RELATIVE PROFITABILITY OF VINE-RIPE TOMATOES IN NORTH CAROLINA AND TENNESSEE

Gene A. Mathia and John R. Brooker

INTRODUCTION

The ability of a farmer or group of farmers in a region to produce a specific product profitably depends on the structure of costs of production and marketing and demands of all competing crops. The final decision to grow a particular product is made on the basis of its profitability relative to profitabilities of other alternatives. Relative profitability of a product changes as technological innovations affect yields, resource requirements and production efficiency. Factors affecting demand for resource inputs and products cause changes in profitabilities. Institutional factors can also necessitate adjustments in farm plans by influencing price and/or production of specific products and thereby affecting the profitability of one product relative to other product alternatives.

The purpose of this study is to analyze relative profitabilities of fresh vine-ripe tomatoes and competing products grown in western North Carolina and eastern Tennessee.

Procedures followed in the study were to (1) develop a programming framework which took into account production and marketing costs, risk preference levels and less than perfectly elastic demands for products, (2) estimate production and transportation costs, risks and demands for fresh tomatoes and competing enterprises grown in western North Carolina and eastern Tennessee and (3) summarize production and marketing advantages of tomatoes in these two production areas.

THE PROGRAMMING MODEL

The programming model developed for each production area had the following characteristics:

(a) less than perfectly elastic demand functions for products incorporating local and non-local demand components,
(b) differing levels of risks and risk aversion and
(c) protection of local demand by transportation costs.

The general mathematical expression for the objective function incorporating the above characteristics has been presented in several sources. A few of these are Hazell [6], Hazell and Scandizzo [7], Duloy and Norton [4], Simmons and Pomerada [13] and Nieuwoudt, Bullock and Mathia [11]. An adaptation of the objective function which maximizes producer and consumer surpluses is as follows:

$$\text{Max } Z = X'W(A - .5BWX) - [C'X] - [L'X] - [R'X]$$

where

Z = sum of net producer and consumer surpluses
$X'W$ = output component
$A - BWX$ = linear demand function
A, B = demand coefficients
W = diagonal matrix of average yields
X = vector of aggregate acres
$C'X$ = production costs including land and capital
$L'X$ = labor costs and
$R'X$ = risk costs.

Gene A. Mathia is Professor of Economics, North Carolina State University at Raleigh; and John R. Brooker is Associate Professor of Agricultural Economics, University of Tennessee at Knoxville.

SUPPLY DATA

Competing Supply Areas

The tomato producing areas of western North Carolina and eastern Tennessee were delineated from census data. Eastern Tennessee was divided into the upper and lower Tennessee Valley producing areas. The counties included in each area are listed in the footnotes of Table 1.

Farming situations for North Carolina and upper and lower East Tennessee were structured according to census classification by acres of cropland as presented in Table 1. The number of farms by farm group and availability of capital and tobacco allotments per farm were included in Table 1.

Enterprise budgets based on 1974 technology were developed. A summary of yields, production costs excluding land, and capital requirements are presented in Table 2. Production costs for North Carolina and Tennessee may not seem comparable because custom harvest labor is included as a production item for most North Carolina crops, but not for Tennessee crops. This technological difference apparently resulted in the substitution of capital investment which is not deducted from the objective function for production costs in the two states. Risk costs were estimated by discounting expected gross income by an income variability index.[1] The level of risks the farmer might wish to avert was set at three predetermined levels; i.e., zero, 20 percent and 40 percent. At the zero level, farmers assumed all risk costs. The 40 percent level represented a situation in which farmers were more risk averse and elected to transfer the risk of potential income variation. This transfer took the form of an insurance premium. In effect, crops with high income variability became less profitable as the level of risk aversion increased.

TABLE 1. REPRESENTATIVE FARMING SITUATIONS FOR THE WESTERN NORTH CAROLINA AND EASTERN TENNESSEE TOMATO AREAS, 1974

Characteristic	Farm size (acres) 1-9	10-49	50-69	70-99	100 and over
North Carolina:[a]					
Acres of cropland/farm	2.0	4.4	7.1	9.3	20.3
Number of farms/area	659	2,242	674	614	1,208
Capital/farm	2,231	11,653	24,584	34,507	80,934
Tobacco allotment/farm	.2	.4	.7	.9	2.0
Upper Tennessee:[b]					
Acres of cropland/farm	1.6	4.7	10.7	10.1	33.7
Number of farms/area	3,674	10,496	3,571	3,355	6,543
Capital/farm	4,072	12,527	22,310	30,113	54,592
Tobacco allotment/farm	.11	.36	.69	.97	2.17
Lower Tennessee:[c]					
Acres of cropland/farm	1.7	7.1	11.6	15.8	46.4
Number of farms/area	236	1,084	515	706	2,516
Capital/farm	3,399	12,567	19,137	24,534	58,498
Tobacco allotment/farm	.02	.10	.17	.22	.66

[a]Includes Buncombe, Haywood, Macon and Madison counties.

[b]Includes Blount, Carter, Claiborne, Cocke, Grainger, Greene, Hamblin, Hancock, Hawkins, Jefferson, Johnson, Knox, Loudon, Sevier, Sullivan, Unicoi, Union and Washington counties.

[c]Includes Bledsoe, Bradley, Hamilton, McMinn, Marion, Meigs, Monroe, Polk, Rhea and Sequatchie counties.

TABLE 2. SUMMARY OF COSTS AND CAPITAL REQUIREMENTS FOR FARM RESOURCE COMPETING ENTERPRISES IN THE TOMATO AREAS OF WESTERN NORTH CAROLINA AND EASTERN TENNESSEE, 1975

Enterprise yield	Production cost[a]	Investment capital
	(dollars/acre)	
Western North Carolina:		
Bell pepper (140 cwt.)	824.11	179.15
Fresh cucumbers (120 cwt.)	551.90	112.93
Stake tomatoes (400 cwt.)	1,516.24	159.89
Trellis tomatoes (512 cwt.)	1,438.67	235.22
Snap beans (52.5 cwt.)	615.14	159.31
Squash (120 cwt.)	669.22	110.72
Cabbage (240 cwt.)	817.27	104.95
Sweet corn (90 cwt.)	556.37	109.31
Okra (80 cwt.)	518.93	140.50
White potatoes (200 cwt.)	656.51	100.24
Corn (grain) (100 bu.)	139.94	117.13
Corn (grain) (100 bu.)	149.51	117.13
Soybeans (35 bu.)	79.75	88.06
Burley tobacco (2600 lbs.)	674.72	396.58[c]
Strawberries (75 cwt.)	1,853.98[b]	897.60
	(dollars/unit)	
Feeder pigs (45 sows)	18,139.76	27,015.00
Market hogs (45 sows)	48,034.29	51,014.00
	(dollars/acre)	
Eastern Tennessee:		
Tomatoes		
Lower Tennessee (200 cwt.)	840.60	712.11
Upper Tennessee (250 cwt.)	870.72	878.78
Pimiento peppers (800 cwt.)	450.93	552.44
Bell peppers (140 cwt.)	489.37	636.56
Corn (80 bu.)	92.39	114.89
Burley tobacco (2200 lbs.)	434.44	1,856.78

[a]Includes labor costs for custom harvesting all crops except burley tobacco, but excludes harvest labor costs for all Tennessee crops.

[b]Includes first year establishment costs.

[c]Excludes capital costs for curing barns.

DEMAND DATA

Demands for each product considered feasible in western North Carolina and eastern Tennessee are composed of a local and nonlocal component. Particular characteristics of these demands are illustrated in Figure 1. DD_S represents total demand for the product grown in the state. DD_L represents market

[1]Gene A. Mathia, Measurement of Price, Yield and Sales Variability Indexes for Selected Crops. ERR No. 36, North Carolina State University, Raleigh, October 1975. Variability in costs of production was not considered in this study since input price data would be available and fairly certain when the farmer made his farm plan. Thus, gross income which included both variability in yield and price of product was selected.

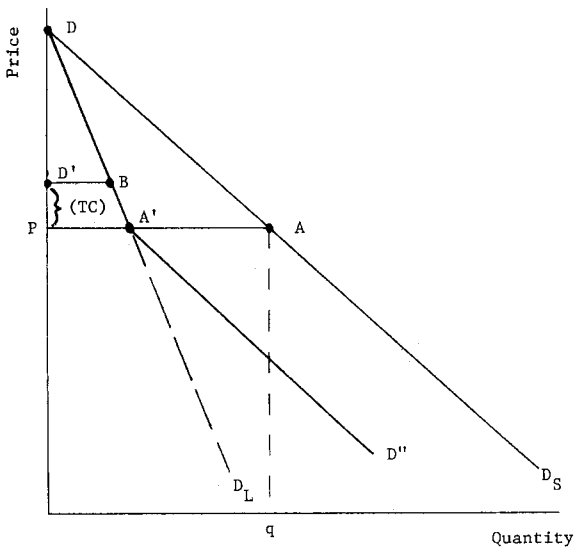

FIGURE 1. HYPOTHETICAL DEMANDS FACING FARMERS FOR A PARTICULAR PRODUCT DURING THE AREA'S SUPPLY SEASON

share of total state demand supplied by local area farmers. DD_L and DD_S have the same elasticity at any given price since they are assumed to have common intercept values. It is assumed that $A'D''$ and DD_S have the same slope.[2] Import demand, $D'B$, was assumed to be perfectly elastic at the state base price, P, as defined below, plus transportation costs.

Individual product demands used in the objective function are specified by the demand segments $D'BA'D''$. They were specified by a three-step process. First, with price elasticities obtained from secondary sources, state demands were positioned with the base quantity (q) and price (P) levels for 1976. Second, the share of state demand supplied in 1976 by local area farmers was determined. This positioned local demand share DD_L relative to total state demand DD_S. The third step was to divide demand schedule $D'BA'D''$ into linear segments. Demand coefficients and market shares for the local and nonlocal demands are presented in Tables 3 and 4.

Protection of the local market for local farmers was set at the level of transfer costs (TC). An "import" activity was included to handle shipments from farmers outside the area into the programmed area at prices above D'. At prices below P, local farmers can make shipments outside the programmed area, but the volume exported would affect the price as dictated by the slope of $A'D''$. Thus, $D'B$ represents the f.o.b. programmed area demand for "imports" and $A'D''$ represents the f.o.b. programmed area demand for "exports."

TRANSPORTATION DATA

Most farmers perform the function of moving the product from the farm to the local primary market. Thus, production cost estimates or enterprise budgets included costs of purchasing and operating a truck of sufficient size for farm-to-local market shipment. Beyond the primary assembly point, however, commercial carriers are contracted. The rate structure was assumed to be 30 cents per 50 pound container.

RESULTS OF ANALYSIS

Results of the programming effort for North Carolina are summarized in Table 5. Enterprise selections assuming no risk costs are presented in the zero risk column, and risk costs are increased to 20 and 40 percent by assuming higher levels of risk aversion by farmers. Imports of products which were not profitable to produce locally at the specified demands are presented after solutions are given for all five farming situations in each programming area. Imports are the acre equivalents at programmed yields of the products. The acres of products produced on the five farm categories were calculated by multiplying optimal per farm value by number of farms in that particular size group.

Volumes of most products actually produced in 1975 were predicted fairly closely for all products except those imported into the area. Acres of each crop produced in 1975 were underestimated because yields used in the program were much higher than actual yields. A reduction of yields to state average would have increased resource utilization, total volume produced would have remained stable but calculated prices would have increased.

In North Carolina, vegetable enterprises were sensitive to the level of risk costs. Acreages of these crops tended to decline while acreages of soybeans tended to increase as risk costs increased. All cropland was utilized. Capital was utilized fully on farms in groups 4 and 5. Tomatoes were grown on farm group 1 (1-9 acres) at all three risk costs. However, a slight reduction in acres occurred at the 40 percent level. These acreage levels amounted to only about 60 percent of tomato acreage in 1975 as estimated by county agents. Programmed yield of tomatoes was

[2]This assumption is based on the premise that local market share of total state demand cannot be increased without affecting price at the same rate producers outside the area would affect state price by increasing output.

TABLE 3. LINEAR DEMAND ESTIMATES FOR NORTH CAROLINA AND THE WESTERN MOUNTAIN DISTRICT COUNTIES OF NORTH CAROLINA, 1975-76

Enterprise	Unit	Quantity[a]	Price[a]	Demand elasticity[b]	North Carolina Demand		Regional Demand	
					Constant	Slope	Share[d]	Slope
		(1000 units)	($/unit)					
Bell peppers	(cwt.)	284	13.60	-2.07	20.17	$.231(10^{-4})$	.10*	$.231(10^{-3})$
Fresh cucumbers	(cwt.)	436	8.58	-1.80	13.35	$.109(10^{-4})$	.10*	$.109(10^{-3})$
Tomatoes	(cwt.)	290	13.50	-0.36	51.00	$.123(10^{-3})$	.35	$.369(10^{-3})$
Snap beans	(cwt.)	137	24.20	-0.50	72.60	$.353(10^{-3})$	.10*	$.353(10^{-2})$
Squash	(cwt.)	300	9.50	-0.32	39.19	$.990(10^{-4})$	.10*	$.989(10^{-3})$
Cabbage	(cwt.)	1,213	4.12	-0.89	8.75	$.381(10^{-5})$	.10*	$.382(10^{-4})$
Sweet corn	(cwt.)	351	7.13	-0.87	15.33	$.233(10^{-4})$	.10*	$.233(10^{-3})$
Okra	(cwt.)	40	25.00	-0.32	103.13	$.195(10^{-2})$	.10*	$.195(10^{-1})$
Summer white potatoes	(cwt.)	2,425	3.36	-0.50	10.08	$.277(10^{-5})$	.06	$.462(10^{-4})$
Corn grain	bu.	150,400	2.37	-0.27	11.15	$.584(10^{-7})$	.04	$.146(10^{-5})$
Soybeans	bu.	23,650	6.71	-1.17	12.45	$.242(10^{-6})$	.02	$.121(10^{-4})$
Strawberries	(cwt.)	44	46.00	-0.60	122.67	$.174(10^{-2})$		$.174(10^{-1})$
Burley tobacco	acre				2,800 per acre			
Feeder pigs	dollars				25,470			
Market hogs	dollars				59,285			

[a]Represents total state production. Production to the programmed area can be estimated by multiplying state quantity by regional share.

[b]References: P. S. George and G. A. King: Consumer Demand for Agricultural Products in the U.S., Giannini Monograph No. 26, March 1971; H. E. Buchholz, G. G. Judge and V. T. West, A Summary of Selected Estimated Behavior Relationships for Agricultural Products, Illinois Research Report (AERR-57), and G. A. Mathia and R. A. Schrimper, Analysis of Shifts in Demand and Supply Affecting U.S. and N.C. Vegetable Production and Price Patterns, Information Report EIR-35.

[c]Regional demand includes volume of production of 17 western mountain district counties including Buncombe, Haywood, Madison and Macon.

[d]Regional demand share is based on the ratio of total 1974 production in the western mountain district counties of North Carolina to total state production. Insufficient data were available to estimate regional shares of selected crops for these products, a regional share of 10 percent was assigned and indicated by *.

TABLE 4. LINEAR DEMAND ESTIMATES FOR UPPER AND LOWER EASTERN TENNESSEE TOMATOES, 1975-76

Product	Unit	Quantity[a]	Price[a]	Demand elasticity[b]	Tennessee demand		Upper east Tennessee demand		Lower east Tennessee demand	
					Constant	Slope	Share	Slope	Share	Slope
		(1000 units)	($/unit)							
Tomatoes	cwt.	257	24.00	-0.36	90.67	$.259(10^{-3})$	.22	$.118(10^{-2})$	.26	$.998(10^{-3})$
Corn	bu.	36,900	2.65	-0.27	12.46	$.266(10^{-6})$	.09	$.296(10^{-5})$	.05	$.532(10^{-5})$
Bell peppers	cwt.	176	8.00	-2.07	11.86	$.220(10^{-4})$	.74	$.297(10^{-4})$	.26	$.845(10^{-4})$
Pimiento peppers	dollars				$ 850 per acre					
Burley tobacco	dollars				$2,250 per acre					

[a]Represents total state production. Production in the programmed area can be estimated by multiplying state quantity by the regional share.

[b]References: P. S. George and G. A. King: Consumer Demand for Agricultural Products in the U.S., Giannini Monograph No. 26, March 1971; H. E. Buchholz, G. G. Judge and V. T. West, A Summary of Selected Estimated Behavior Relationships for Agricultural Products, Illinois Research Report (AERR-57), and G. A. Mathia and R. A. Schrimper, Analysis of Shifts in Demand and Supply Affecting U.S. and N.C. Vegetable Production and Price Patterns, Information Reports EIR-35.

[c]Upper east Tennessee demand includes volume of production of the 18 counties listed in footnote b of Table 1.

[d]Lower east Tennessee demand includes volume of the 10 counties listed in footnote c of Table 1.

TABLE 5. OPTIMUM ENTERPRISE SELECTION FOR WESTERN NORTH CAROLINA BY FARM SIZE AND LEVEL OF RISK PROTECTION, BASE SOLUTION[a]

Farm and crop	Level of risk protection[b]		
	Zero	20 percent	40 percent
		(acres)	
Farm #1 (659)[c]			
Cabbage	507	491	459
Tobacco	109	111	124
Tomatoes	277	277	258
Soybeans	328	341	383
Farm #2 (2,242)[c]			
Cucumbers	2,334	1,842	1,842
Peppers	2,159	1,767	1,767
Squash	469	415	359
Tobacco	3,921	4,358	4,345
Snap beans		395	464
Farm #3 (674)[c]			
Okra	149	149	149
Snap beans	818	312	130
Tobacco	438		
Soybeans	3,110	4,190	4,371
Strawberries	160	135	135
Farm #4 (614)[c]			
Pigs (units)	448	448	448
Soybeans	5,710	5,710	5,710
Farm #5 (1,208)[c]			
Pigs	2,074	2,074	2,074
Soybeans	24,522	24,522	24,522
Imports			
Corn	58,104	58,104	58,104
White potatoes	662	662	662
Sweet corn	361	361	361

[a]Base solution is derived at a base wage rate of $2.00 per hour and opportunity cost of land of $50 per acre.

[b]Calculated as a percent of expected income variability charged off similar to an insurance premium.

[c]Numbers in parentheses represent the number of farms in the size group.

TABLE 6. OPTIMUM ENTERPRISE SELECTION FOR UPPER AND LOWER EASTERN TENNESSEE BY FARM SIZE AND LEVEL OF RISK COST, BASE SOLUTION[a]

Farm and crop	Level of risk protection[b]		
	Zero	20 percent	40 percent
		(acres)	
Upper East Tennessee			
Farm #1 (3,674)[c]			
Pimiento peppers	6,025	6,025	6,025
Farm #2 (10,496)[c]			
Pimiento peppers	1,917	1,917	1,917
Corn	27,267	27,047	26,826
Farm #3 (3,571)[c]	--	--	--
Farm #4 (3,555)[c]			
Bell peppers	1,624	1,451	1,277
Corn	48,317	48,538	48,758
Tomatoes	585	538	491
Farm #5 (6,543)[c]			
Tobacco	27,639	27,639	27,639
Lower East Tennessee			
Farm #1 (236)[c]			
Corn	411	411	411
Farm #2 (1,084)[c]	--	--	--
Farm #3 (515)[c]			
Corn	5,948	5,948	5,948
Farm #4 (706)[c]			
Corn	11,169	11,169	11,169
Farm #5 (2,516)[c]			
Bell peppers	1,021	847	674
Tobacco	5,057	5,057	5,057
Corn	39,606	39,606	39,606
Pimiento peppers	225	225	225
Tomatoes	800	800	800

[a]Base solution is derived at a base wage rate of $2.00 per hour and opportunity cost of land of $50 per acre.

[b]Calculated as a percent of expected income variability charged off similar to an insurance premium.

[c]Numbers in parentheses represent the number of farms in the size group.

greater than actual average yield in the area. Acreage of tomatoes would approximate the 1975 level if actual average yield had been used in the program. Soybeans would have been displaced in the optimum plan. The program price which resulted at this level of production was $8.37 per cwt. which is considerably less than the $13.50 average price in the 1975-76 season. The calculated price reflected lower average costs resulting from assumed high yields alluded to above. It would increase as yield decreased to the 1975 level.

Pigs and soybeans were produced on farm groups 4 and 5. On these farms they were not sensitive to level of risk costs considered.

Imports of the several products with less than perfectly elastic demands show how competitive certain enterprises are for farm resources. Corn, white potatoes and sweet corn were not competitive for resources in the western North Carolina mountains.

Stability of enterprises on upper Tennessee farms is greater than on western North Carolina farms (Table 6). This was true across risk levels as well. Burley tobacco was grown only on farm group 5. Pimiento peppers were grown on farm groups 1 and 2 in upper Tennessee; corn, bell peppers and tomatoes were grown on farm group 4. Only corn and bell peppers were sensitive to risk costs in upper Tennessee, with bell pepper acreage declining slightly as risk costs increased. The resource situation and the profitability of enterprises were such that no imports of these crops were profitable at any risk level. In fact, resources on farms in group 3 were not used. Land, labor and capital were underutilized on farms in other farm groups. In most cases, it was apparent that demands were the limiting factor to resource use in Tennessee.

The situation was similar in the lower Tennessee Valley in that the enterprise solution was relatively stable across different risk levels. Corn was produced on farm groups 1, 3, 4 and 5. Land and other resources were not utilized on farms for group 2. Burley tobacco was produced on farm group 5 at the maximum allotted acreage for the area. Bell peppers, pimiento peppers and tomatoes were produced on farm group 5. Acreages of pimiento peppers and tomatoes were not affected by risk costs. Imports of any product were not required to satisfy local demand. As in the case of upper Tennessee, demands for products restricted use of resources in that the price fell below production costs with increased resource utilization.

Tomato acreages in both upper and lower Tennessee areas summed to 1358 acres at zero risk protection. These are more acres than are currently grown in the area. The resultant program price at this level of production was only $10.20 per cwt. at zero risk protection, but increased to $14.80 at 40% risk protection. The 1975-76 price averaged $24 per cwt. As noted previously, projected acreages of tomatoes in North Carolina were less than are currently grown, but total output for 1975 was closely approximated because assumed yields were greater than actual yields for 1975. It appears that Tennessee may be able to develop a comparative advantage in tomato production relative to North Carolina since resources are more underutilized there. However, demand expansion or increased production efficiency (higher yield, low costs) will be necessary to exploit this potential. North Carolina has more profitable alternatives than Tennessee and is utilizing resources more fully. Expansion of tomatoes means a substitution of tomatoes for other crops. Methods of lowering production costs in North Carolina will be necessary to keep tomato acreage from declining.

The programming format is constructed for easy testing of sensitivity of the solutions to changes in demand relationships, transfer costs, input prices, wages and general technical coefficients. It is not feasible to include these sensitivity analyses in this paper. However, these analyses are incorporated in a forthcoming Southern Cooperative Series report sponsored by the Southern Regional Technical Committee on Vegetable Marketing (SM-46).

REFERENCES

[1] Allgood, J. G. et al. "Planning for Profit, Field Crops," North Carolina Extension Circular 519, Revised, North Carolina State University, 1975.

[2] Allgood, J. G. et al. "Planning for Profit, Grains and Soybeans," North Carolina Extension Circular 522, Revised, North Carolina State University, 1975.

[3] Buchholz, H. E., G. G. Judge and V. I. West. "A Summary of Selected Estimated Behavior Relationships for Agricultural Products," Department of Agricultural Economics Research Report No. 57, University of Illinois, Urbana, October 1962.

[4] Duloy, J. H. and R. D. Norton. "CHAC: A Programming Model for Mexican Agriculture," *Multi-level Planning: Case Studies in Mexico*, L. Goreux and A. Manne Eds., North Holland Publishing Company, 1973, pp. 1-59.

[5] George, P. S. and G. A. King. "Consumer Demand for Food Commodities in the United States with Projections for 1980," Giannini Foundation Monograph No. 26, University of California, Berkeley, March 1971.

[6] Hazell, P. B. R. "A Linear Alternative to Quadratic and Semi-variance Programming for Farm Planning Under Uncertainty," *American Journal of Agricultural Economics*, Volume 53, 1971, pp. 53-62.

[7] Hazell, P. B. R. and P. L. Scandizzo. "Competitive Demand Structures Under Risk in Agricultural Linear Programming Models," *American Journal of Agricultural Economics*, Volume 56, 1974, pp. 235-244.

[8] Liner, H. and George Hughes. "Planning for Profit, Vegetables," North Carolina Extension Circular 520, Revised, North Carolina State University, Raleigh, 1975.

[9] Mathia, G. A. and R. A. Schrimper. "Analysis of Shifts in Demand and Supply Affecting U.S. and N.C. Vegetable Production and Price Patterns," Department of Economics Information Report No. 35, North Carolina State University, Raleigh, January 1974.

[10] Mathia, G. A. "Measurement of Price, Yield and Sales Variability Indexes for Selected North Carolina Crops," Department of Economics Research Report No. 36, North Carolina State University, October 1975.

[11] Nieuwoudt, W. L., J. B. Bullock and G. A. Mathia. "Alternative Peanut Programs: An Economic Analysis," Technical Bulletin No. 242, North Carolina State University, May 1976.

[12] North Carolina Department of Agriculture. *Agricultural Statistics, 1975-76 Annual*, NCDA-Division of Statistics, Raleigh, July 1976.

[13] Simmons, R. L. and C. Pomareda. "Equilibrium Quantities and Timing of Mexican Vegetables Exports," *American Journal of Agricultural Economics*, Volume 57, 1975, pp. 472-479.

[14] Tennessee Department of Agriculture. "Agricultural Statistics, 1975" and other annual reports, Tennessee Crop Reporting Service, Nashville, Tennessee.

[15] U.S. Department of Agriculture. *Agricultural Statistics*, Washington, D.C.: U.S. Government Printing Office.

[16] U.S. Department of Agriculture. "Fresh Fruit and Vegetable Unloads," various issues of 1976 series, Washington, D.C.: Agricultural Marketing Service.
[17] U.S. Department of Agriculture. "Crop Production," Statistical Bulletins 108, 290, 384 and other annual series, Washington, D.C.: Bureau of Agricultural Economics.
[18] U.S. Department of Agriculture. "Vegetables for Fresh Market," Statistical Bulletins 126, 212, 300, 412, 495 and other annual reports, Washington, D.C.: Statistical Reporting Service.
[19] U.S. Department of Agriculture. "Vegetables for Processing," Statistical Bulletins 132, 210, 411 and selected annual reports, Washington, D.C.: Statistical Reporting Service.