The Economic Viability of Commercial Fresh Vegetable Production in the Northeastern United States

John W. Wysong, Mary G. Leigh, and Pradeep Ganguly

The Northeast region with nearly 25 percent of the U.S. population and purchasing power in 1983 is a deficit region in both processing and fresh market vegetable crops. This study explores the underlying factors in the long post-World War II decline in Northeastern vegetable production. It evaluates the economic viability of small-scale, family operated vegetable farms with emphasis on Maryland and the Baltimore-Washington Wholesale Market outlet near Jessup, Maryland.

Preliminary results of our study indicate that, under certain conditions, small-scale family farms can grow and commercially market fresh-market vegetables at competitive prices, and generate healthy cash flows. The optimum mix of crops would include up to three, non-competing crop sequences, with four different vegetable crops including spinach, snap beans, tomatoes and broccoli. Family (owner-operator) labor was found to be a major resource constraint on volume of vegetables marketed, especially tomatoes. Potentials for future expansion in selected crops seem to exist with improved technology and better management.

Commercial vegetable production for processing as well as fresh markets in the Northeast part of the United States has declined over the past fifty years or so. Even as recently as 1950, USDA data indicated that the Northeast region accounted for 21 percent of the total U.S. commercial vegetable production. However, by 1980, that proportion was down to only seven percent (Table 1). In recent years, potentials for the expansion of commercial fresh vegetable production and marketing in the Northeast have been evaluated and addressed by several scholars (Dhillon, 1980; Sinclair, 1980; Kerr, 1982). Among the major issues addressed are: 1) comparative costs and advantages of commercial fresh vegetable production and marketing in the Northeast, 2) the economic benefits-costs of transcontinental movement of produce, 3) the availability and relative opportunity costs of resources and inputs, 4) economies of size and scale, 5) the economic viability of small-scale commercial vegetable farms, and 6) the locations of production or regional markets in the absence of direct or indirect governmental intervention. This paper is intended 1) to report the procedures and some of the results of a study of the economic viability of small-scale commercial vegetable farms, with emphasis on Maryland and the Northeast and 2) to analyze and evaluate some potentials for fresh vegetable production and marketing in the Northeast and Maryland during the next decade.

This study differs from some of the previous ones in that the emphasis is on the economic viability of the smaller, family-sized vegetable farms which can utilize effectively modern marketing and production technologies to fit the existing and potential vegetable markets. After a brief background statement and literature review, an evaluation of national and regional trends in vegetable production, marketing and consumption and recent research is presented. Procedures and assumptions of the economic feasibility evaluation of management and marketing technologies at the farm firm level are presented to facilitate interpretation of anticipated financial results from certain decisions and actions of farm managers. Extending the growing season through improved crop selection and adoption of quality-improving, higher-yielding production and

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Professor, former graduate student and former Extension Associate, Department of Agricultural and Resource Economics, University of Maryland, College Park, MD 20742. Assistance from personnel of the Md. Coop. Ext. Service was received in this study. This included collecting the farm organization and operation data from vegetable farms in the study areas.

Table 1. Commercial Vegetable Production, U.S., Northeast, and Selected States, 1950, 1960, 1970 and 1980

State Ranked by 1980 Output	1950	1960	1970	1980	Percent Change 1950–1980
	Tons				(percent)
1. New York	1,338,500	1,130,650	974,250	959,800	−29
2. New Jersey	643,900	694,400	602,950	306,070	−52
3. Maryland	388,700	325,950	254,950	160,070	−59
4. Pennsylvania	417,200	329,150	283,150	151,700	−64
5. Delaware	92,000	101,550	97,700	71,980	−22
6. Massachusetts	118,600	98,400	76,100	59,020	−50
7. Connecticut	48,400	56,750	40,350	19,800	−59
8. Maine	42,100	35,150	13,650	8,380	−80
9. West Virginia	1,500	1,800	400	160	−89
10. New Hampshire	14,400	10,650	5,750	*	−89
11. Rhode Island	11,800	7,750	*	*	N.A.
12. Vermont	2,400	300	*	*	N.A.
Northeast Total	3,119,500	2,792,500	2,349,160	1,736,980	−44
U.S. Total	15,038,800	18,276,100	20,510,900	24,012,770	+60
N.E. Percent of U.S. Total	20.7	15.3	11.5	7.2	

Source: U.S.D.A., Agricultural Statistics; various issues, 1951 to date.
* Insignificant acreage reported in recent years.

market-oriented technologies are essential to the attainment of high average levels of net returns above variable costs on the vegetable farm plans and programs evaluated in this study. Finally, some conclusions and implications for Maryland and the Northeast metropolitan areas are presented with suggestions for future research and extension activities in the Northeast.

The future of fresh vegetable production in the Northeast has been confounded by a multitude of economic objectives, many of them complementary, but some dictated by the current nationwide structure of contract production, transportation and marketing. The debate over regional self-sufficiency includes, on the one hand, consumer groups, local agricultural interests, and environmentalists (Harwood and Madden, 1982, pp. 1–22), and on the other hand, those who challenge the economic validity of regional food self-sufficiency. Tyrell, Anderson and Weaver have raised the question of whether "the goal of self-sufficiency adequately reflects all the important issues which should govern the use of our land resources" (1982, pp. 47–51). They list among the economic costs of self sufficiency 1) farmland preservation programs; 2) keeping farmers farming when comparative advantage is absent; 3) maintaining the availability of agricultural inputs, and 4) the opportunity cost of foregone uses of economic resources. The issue of food self-sufficiency for the Northeast is not one which can be advocated in absolute terms, but only in terms of degree, with the optimum allocations of national resources a component consideration. Fresh produce is especially vulnerable to physical disturbances, such as droughts, pest infestations and the risks involved in long distance transportation. Seckler and Young (1978, p. 515) have indicated there are many social and economic costs to federally subsidized irrigation so important to Southwestern, and especially California, production. They have estimated that a modest farm operation of 160 acres in California may draw upon subsidized water whose capitalized value may be in excess of $100,000. Fossil fuel reserves also have been drawn down by long distance refrigerated transportation requirements.

Such factors as 1) economies of size, 2) almost year-round growing conditions, 3) aggressive marketing techniques, 4) easy access to migrant labor, and 5) improved transportation systems have in the past contributed toward shifting the apparent comparative advantage of fresh vegetable production to the far West, Southwest and Florida. Some of these advantage factors may not be as important in the 1980's and 1990's as in the post-World War II period of market development. Irrigation water in the key growing districts in the West apparently has approached its available maximum in terms of annual supply during the early 1980's with continuing economic

pressures developing for alternative non-agricultural water uses. Farm laborers in the West and Southwest have obtained, or are demanding, average wages which are competitive nationally (Huffman, 1982, pp. 989–998; Holt, 1982, pp. 999–1,006). Even some of the traditional advantages of economies of size of the western producer have been called into question (Hanson and Eidman, 1983). In a study of farms in the Imperial Valley of California, Madden (1972, p. 94) indicated that a rather flat long range average cost curve for vegetable production tended to show that farms of less than 640 acres can produce almost as efficiently as larger ones by hiring custom work for all, or most, operations. Hall and LeVeen determined that overall economic efficiency, comprising both technical and price efficiency, did not necessarily increase with size (1978, pp. 589–600). Farms, depending on the cropping enterprise, achieved technological efficiency at 100 to 320 acres; and factors other than labor-saving technology may be important to overall economic efficiency and marketing processes.

The degree to which the Northeast, with nearly a quarter of the nation's population and income, will continue to import the major share of its fresh vegetables, even during its own prime growing season, depends on a number of factors. These factors include: (1) the relative costs of natural resources, such as land, water, and fuel oil; (2) the availability of skilled and unskilled labor; (3) the ability of Northeastern growers to compete in the food-chain markets; (4) the development and extension of the local produce growing season to include more cool weather crops which can provide extended cash flow; and finally, (5) changes in consumer tastes and imputed elasticities of demand for fresh vegetables grown locally.

National and Regional Trends in Production, Marketing and Consumption

Although there has been an absolute reduction nationwide of about 19 percent in total acreage for vegetable production from 1950 to 1980, improved production techniques and marketing arrangements have helped raise yield per acre by 74 percent and total production almost 60 percent during those three decades. Between 1966 and 1980, there was an eight percent increase in per capita consumption of fresh vegetables, excluding potatoes and sweet potatoes, according to UDSA statistics. Among these fresh vegetables, the largest increase, 500 percent, was in broccoli, followed by a 50 percent increase in the consumption of cucumbers, and 27 percent increase in lettuce. These are all salad vegetables which have appeared with growing frequency as components of a changing U.S. consumption pattern both at home and away from home eating sites. Yet during this same period, snap beans were removed from the USDA list of statistically important vegetables in 1982. Perishable fresh snap beans may no longer be regarded by consumers as desirable a vegetable as the earlier snap beans varieties which were hand-picked; and, because they were locally grown, were available in a generally fresher state. Another factor which might account for the decline in consumption of such fresh produce is the development of cultivars which are more resistant to mechanical handling and deterioration, but which may forfeit taste and texture in obtaining longer shelf life.

Such horticultural development has also changed the commercially grown tomato, which Hightower (1973) described a decade ago. Fresh tomatoes can be grown commercially in many areas of the Northeast. This is one crop that can be compared for many production regions and seasons of the year.

Some of the research literature on the economics of vegetable production shows substantial concern for the competitive position of Northeastern growers extending back beyond the pre-World War II period. Wysong and Porter (1963) examined the impact of competitive forces during the 1950's and early 1960's in explaining some of the long-term decline in Maryland's vegetable industry, especially with respect to tomatoes and other canning and processing crops grown in Maryland such as sweet corn, snap beans, peas and lima beans. High financial risks relative to market prices and productive output (yields), efforts to mechanize and increased average annual net returns to labor resources and shifts in the hired labor markets were important factors underlying the shift toward cash crops such as soybeans and grain corn in Maryland. Other studies have indicated some of the technological, labor supply, and climatic factors underlying the long-term growth and expansion of processing tomato production in California at the expense of some Northeastern states such as Maryland, New Jersey, Pennsylvania and Delaware (Brant and French, 1983). How-

ever, nationally, fresh market tomato production has not been as subject to intensive mechanization pressures as has the production of tomatoes for canning and other processing purposes in California.

A number of economic studies have been undertaken in the late 1970's and early 1980's to determine the more efficient product mixes with acreage and skilled labor constraints applied. Dhillon (1980) used LP models to analyze 400 acre farms in Southern New Jersey, and Ahmad (1980) made a risk analysis of small farms on the Eastern Shore of Maryland. Leigh (1982) conducted economic feasibility studies using primary data obtained from 12 case study farms in selected Maryland counties adjacent to the metropolitan Baltimore and Washington, D.C. fresh produce marketing area. Some of the results and regional implications of this Maryland vegetable economics research follow.

A Comparative Evaluation of a Central Maryland Commercial Vegetable Farm

Procedures and Assumptions

The empirical data for economic analysis of the representative farm were derived from on-farm personal interviews with 12 vegetable farm managers and interviews with five county agricultural agents, as well as from secondary sources. Consultation with county level personnel of the Maryland Cooperative Extension Service was used to select a range and diversity of farm sizes and methods of organization. Data on 1982 product prices were obtained from the Maryland Wholesale Produce Market at Jessup, while input prices and requirements for labor, machinery, seed, and fertilizer were derived from secondary statistical information, and specific crop budgets in New Jersey, Maryland, and New Hampshire, as well as California. Selected vegetable production areas of California were visited and data obtained from California Cooperative Extension Service personnel in August 1982 in order to compare variable production costs regionally. Yields assumed in the future were based on data from the Maryland Crop Reporting Service, the University of Maryland Cooperative Extension Service, and the on-site vegetable farmer surveys.

North Central Maryland counties were selected for study to represent the expected future situation for local vegetable growers in such areas of the Northeastern region as Wilmington, Philadelphia, New York and surrounding areas. These counties of Montgomery, Howard, Baltimore, Anne Arundel, and Prince George's do not contain either the largest vegetable farming area in Maryland or the most productive land. However, they have historically provided the growing metropolitan communities in the Baltimore-Washington corridor a portion of their fresh vegetable requirements.

The actual Maryland farms from which the representative economic engineering model farm firm was largely constructed, revealed a wide divergency of agricultural practices and attitudes toward marketing, willingness to innovate with new crops and management technology. The farmers also differed in their evaluation of labor availability. All were family-owned farms where, typically, the family members provided the bulk of the full-time labor. In several instances, there was one family member employed off the farm to provide a small cushion against cash flow crises. The acreage under vegetable production per farm ranged from six to 400 acres in the study area. One-half of the farms supplemented their vegetable enterprises with orchard, berry or small grain production. The vegetables, however, comprised the major source of gross revenue. A wide range of vegetables was produced, but no two farmers gave the same response when asked which crop consistently gave them the best net returns to their capital or labor on their specific farm acreages.

The fixed cropland acreage was developed on the basis of some of the better farm practices observed. For simplicity of analysis, five crops were chosen based on 1) current practices, 2) possibilities for extension of the growing season, 3) ability to be integrated into a multi-cropping system (including integrated pest management) and 4) crop marketability either by direct marketing or wholesale or retail outlets. Broccoli was chosen as a cold weather crop which can be planted as transplant or directly into the ground as soon as the ground can be worked, or in late summer for late fall harvest. Spinach, also a cool season crop, was chosen as an early to late spring planted crop. If an over-wintering cultivar is used, the spinach can be harvested in early to mid-spring the following year. Snap beans, which can be planted in several successions, are a popular crop if freshness can be assured

at market. Locally grown fresh snap beans would appear to have a decided competitive advantage over the product which is shipped long distances. Sweet corn, as expected, was cited by the vegetable farmers surveyed to be much less labor intensive than many other vegetables. Early maturing varieties, or late planting, can benefit from more advantageous prices as is also the situation for tomatoes. Techniques, such as slit-row covering for inducing early maturity, can also bring higher prices, although competition from the Carolinas has increased.

The model vegetable crop farm was assumed to have 60 tillable acres with the average rental value set at $35 an acre, which had been the average rental price paid in the study area.[1] The unskilled labor wage rate was $4.00 an hour. The greatest constraint for the farm manager was owner-operator and family labor time. This was set at 2.5 man years for the economic model, which was similar to the farm data mean obtained from personal interviews.

Economic feasibility evaluations using successive partial budgets of increased resource use intensity for one year's forward planning were made for the 60-acre mixed-crop enterprise. Since spinach and broccoli are not necessarily competitive with beans, corn or tomatoes, these may be considered supplementary or complementary crops. The time and, to some extent, the fertilizer requirement for one crop, can be subtracted from the total variable costs of succession crops. A good farm manager, well aware of the risks involved in single cropping or single plantings of an individual crop, will want to spread out his risks by planting several crops over a longer growing season. The optimum mix of crops and plantings within the acreage and owner-operator labor limitations was one which might include up to three cropping sequences per acre. Sixty acres of early spring or winter spinach (which had served as a cover crop) would be harvested in the spring before 27 acres of snap beans are succession planted, along with 33 acres of tomatoes, but the snap beans could be planted simultaneously as their harvests would precede those of the tomatoes. The snap beans and tomatoes would be followed by late August plantings of broccoli. (Table 2).

Sensitivity analyses of the net cash flow changes when spinach yields decreased did not change the optimum product mix as these crops were not competitive. The five crops chosen for this study and the four crops in the final model plan demonstrate the advantages of intensive cultivation by stretching the growing season at both ends on the southern and eastern fringes of the Northeast region. The selection of broccoli and tomatoes in the optimum farm program resulted in high average returns above variable costs. With commercial vegetable production and marketing risks and uncertainties such as risk of price and yield fluctuations, net farm incomes may vary widely from year to year in future periods.

[1] This low rental price is partly attributive to the agricultural use value tax which encourages maintenance of Maryland agricultural land in farming activities.

Table 2. Estimated Per Acre Costs and Returns, Selected Crops with Multiple Cropping[a], Maryland, 1982

Rotation	Gross Return	Total Variable Costs	Return over Variable Costs	Owner/Operator Labor
	----------per acre----------			
	----------dollars----------			(Hours)
CN/BR	3,995	1,413	2,582	30
BR/SP	4,282	1,636	2,646	30
SP/BN/BR	5,404	2,422	2,983	50
SP/TM	6,512	3,285	3,227	44
SP/TM/BR	7,334	3,033	5,656	59
SP/BN-TM/BR	7,840	3,387	5,807	79

[a] Estimated from Table 4.
[b] Most feasible combination, with a return over variable costs on 60 acres = $267,161 annually. Management labor constraints would limit tomato-production to 33 acres. The remaining available 27 acres would be planted in snap beans whose management and harvest labor requirements would not compete directly with the tomato harvest. 60 acres would be planted in spring harvested spinach and 60 acres in late fall harvested broccoli.
[c] See Leigh, 1982, p. 71.

When two or more crops per acre are succession planted, average per acre net returns are increased, the farmer's cash flow period is extended, his managerial and skilled labor requirements are spread out, and finally, the crops themselves can provide the cover to inhibit soil erosion.

Prices received by Maryland growers from such crops as spinach and tomatoes were generally lower than those shipped from the West Coast during the same 1982 study period. The apparent price discriminations confronting Maryland growers may indeed be owed to competitive quality considerations or may be a psychological holdover of past perceptions of quality and presentation. In a paper interpreting quality evaluations of horticultural crops, Lipton (1980) warns that we must keep in mind that human perceptions of quality are influenced by chemical, physical, physiological, and even sociological factors. The wholesale produce manager contacted at the Baltimore-Washington Wholesale Market indicated that if: 1) Maryland growers standardized their produce and pack, and 2) presented a product that looked as good as that from out of state, such produce could be priced competitively.

Where fresh tomato shipments arrive from California at Maryland wholesale markets during the height of the local harvesting season, a cost of production comparison between Maryland growers and growers in the exporting California counties is revealing. As with the Maryland study farms, the three different county sample budgets for Tulare, Fresno and Santa Clara Counties represent different production technologies.

Yet the unit cost of tomato production is found to be higher in California than in central Maryland in two out of three counties, and in Fresno County more than one-half of the tomatoes were used for canning, which would generate lower net receipts (Table 3). According to the California county budgets, land rental was set at $250.00 per acre for the first two counties and $175.00 for the third. Harvesting wage rates were set at $4.50 per hour. Although yields in these California counties were higher than that designated for the Maryland model, the variable costs of production could place the Northeastern grower at a competitive advantage as transcontinental shipping costs, on top of production costs, continue to increase.

Table 3. Estimated Per Acre Yields and Variable Costs for Fresh Tomatoes in California Counties and Central Maryland

	Yield cwt.	Total Variable Cost	Cost per cwt.
Tulare Co., CA	500	$9,414	$18.83
Fresno Co., CA	360[a]	2,571	7.14
Santa Clara Co., CA	320	3,425	10.70
Central Maryland	300	2,540	8.46

Source: *California Cooperative Extension Service*, County Agricultural Agents developed tomato crop budgets for each county.
[a] 200 cwt. of the 360 cwt. in the Fresno County, California budget total was assumed to be used for canning and only 160 cwt. for fresh market purposes.

Conclusions and Implications

The analysis of the Maryland model farm has been based on the wholesale prices of the Maryland Wholesale Produce Market. Many local growers, as the study revealed, can capture the higher retail price for their produce either by selling at their farm or at farmer's markets. Others may receive more advantageous wholesale prices by dealing directly with local wholesalers or local retail markets. It would appear that there are sufficient financial incentives for Northeastern and Maryland growers, in particular, to continue to compete for a larger share of the fresh produce market. Based on the model study, net receipts above variable costs may provide a competitive alternative in the future to the more labor extensive farming enterprises, such as cattle raising and small grain production. This would seem to be especiallly true for farms located close to large metropolitan centers where markets are at hand. Although vegetable growing and marketing is acknowledged to be hard work with high financial risks, there are many seasons including new entrants, who can see the potential profitability in future vegetable production, especially when the best new horticultural methods are applied and top quality produce is presented for commercial markets. With stabilizing crops of producers and improved marketing outlets, increased fresh vegetable production in the Northeast would widen the margin of fresh produce independence during the eight or nine months of the year when the Northeast is capable of growing its own. The allocation of flow and stock resources—land, water and fossil fuel—would be more efficiently distributed.

Table 4. Estimated Average Per Acre Variable Production Costs, Yields and Returns for Selected Vegetable Crops, Central Maryland

	Spinach (SP)	Broccoli (BR)	Beans (BN)	Tomatoes (TM)	Corn (CN)
1. *Pre Harvest Costs*					
a. Lime	6.00	6.00	6.00	6.00	6.00
b. Seed/Transplants	22.50	150.00	110.70	350.00	36.00
c. Fertilizer	92.34	98.10	43.50	82.81	135.00
d. Herbicide	22.00	9.00	6.75	9.00	14.02
e. Insecticides/ Fungicide	13.02	30.24	16.56	98.69	27.40
f. Fuel and Oil	51.88	51.88	41.00	21.42	13.22
g. Irrigation	16.28	16.28	16.28	32.56	0.00
h. Other Labor[a]	—	4.00	—	40.00	—
	(224.02)	365.50	(240.79)	(640.48)	(231.64)
2. *Harvest to Sale Costs*					
a. Harvesting & Crating	400.00	300.00	400.00	840.00	120.00
b. Crates/Cartons	76.50	76.50	76.50	750.00	135.00
c. Hauling/Cooling[a]	—	35.00	20.00	120.00[b]	—
d. Fuel and Oil	15.00	15.00	15.00	15.00	15.00
e. Selling Charge	28.88	99.60	33.66	175.50	20.25
	(520.38)	(526.10)	(545.16)	(1,900.50)	(290.25)
3. Total Variable Costs	744.40	891.60	685.95	2,540.98	521.89
4. Yield (CWT)	35	80	33	300	78
5. Price (CWT)	27.50	41.50	34.00	19.50	8.60[c]
6. Expected Receipts	962.50	3,320.00	1,122.00	5,550.00	675.00
7. Returns over Variable Costs	218.10	2,428.40	336.05	3,009.02	153.11
8. Family Labor (hrs)	15.0	15.0	19.8	29.2	15.4

[a] See under item 8, family labor.
[b] Washing and grading.
[c] Equivalent price per dozen = $0.90.
Source: Compiled from draft of *Maryland Farm Data Manual*, 1983, with some revisions.

Additional research of an applied nature appears to be needed in other Northeastern states to verify the full productive viability of small, family farms in the vegetable production and marketing sector. There will probably be an increased need for extension education activities with computers, technical production processes, and dynamic vegetable and food marketing alternatives in the future.

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