	$3.78	$3.79
600	$3.53	$3.54	$3.55	$3.56	$3.57
700	$3.38	$3.38	$3.39	$3.40	$3.41
800	$3.26	$3.27	$3.27	$3.28	$3.28
900	$3.17	$3.17	$3.18	$3.19	$3.19

21 b. Estimating per acre returns to land and management with varying yields and prices.

		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$6.50	$7.00	$7.50	$7.50	$8.50
500	3.71	$1,395	$1,645	$1,895	$2,145	$2,395
600	3.50	$1,801	$2,101	$2,401	$2,701	$3,001
700	3.35	$2,206	$2,556	$2,906	$2,906	$3,606
800	3.23	$2,612	$3,012	$3,412	$3,412	$4,212
900	3.15	$3,018	$3,468	$3,918	$3,918	$4,818

Appendix A, Table 22 a. Estimating cost per box with varying yields and land cost/rent per acre: fresh market broccoli.

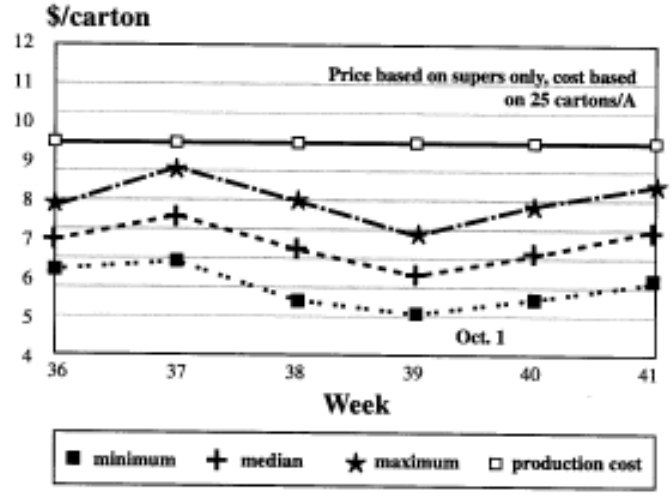
	--- Land Cost per Acre ---				
Yield Per Acre (Box)	$40.00	$50.00	$60.00	$70.00	$80.00
250	$5.98	$6.00	$6.02	$6.04	$6.06
300	$5.46	$5.47	$5.49	$5.51	$5.52
350	$5.08	$5.10	$5.11	$5.13	$5.14
400	$4.80	$4.82	$4.83	$4.83	$4.85
450	$4.59	$4.60	$4.61	$4.62	$4.63

22 b. Estimating per acre returns to land and management with varying yields and prices.

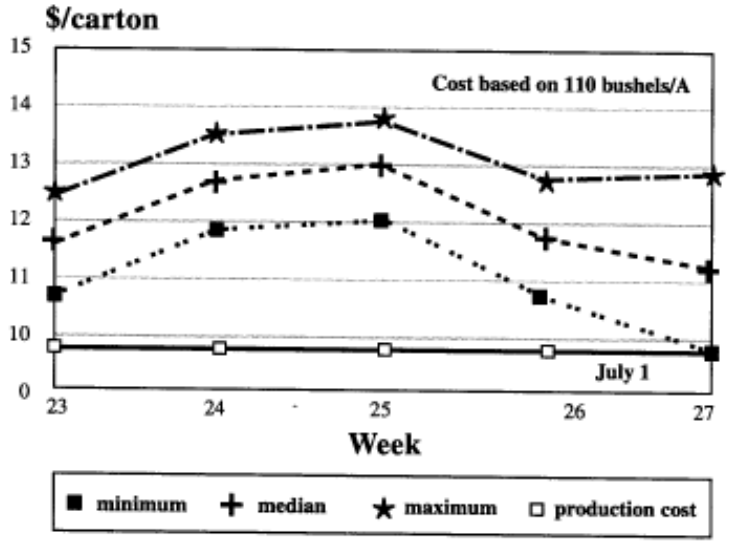
		--- Selling Price ---				
Yield per Acre (Box)	Total Cost/Box	$3.75	$4.25	$4.75	$5.25	$5.75
250	5.90	-$100	$25	$150	$275	$400
300	5.39	$33	$183	$333	$483	$633
350	5.03	$166	$341	$516	$691	$866
400	4.75	$298	$498	$698	$898	$1,098
450	4.54	$431	$656	$881	$1,106	$1,331

APPENDIX B: MARKET-WINDOW ANALYSIS FOR EASTERN SHORE CROP

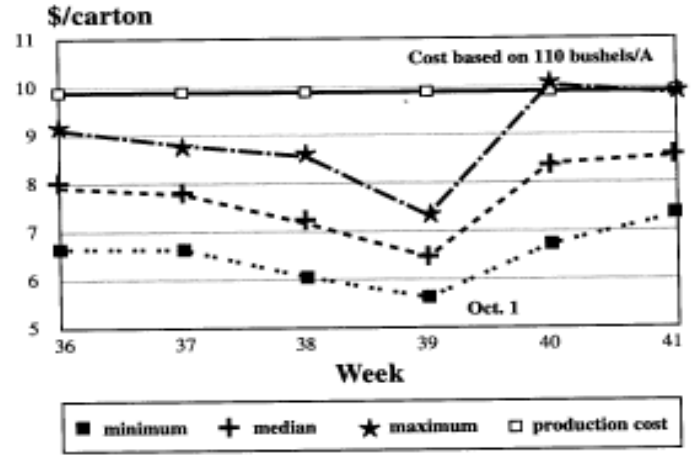
Appendix B, Figure 1. Market window for market cucumbers, 4-market average



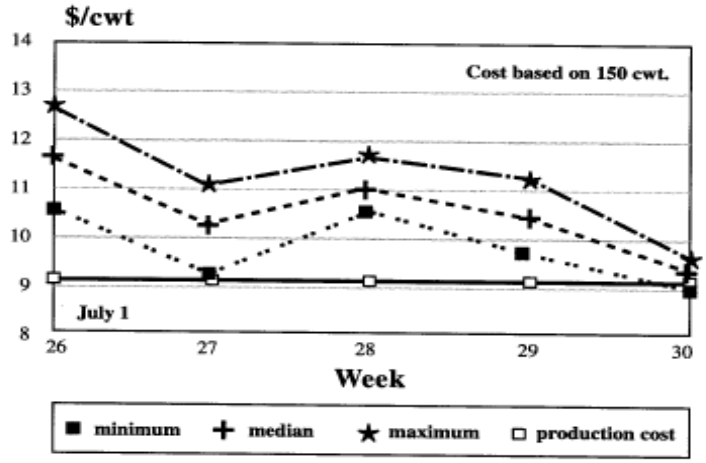
Appendix B, Figure 2. Market window for spring snap beans, 4-market average



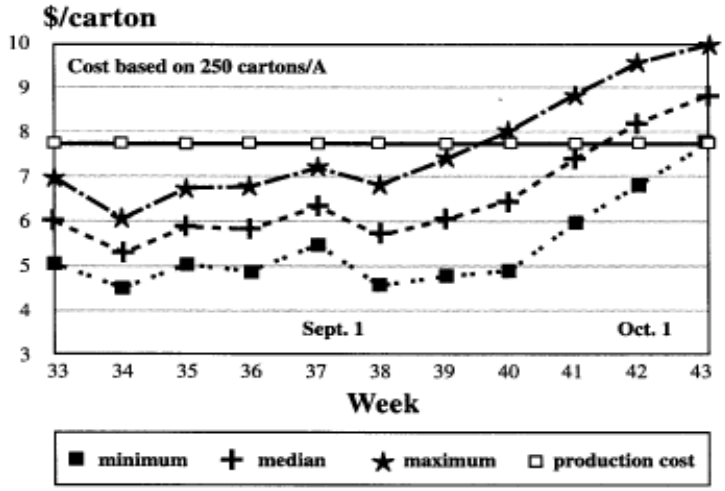
Appendix B, Figure 3. Market window for fall snap beans, 4-market average



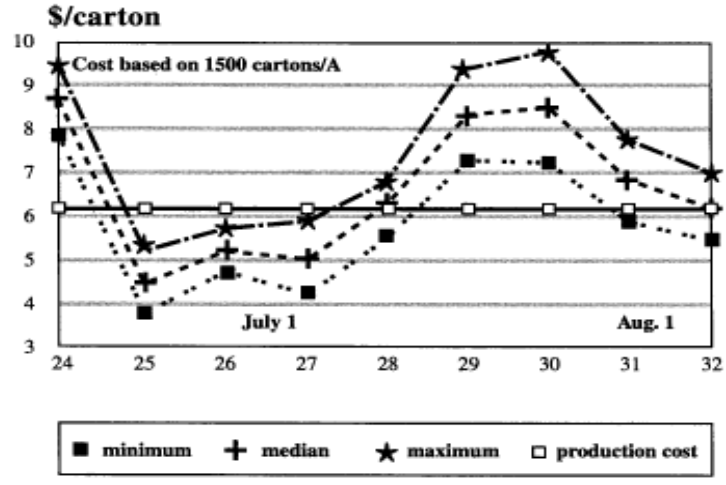
Appendix B, Figure 4. Market window for Irish potatoes, FOB Eastern Shore



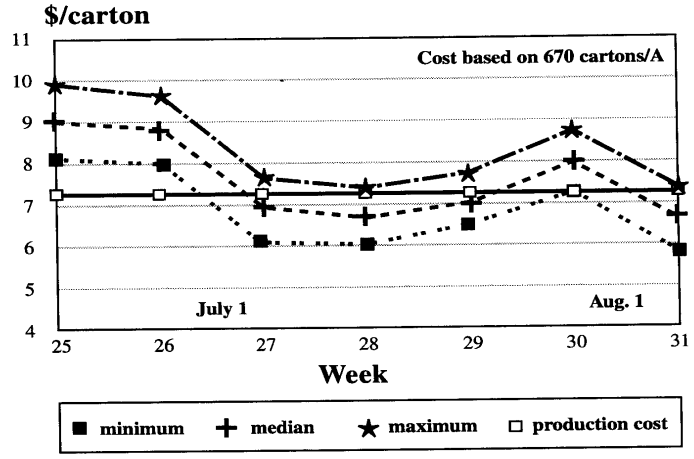
Appendix B, Figure 5. Market window for fresh market fall peppers, 4-market average



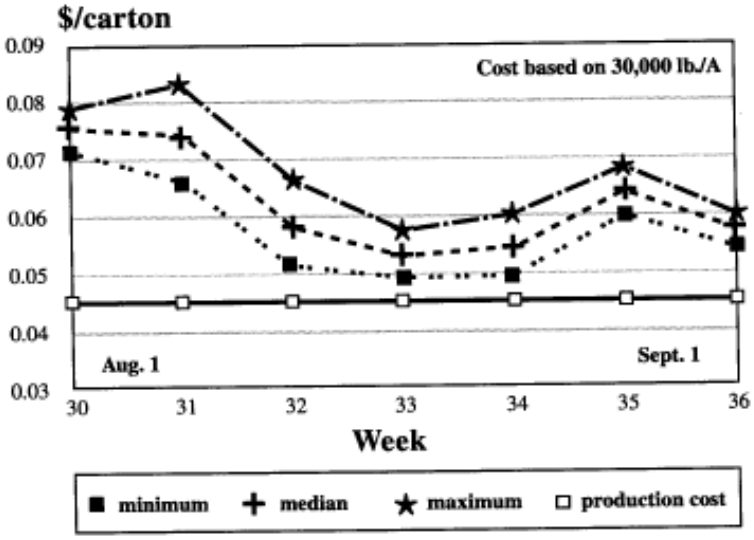
Appendix B, Figure 6. Market window for fresh market spring peppers, 4-market average



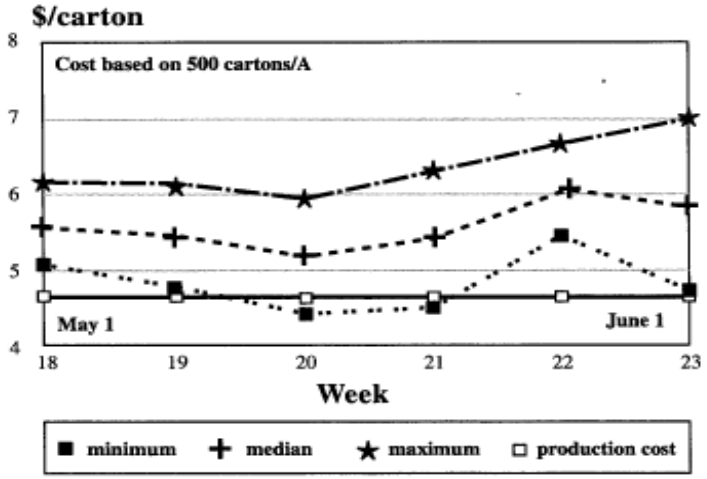
Appendix B, Figure 7. Market window for western melons, 4-market average



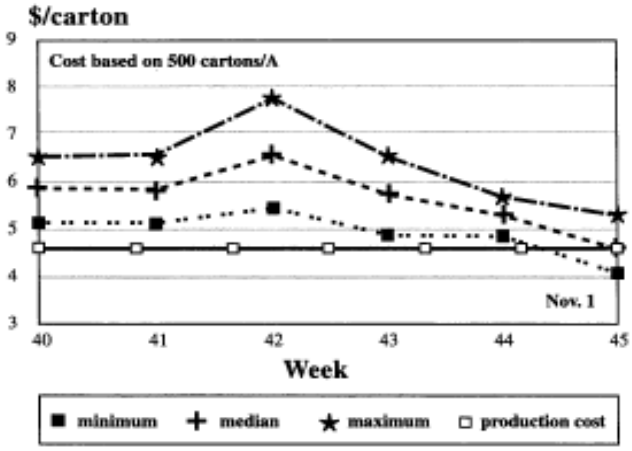
Appendix B, Figure 8. Market window for watermelons, 4-market average



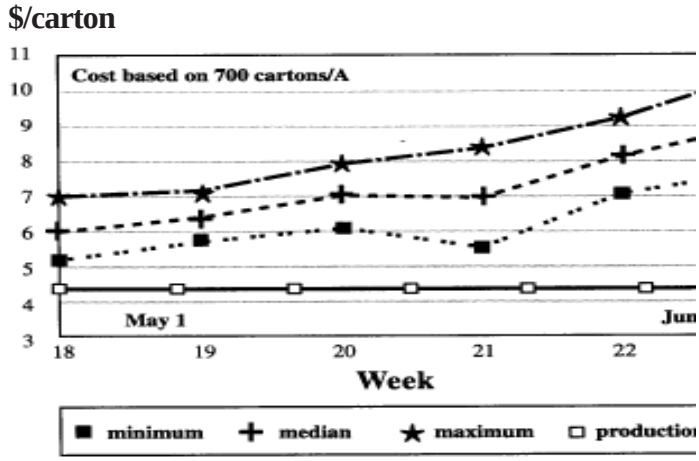
Appendix B, Figure 9. Market window for spring Boston lettuce, 4-market average



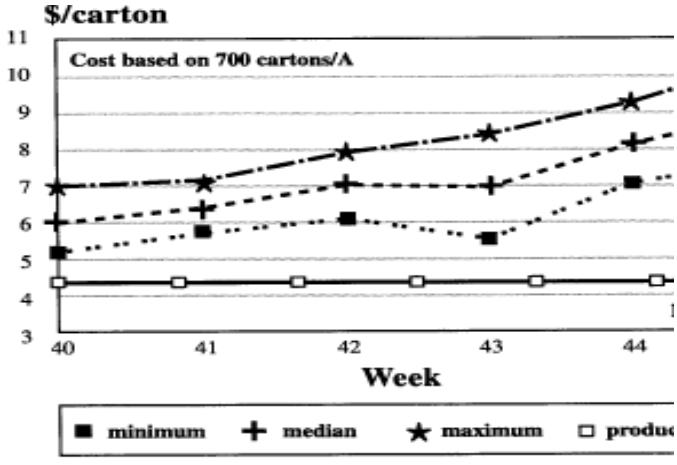
Appendix B, Figure 10. Market window for fall Boston lettuce, 4-market average



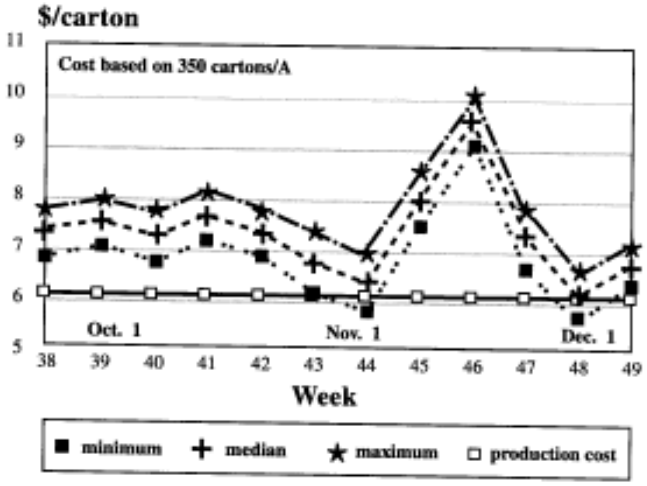
Appendix B, Figure 11. Market window for spring Romaine lettuce, 4-market average



Appendix B, Figure 12. Market window for fall Romaine lettuec, 4-market average



Appendix B, Figure 13. Market window for broccoli, 4-market average



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