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Determining Commercial Marketing and Production Opportunities for Small Farm Vegetable Growers

Jack L. Runyan, project leader, Joseph P. Anthony, Jr., Kevin M. Kesecker, and Harold S. Ricker

In cooperation with Charles W. Coale, Jr. and Charles R. O'Dell

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Determining Commercial Marketing and Production Opportunities for Small Farm Vegetable Growers

By Jack L. Runyan, project leader, Joseph P. Anthony, Jr., Kevin M. Kesecker, and Harold S. Ricker[1]

In cooperation with Charles W. Coale, Jr. and Charles R. O'Dell[2]

Many farmers are considering growing vegetables for the commercial fresh market as an alternative or addition to their present production enterprises. Before undertaking commercial vegetable production, farmers should be aware of production and marketing requirements and opportunities for their region. They must learn the needs of the commercial vegetable market and meet those they are most capable of meeting with respect to management and/or resources.

The problem studied is as follows: How can small farm vegetable growers who want to compete in the commercial fresh vegetable market identify market opportunities and requirements and overcome market entry barriers?

The research was conducted in the southside and southwest areas of Virginia. Both areas are similar in that agriculture is the primary industry and most production units are less than 150 acres, but they have dissimilarities such as climate, terrain, and types of products produced. The southside area has a warmer climate and longer growing season than the southwest area. There is potential for having two seasons (spring and fall) for some of the cool weather vegetable crops in the southside area. The southside area also has a level to slightly rolling terrain but the southwest area is more mountainous. Because of its terrain, mechanical harvesting could be more easily adapted in the southside area. On the other hand, the cooler climate in the southwest area is suited for growing cool weather vegetables and offers opportunities when areas east of it are too warm to produce heat sensitive vegetables. The major agricultural products produced in the southside area are tobacco, grains, cattle and calves, and hogs and pigs. In the southwest area the major agricultural products are tobacco, cattle and calves, dairy products, and fruit. Thus, since the two areas in Virginia where the research was focused are representative of the types of agricultural communities found in many areas of the United States, the results of this study should have wide application.

Objectives

The general objective of this study was to develop a methodology for determining production and marketing opportunities and requirements for small farm vegetable growers. In addition to the general objective, the following specific objectives were developed:

1. To identify potential market opportunities for small farm vegetable growers.
2. To develop requirements and costs for various processing, packing, and cooling operations.
3. To identify institutional barriers to marketing opportunities, and assess possibilities for overcoming those barriers.

[1]Respectively, marketing specialist, agricultural economist, and deputy director, Market Research and Development Division, Agricultural Marketing Service, U.S. Department of Agriculture.

[2]Respectively, extension economist and extension horticulturist, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University.

4. To describe and encourage development of the marketing mechanisms and institutions required to overcome barriers and economically capitalize on potential market opportunities.

Methodology

Accomplishing the objectives of the study required the collection and analysis of both primary and secondary data. The primary data were collected by surveying vegetable growers, potential vegetable growers (those who had expressed an interest), packers, brokers, wholesalers, and retailers. The grower and potential grower surveys were conducted by local agricultural extension agents, and Virginia State University and Virginia Polytechnic Institute and State University extension personnel. The packers, brokers, wholesalers, and retailers were surveyed by members of the U.S. Department of Agriculture study team.

Secondary data were used to determine market potential in four terminal market areas—Atlanta, Baltimore-Washington, Dallas, and New York. These data were obtained from the Market News Branch, AMS, USDA, and consisted of historical price and unload data from the four terminal market areas.

Market Opportunities

One of the first steps in determining market opportunities is to identify and analyze trends in per capita consumption, production potential, and the availability of marketing institutions. If, after studying these, there appears to be an opportunity for marketing specific products (in this case vegetables), local and regional marketing programs must be analyzed.

The objectives of this section are to develop methods for determining the market potential for fresh vegetables, and the local market opportunities available to growers and potential growers in the study area.

Market Potential For Fresh Vegetables

In determining market potential, per capita consumption figures for selected vegetables, trends in vegetable production, and the availability of marketing institutions help to develop a framework on which a marketing program can be based.

Per Capita Consumption

Changes in per capita consumption of selected fresh vegetables have been rather dramatic over the past 25 years, particularly in the last decade, as indicated in table 1. The shifts in consumption figures tend to parallel and support the increasing consumer concern for diet and nutrition, and the resulting expansion and proliferation of salad bars in food service facilities. Related to these changes are notable increases in the consumption of those vegetables that can be eaten raw, as opposed to those that require cooking.

Table 1.—Per capita consumption of selected fresh vegetables (farm weight), United States, selected years

Item	1958	1963	1968	1972	1977	1980	1983
				Pounds			
Broccoli	0.4	0.4	0.4	0.7	1.2	1.8	2.1
Cabbage	10.8	9.7	9.3	8.8	8.5	9.0	[2]
Cantaloupe	8.2	8.7	8.6	8.7	7.5	7.2	[2]
Cauliflower	1.4	1.1	1.0	.8	1.1	1.4	1.7
Lettuce	19.5	20.7	21.8	22.5	25.8	26.8	25.9
Peppers	2.1	2.5	2.8	2.7	3.4	3.6	[2]
Potatoes	83.8[1]	79.3	67.7	56.6	53.6	56.1	54.1
Spinach	1.1	.7	.6	.5	.6	.8	[2]
Sweet corn	8.4	8.2	7.8	7.8	7.7	7.0	7.0
Tomatoes	11.9	12.0	11.9	12.1	12.4	13.4	13.2

[1]1960.
[2]Data series discontinued in 1982.
Sources: Food Consumption Prices and Expenditures, 1963-83, Statistical Bulletin No. 713, ERS, USDA, Agricultural Economic Report No. 138, ERS, USDA, for prior years; Agricultural Statistics, 1983, U.S. Department of Agriculture.

As shown in table 1, the per capita consumption of broccoli, cauliflower, spinach, and peppers has increased substantially during the past decade, with lettuce and tomatoes also increasing but at a relatively slower yet steady pace. Spinach consumption, which declined from 1958 to 1972, turned around in the past decade with an increase of nearly one-half pound per capita. In 1980 per capita consumption of spinach reached 0.8 pound.

This rising spinach consumption pattern at a time when consumption of other greens has been declining is likely attributable to the growing popularity of spinach as a salad item. Cabbage consumption which had been declining, also turned around in the 1970's. This about-face could be attributed to the expanded offerings of cole slaw in the fast food restaurants. The potato consumption figures do not include processed potatoes such as french fries, and thus only reflect fresh whole potatoes.

The vegetables included in this table were selected after meetings with local growers, and state and university marketing officials, as commodities that were of interest as possible production opportunities. The list is by no means exhaustive, but does emphasize some of the changes in eating habits nationwide. The data shown in the table suggest some interesting changes in per capita consumption of these vegetables, which in turn imply there are potential market opportunities available to producers

who might have a comparative production-marketing advantage over producers in current production areas.

Trends in Virginia Production

The trends in commercial vegetable production for the United States and Virginia are compared in table 2. For the United States, fresh vegetable production declined into the mid-1960's, then increased fairly steadily until the eighties. Virginia fresh vegetable production, at 30,200 tons in 1983, was less than one-fourth of what it was in 1958. The processing of Virginia vegetables has fluctuated over the past two decades, but showed a 50-percent decrease in 1980 from 1979 and again between 1982 and 1983. Virginia marketing officials indicated that some processing facilities were closed and are not scheduled to be reopened. In summary, the trend in commercial fresh vegetable production in Virginia has been downward.

Availability of Marketing Institutions

The changes in the number of fresh fruit and vegetable wholesalers, assemblers, and brokers in Virginia between 1958 and 1977 are shown in table 3. The number of merchant wholesalers has not changed greatly but the number of brokers and assemblers had declined significantly from 53 to 7 in 1977. This decrease was probably not unexpected, given the sharp drop in commercial fresh vegetable production between 1967 and 1972. Virginia producers shifted to corn and soybean production in the 1970's, and the fresh vegetable marketing brokers and assemblers disappeared. Of course, part of the reason for the shift in commodities was the comparative advantage other parts of the country enjoyed because of their lower vegetable production and marketing costs (transportation, fuel, labor, and so forth).

Implications

Two implications can be drawn from the above discussion. First, based on percapita consumption data, there is market potential for fresh vegetables that can be grown in the study area. Second, most of the marketing effort will fall back on the producers.

Local Market Opportunities

Based on the above findings there was justification to proceed to determine local market opportunities. Obviously historical figures are helpful, but they need to be placed in perspective with developments in the prevailing local situation. The farmers in southside and southwest Virginia indicated, at a series of grower meetings, that the local retail chain markets were closed to Virginia vegetable producers.

Table 2.—Commercial vegetable production[1]

Year	Virginia		U.S. Total	
	Fresh	Processing	Fresh	Processing
	1,000 tons			
1958	134.0	71.5	12,445	7,496
1963	102.8	53.6	10,998	8,022
1967	102.2	81.5	11,143	9,979
1972	62.2	60.6	11,578	10,242
1977	57.8	49.8	12,688	12,612
1978	74.0	72.4	13,140	11,323
1979	69.3	67.6	13,411	12,576
1980	63.3	33.2	13,230	10,783
1981	37.8	22.4	9,643	9,222
1982	42.2	32.6	10,281	11,180
1983*	30.2	13.2	9,930	10,246

*Preliminary.
[1]For years of Census of Wholesale Trade, 1958-77, plus most recent years.

Sources: Agricultural Statistics, 1961, 1965, 1970, 1973, 1980, and 1981, U.S. Department of Agriculture.

Table 3.—Fresh fruit, vegetable wholesalers and brokers, Virginia

Year	Establishments			
	Total	Merchant wholesalers	Brokers and assemblers	Total establishment sales
		Number		*$1,000*
1958	119	[1]	[1]	48,962
1963	124	71	53	54,256
1967	104	66	38	66,541
1972	91	76	15	66,840
1977	79	72	7	102,590
1982	72	62	10	N/A

N/A = Not available.
[1]1958 Census publication unavailable.

Source: Census of Wholesale Trade.

Research Method

Local instate buyers were surveyed to determine their attitudes and receptivity toward Virginia vegetable production, and to see if the market could be reopened. We visited six retail chain headquarters, including two cooperatives, five produce wholesalers, plus three produce packers and shippers to determine their attitudes and viewpoints. The firms surveyed represented a cross section of Virginia produce buyers.

The produce packers and shippers were located on the Eastern Shore, which has traditionally been, and will likely continue to be, the major commercial vegetable production area in Virginia. The other firms were located primarily in the Richmond and Roanoke areas. The survey was structured to include representation of the principal vegetable buyers for both retail store and food service sales in Virginia in 1982. The survey size could have been larger but was terminated when it became apparent that we were consistently getting the same answers to the major questions.

Analysis

The produce packers and shippers indicated that if there was a need for additional vegetable production in Virginia, it could be done more effectively on the Eastern Shore. While this statement may be true, it certainly would not help the farmers in the southside or southwestern parts of Virginia. Our principle objective was to identify potential market opportunities that could be met by farmers in these parts of Virginia. The produce packers and shippers on the Eastern Shore did suggest potential marketing opportunities for local cucumbers from September 15 to October 15, and for turnips and collard greens during a short period in the late spring after production drops in Georgia. In fairness to these packers and shippers, we might have received a better response from them had we not conducted our survey during the time of year when they were very busy trying to pack, grade, and sort potatoes.

In terms of specific areas of interest, most attention was focused on the vegetable buyers for the local retail food stores and the institutional or food service market. While buyers for retail food stores and the food service market were both interested in local vegetable sources, we detected a greater interest on the part of the retail store buyers. This may reflect the fact that the food service buyer is under greater pressure for assured sources of a given quality and quantity of supplies, and tends to be more strongly tied to established supply sources to meet the needs of particular clientele.

The buyer for a number of retail stores, while demanding uniform quality and adequate quantity, can be more flexible in both sources of supply and in having product available for sale. As long as the product is not featured in advertisements, the only pressure to have the product available is the retailer's desire to offer his customers a good and possibly complete assortment of quality vegetables. Having said that, it was interesting to find that the food service produce wholesalers indicated at least a dozen vegetables that they buy locally, while the retail store buyers identified over 20 items that they purchased locally. This was pleasantly surprising in view of the attitudes held and expressed by the potential vegetable growers.

Locally Grown Items Purchased

Retail store buyers indicated they purchased the following locally grown items: snapbeans, broccoli, cabbage, green cabbage, cauliflower, sweet corn, cucumbers, eggplant, salad greens, leaf lettuce, bell peppers, pumpkins, spinach, crookneck squash, spaghetti squash, acorn squash, butternut squash, sweet potatoes, vine-ripe tomatoes, turnips, and two fruits: cantaloupe and watermelon. We did not ask retail store buyers specifically about their purchases of locally grown fruits and recognize that there are some such as apples that we know they buy locally to sell in their stores.

Produce wholesalers indicated they purchase the following locally grown items: broccoli, green cabbage, sweet corn, cucumbers, eggplant, lettuce, edible pod peas, bell peppers, spinach, squash, sweet potatoes, and vine-ripe tomatoes.

The identification of items purchased locally is not meant to be exhaustive, since we neither surveyed all potential local buyers, nor inquired about all potential vegetable products. More importantly, we found that some buyers for the principal local outlets for fresh vegetables were in fact currently buying local produce when it was available in the qualities and at least partially in the quantities they required.

By listing the types of items that these two groups of buyers indicated they purchased locally, we do not mean to imply that all had a completely receptive attitude toward the purchases of locally grown vegetable products. Indeed there is variation among buyers in their interest in local production. This ranged from very supportive to very negative, although most buyers interviewed were supportive. Many seemed to like the idea of tying in with local producers and featuring locally grown produce in their stores. But some had a policy that they did not buy anything locally, or they preferred to continue with their established supply sources exclusively.

Problems With Local Produce.—We asked the buyers for their perceptions of problems they have encountered with locally grown produce, particularly Virginia produce. While these items are not ranked in any priority order, the *lack of consistent quality* was frequently mentioned. By lack of consistent quality, they referred to the product quality within the cartons, between the cartons, and between growers.

Related to the issue of inconsistent quality was the problem of *uneven sizing and grading*. Part of the problem may be that the grower is inclined to box a product when it is ready for harvest without giving much thought to the retailer's requirements. Growers must remember that the retailer is a merchandiser and as such is primarily interest-

ed in sales. Therefore, he is interested in having a uniform, clean, attractive display that will invite the shopper to buy and help to establish an image of quality fresh produce for his store.

Cabbage and cantaloupes were identified as examples of the sizing problem frequently encountered with local sources of supply. Buyers complained that when local cantaloupes and cabbage were delivered to the stores, different sizes—very large, medium, and small—were often placed in the same containers. This lack of uniformity not only detracts from the appearance of the display, but it also hinders the retailer's ability to price items individually.

The third problem is that the *product is frequently too mature* when harvested. Typically, the growers know when the product is at the peak of quality it tastes best. If they are not familiar with the marketing system, they forget that the product has to withstand 4 or 5 days or maybe even a week in transportation, in the warehouse, and on the retail store shelf, before it reaches the home or restaurant where it will be consumed. For this reason, growers need help to be able to predict when the product is going to be ready for harvesting. Extension agents and other marketing officials should provide training, color guides, or other aids to help growers predict when their particular product will be at the right stage for harvesting. Predicting ripening time for products is not an exact science, given the impact that changes in weather can have upon maturity, but reasonable estimates can be made to help the grower alleviate part of the next problem.

Lack of advance notice of product availability is another problem. Retailers want to know at least 4 days in advance of delivery when the product is going to be available so they can plan their supplies and schedule the product for their retail stores. Most buyers indicated that they needed at least 4 days lead time to be able to plan to buy their products. They were emphatic in stating that they do not want growers to appear at their warehouse dock with products that are unexpected. In fact, they would likely refuse such products, unless they happened to be in short supply on that particular day. A related point is that if a growers' association or a grower expects to have a large enough quantity of a given product ready for delivery within a couple of weeks, retail buyers would like to be advised at that time so they can feature the product in their advertisements. Retail buyers like to promote local produce, but it takes l0 days to get their ads drawn up and featured in the local papers. Of course, the question of whether the quantities will be sufficient will depend a lot upon the size of the retail organization and the number of stores that are to be served, as well as the quantity of specific product that is available.

The fifth problem centers upon *whether or not the field heat has been adequately removed* from the product in order to protect and maintain the necessary shelf life. This is a critical item for some products, such as sweet corn, greens, and broccoli. The procedures used to remove the field heat may range from hydro-cooling, or vacuum cooling, to simply top icing the product. Contact should be made with local extension agents, marketing specialists and buyers to establish the proper procedures that will be acceptable and maintain product quality.

The sixth problem mentioned centers around the *lack of established trading relationships between the buyers and the growers*. Growers often have great difficulty selling their products to buyers who do not know them. Most of the buyers, however, indicated that if growers can assure them that they can meet some of the other criteria previously mentioned, the buyers will be willing to give the growers a chance. Given this chance, it is up to the grower to establish a reputation for a consistently good quality of product that meets the need of the particular buyers. If buyers get product that is not of the quality they had expected from growers one time, it spoils the image or reputation of the local grower and causes the buyers to think twice about considering that grower for future purchases.

The seventh problem mentioned by the buyers was the *lack of grower organizations among local growers*. This did not mean that buyers would not accept product from individual growers, but that they prefer to buy from grower associations or cooperative organizations. Some of the buyers' reasons center around the availability of greater quantities of product, the better assurances of uniform quality, and the possibility of product availability over a longer period of time. Grower organizations can help to schedule deliveries among a number of buyers, keeping any one buyer from being inundated with product from many growers, and possibly helping all growers get a better price. Such arrangements also simplify the paperwork and recordkeeping process.

Vegetable Opportunities Identified by Buyers.— Discussions with Virginia buyers identified potential market opportunities for several commodities at specific times in the season. Not all of these market opportunities could be met by local growers, but the list does have some good suggestions that could be met by growers in different parts of the State.

Ten commodities that were specifically mentioned by the buyers as having potential market opportunities are shown in table 4. A caution is that these commodities are the buyers' perceptions, and it would be well to check out the potential sources of supply that might be competing in the time periods the buyers indicated as potential market win-

Table 4.—Vegetable opportunities identified by Virginia producer buyers

	April	May	June	July	Aug	Sept	Oct	Nov
Broccoli		XXXXXXXXXX	XXXXXXXXXX			XXXXXX	XXXXXXXXX	XXXXXXX
Cantaloupe				XXXXXXX	XXXXXX			
Cauliflower		XXXXXXXXXX	XXXXXXX				XXXXXXXX	XXXXXXXXXX
Turnips and greens		XXXXXXXXXX	XXXXX					
Tomatoes			XXXXXXX	XXXXXXXXXX	XXXXXXXXXX	XXXXXXXXX	XXXXXXXXXX	
Sweet corn				.....	.....	XXXXXXXXXX	XXXXXXX	
				(Shipped south)				
Cucumbers						XXXXXXX	XXXXXXXXXX	
Collard greens		XXXXXXXX	XXXXXXXXXX	XXXX				
Spinach		XXXXXX	XXXXXXXXXX	XXXXXXXXXX			XXXXXXXXXX	XXXXXXXXXX
Squash, acorn							XXXXXXXXXX	XXXXXXXXXX

dows. There are no assurances that products could be successfully marketed at this time, but they do provide some worthwhile leads for investigation. A few of these vegetables were identified as potential commodities for parts of Virginia, specifically the southside and southwest.

Some of the opportunities identified are in the normal local season for these commodities and suggest that the buyers have not seen enough locally grown product available to meet their needs, and thus, perceive it to be an opportunity. Of particular interest were some of the cool season crops like broccoli, cauliflower, spinach, and greens, where Virginia might have an advantage, due to seasonal factors, over some southern sources of supply. Specific mention was also made of the desirability of having a locally grown supply of fall tomatoes. Horticulturalists will have to determine if there is a variety that could be successfully produced in Virginia.

Another particularly interesting viewpoint expressed was there may be opportunities for some vegetables that could be grown in Virginia and shipped south after the peak southern seasons are over. A specifically mentioned example was sweet corn, which tends to peak and be over within Georgia by the Fourth of July.

Conditions for Market Entry.—Avoiding the perceived problems of local buyers with Virginia produce is obviously one of the first steps toward gaining market entry. This requires providing uniform sizes and quality of pack, and giving advance notice of product availability with a minimum of 4 days before delivery to the buyer's warehouse. In addition, the buyers did make a few other points which should be helpful to growers planning to deliver fresh vegetables to them.

Buyers will accept mixed loads of products, as long as their arrival is anticipated and they meet the other requirements. These mixed loads need **not** be from only one shipper. Thus, growers in an area could pool their products and provide a truckload of product going to a given buyer.

The sizes and types of shipping containers used are not critical, but they must protect the product, and must be adaptable to palletized handling. In addition, they should meet the competition, that is, contain the quantities and qualities of product that will make them equally or more attractive to the buyers. Having indicated that the buyers thought the sizes and types of containers were not critical, it should be pointed out that a different response might be obtained if one were to talk with the warehouse supervisor. Products properly filled in fairly standardized containers permit improved handling efficiency and product protection.

A visit to any produce warehouse will find palletloads of mixed products that appear ready to collapse because they are composed of many different types and sizes of containers, or because they are top iced in an untreated container and the wet fiberboard is collapsing. In addition to being an inefficient handling method, the products in the containers are subject to additional stresses and, in many instances, damage by the way other products are stacked on them or by the way in which they may be hit in transit.

Packing containers typically used were the 5/9-bushel boxes for zucchini squash, finger-hot and Jalapeno peppers; bushel containers for crookneck yellow squash, pole and snapbeans; and, half bushel containers for straight neck squash. However, growers should check to determine the type of container that would effectively protect their product at minimum cost, while meeting local competition.

The formation of a growers' cooperative or growers' association provides an opportunity for pooling resources, and for establishing a reputation and identification for marketing a quality vegetable product that will help to open more marketing opportunities for local production. Buyers or their field representatives would be more receptive to meeting with and discussing their needs with groups of local growers than with individual growers, unless the latter had substantial acreage of a particular commodity.

Working with local extension agents, university horticultural and marketing specialists, and personnel from the state departments of agriculture can help smooth the way to a carefully planned and successful marketing season. Each of these groups brings a degree of specialization in different aspects of the marketing system that can be very helpful. For example, horticultural specialists and buyers can work together on identifying the varieties of products the buyers want that can be grown in a local area, and then follow through with the production techniques that are necessary to ensure a successful harvest. Horticultural specialists and buyers can help to determine when the crop will be ready for harvest and how best to harvest, pack, and handle the product in order to meet the buyer's needs.

Additional Observations.—Most buyers indicated that while they liked to buy from as few sellers as possible to meet their requirements, they did not have minimum order quantities. In fact, we observed one buyer receiving 10-12 bushel baskets of eggplant from a local grower while we were at his facility. He indicated that he knew the quality of product that this farmer was delivering and had been buying this product from him for several years.

The needs of retail buyers and the needs of food service buyers are different. Products going to food service buyers may not have to withstand as much rehandling or as lengthy a storage period, but the quality must meet the demanding needs of a specific clientele. A close working relationship with a receptive buyer to determine these needs would likely be rewarding if growers produce to his specifications. A premium quality pack will not command as high a price from a discounter as it will from the buyer who supplies the top quality restaurants or the better neighborhood, yet both are in the market for produce.

Several retail firms expressed an interest in backhauls, which in some cases might be local production. Of course, these backhauls would have to be planned and scheduled with individual firms. Most produce is purchased on a delivered basis subject to quality and condition. Supermarket members of cooperatives may buy produce directly from growers, that is, it may be possible to sell directly to stores in the growers' neighborhood who are members of the cooperative. The disadvantage is that local retailers may not be able to take the quantity of product that is ready for market.

Buyers indicated that there was little price difference between the product purchased locally or from a distant point. This can work against local production, because the buyers already know their established sources of supply at the distant locations and in many instances the local producers haven't developed the positive reputation that is necessary. Thus, it may be important, when trying to gain market entry, to refrain from trying to capture all of the transportation savings that might accrue to the buyer, at least initially, until growers' reputations are established.

Packers indicated that they do not contract with growers, but do make verbal agreements with growers to clean, size, grade, and pack individual grower production. Generally, with the exception of a few processors, such as those for horseradish, little evidence of any contracting was found.

Summary of Local Marketing Opportunities

In summary, there are market opportunities for local growers who wish to produce vegetables for the local market. Obviously, there are risks such as weather, both locally and in traditional production areas, and competitive sources of supply which can result in a lower price. But the opportunities for successful entry are there.

Successful market entry requires a serious commitment. Neighboring states and other parts of the country are looking for produce opportunities too, and they are also looking at Virginia and neighboring markets. In order to meet this potential competition, it is essential that local growers band together to establish an identity and dependability that will win the confidence of the local produce buyers. They must agree to pack to accepted quality standards and to merchandise products with pride. Above all, growers, buyers, county extension agents, and university specialists must work together as a team.

Market Opportunities in Wholesale Produce Terminal Markets

Wholesale produce terminal markets are the intermediate link between producers and retailers (includes food stores and food service outlets) in the produce distribution chain and may represent an alternative outlet for locally grown produce. Wholesalers on the terminal markets handle large volumes of produce each day. Many of the products handled by terminal market wholesalers are supplied by growers and shippers in a few large producing areas such as Arizona, California, Florida, and Texas. Because of soil and climate conditions in the large producing areas, a

relatively stable year-round supply of fresh vegetables is available to terminal market wholesalers. Therefore, in order for growers from small-volume production areas to sell their products to terminal market wholesalers they must discover periods of limited supply when the products of one large producing area are declining and those of the next large producing area are beginning to enter the market. These periods are called market windows.

Given the above, the objective of this section of the study was to develop a method for examining a wholesale terminal market to discover market windows by identifying: (I) Possible terminal markets for Virginia commercial vegetable production; (2) the major origins for specified vegetables to each terminal market selected in (1) above; and (3) the seasonality in prices and unloads (I,000 cwt units) within each selected terminal market.

Research Method

An extension specialist in the Department of Horticulture at Virginia Polytechnic Institute and State University and county extension agents in the study area were asked to provide a brief list of vegetables they thought might be grown commercially in the study area. They suggested bell peppers, broccoli, cabbage, cantaloupes, and cauliflower.

Initially plans were made to analyze data from four terminal markets—Atlanta, Baltimore-Washington, Dallas, and New York. However, after further reflection and due to transportation costs, only the Atlanta and Baltimore-Washington markets were considered feasible during the initial years of the commercial vegetable production program for southern Virginia.

Weekly price and monthly unload data from the two terminal markets for the suggested vegetables were obtained for 1977-81 from the Market News Branch, Fruit and Vegetable Division, AMS, USDA. The weekly price data were prices received by wholesalers on the terminal markets. Based on information obtained from produce wholesalers, an average markup of 15 percent is applied to wholesalers' purchase prices to arrive at their selling prices. Therefore, the weekly price data were discounted I5 percent to arrive at an estimate of the prices producers would receive.

Production cost data were obtained from enterprise planning budgets prepared by extension specialists, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University. When possible, growers were asked to review the planning budgets and record any differences between their actual experience and the planning budget.

Transportation costs were estimated from data obtained from the Market News Branch. Since the transportation cost data were in terms of dollars per mile, per truckload and other data in terms of cost and price per unit, the transportation cost data had to be converted to cost per unit. This conversion was accomplished as follows: (1) Assumed a truckload was 40,000 lbs; (2) divided 40,000 lbs by 25 lbs, to arrive at the number of units of cauliflower per truckload, by 30 lbs to arrive at the number of units of bell peppers and broccoli per truckload, 43 lbs to arrive at the number of units of cantaloupes per truckload, and 50 lbs to arrive at the number of units of cabbage per truckload; and (3) divided the average cost of transporting from two central points (one in each production area) to each terminal market by the number of units for each product.

Analysis

The following assumptions were made to aid in the analysis:

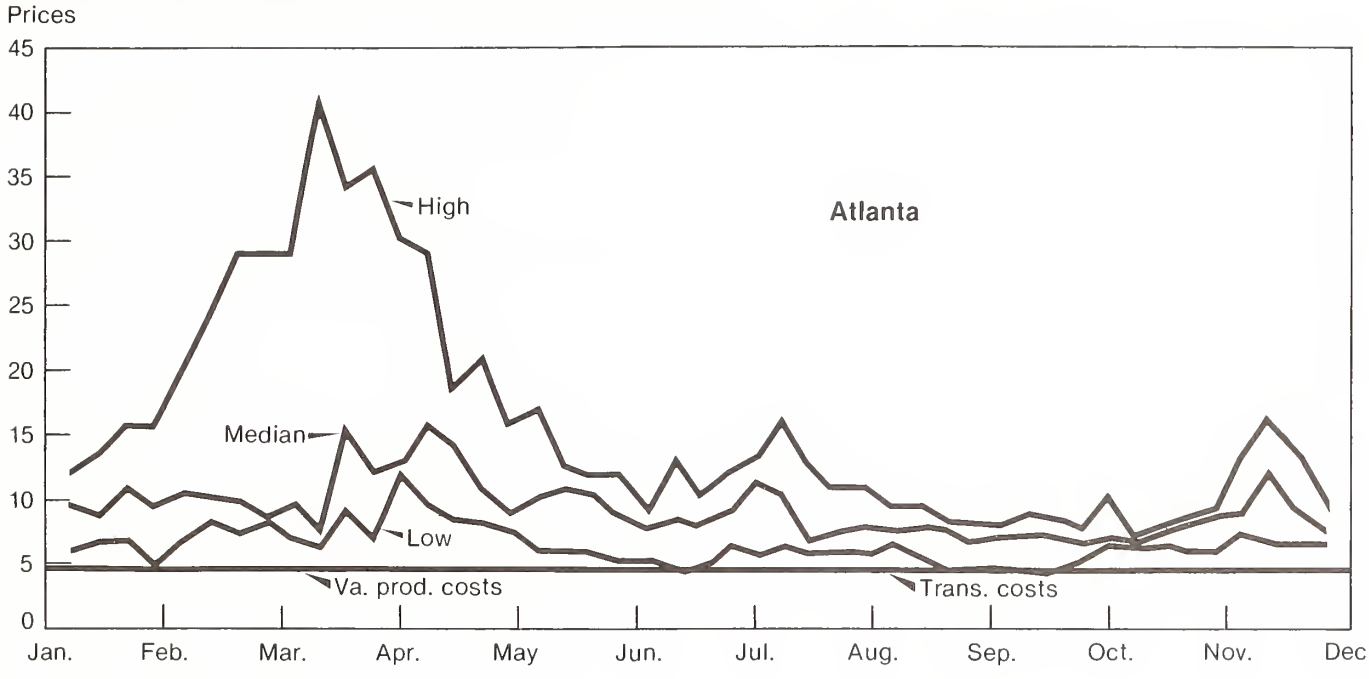
1. Virginia growers can and will meet all quality and quantity requirements of wholesale produce firms.
2. The most recent 5-year time period is more appropriate for examining price and unload data than for establishing a normal year.
3. The seasonal price and unload fluctuations can be used to identify possible market windows.
4. The Atlanta and Baltimore-Washington terminal markets are the most feasible for Virginia growers to use.

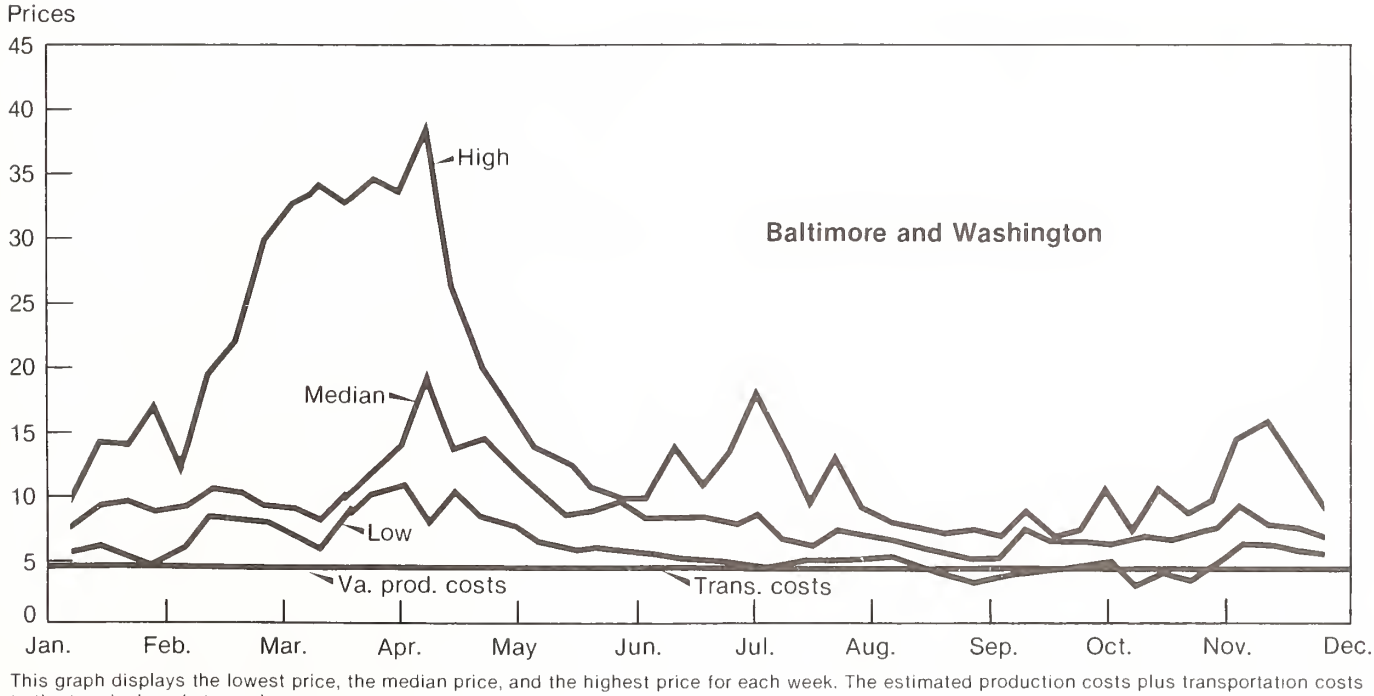
Based on the objectives, methods, and assumptions discussed above, the results of the analysis will be summarized for each vegetable crop considered. The discussion of the analysis will be aided by the use of two figures for each vegetable — one for the Atlanta terminal market and the other for the Baltimore-Washington terminal market. Three price lines are shown on each figure representing the highest, the lowest, and the median weekly price reported from the specific market for the vegetable during the 5-year period, 1977-81. In addition to the price lines, two horizontal lines are shown on each figure. The lowest horizontal line represents the cost of producing the vegetable and the highest horizontal line represents the cost of producing the vegetable plus the cost of transporting the vegetable to the terminal market. For this analysis the differential between the lowest price lines and the production plus transportation cost lines will be used to determine market windows. In other words, the most conservative approach will be used.

Bell Peppers.—According to the analysis there are market windows (lowest price is above the production plus transportation cost) for Virginia-grown bell peppers in the Atlanta terminal market (fig. 1), beginning about the third week in June and ending about the second week in August and beginning about the last week in September and continuing throughout the year. A small market window opens

Figure 1

Wholesale Terminal Market Prices of Peppers, 1977-1981





This graph displays the lowest price, the median price, and the highest price for each week. The estimated production costs plus transportation costs to the terminal market are shown.
Source: USDA and VPI&SU.

Figure 2

briefly in the Baltimore-Washington terminal market from about the first week in July and closes about the third week in August (fig. 2).

The normal harvesting time for bell peppers starts in August and ends in October in the Virginia study area. The Atlanta terminal market appears to be a very limited alternative outlet for Virginia-grown bell peppers because of the 6-week period of no market window beginning the middle of August and ending the last of September.There appears to be no window for Virginia-grown bell peppers during the normal harvest season in the Baltimore-Washington terminal market.

According to the analysis of unload data, Florida, Texas, and local producers are the major competition for Virginia bell pepper producers in both of the terminal market areas. However, shipments from Georgia producers to the Atlanta market end in August and the Texas shipments to this market do not become numerous until October. During this time (August-October) shipments to the Atlanta market originate in California and Michigan, both considerably more distant from Atlanta than the Virginia study areas. This implies Virginia growers should merchandise their bell peppers to wholesalers on the Atlanta market between the decline in Georgia shipments and the rapid rise in Texas shipments (August-October).

Broccoli.—Market windows for broccoli exist in both the Atlanta and Baltimore-Washington terminal markets (figs. 3 and 4). The Atlanta terminal market appears to have a higher minimum (low) price during the October to December harvesting period for Virginia-grown broccoli. However, according to the information shown in figures 3 and 4, shipping to either market would yield a favorable return to growers. Windows also exist for spring broccoli from the warmer Virginia study area. A word of caution should be given at this time: the supply and demand relationship on a market may be so sensitive that an extra truckload of product may reduce the price to below production and transportation costs. Therefore, growers should be in contact with dealers on the terminal markets to assure themselves they will have a buyer and receive an acceptable price.

The major broccoli supply region for both terminal markets is California, with Texas, Arizona, and New Jersey being the only other supply areas. The great distance between the major supply area and the terminal markets, together with the large gap between production plus transportation costs and the minimum prices, implies that with proper merchandising and quality control, Virginia broccoli producers should be able to profitably capture a portion of the terminal markets' sales.

Cabbage.—There is, according to the analysis, a window in the Atlanta terminal market for cabbage during the August to November harvest season (fig. 5). However, there is no apparent window in the Baltimore-Washington terminal market from late May through December (fig. 6). If an economical and effective method for storing cabbage could be developed, a window is available from January through early May in the Baltimore-Washington terminal market.

Based on the analysis of unload data, Florida producers are the major suppliers to both Atlanta and Baltimore-Washington terminal markets. In addition, small amounts of cabbage are supplied by producers in as many as 17 States. Shipments from 4 of these 17 States (Georgia, North Carolina, New York, and Wisconsin) dominate the unloads on the Atlanta terminal market during the harvesting season for cabbage in Virginia. There may be an opportunity for Virginia producers to producers to capture a share of the Atlanta terminal market sales from New York and Wisconsin with a concentrated merchandising effort.

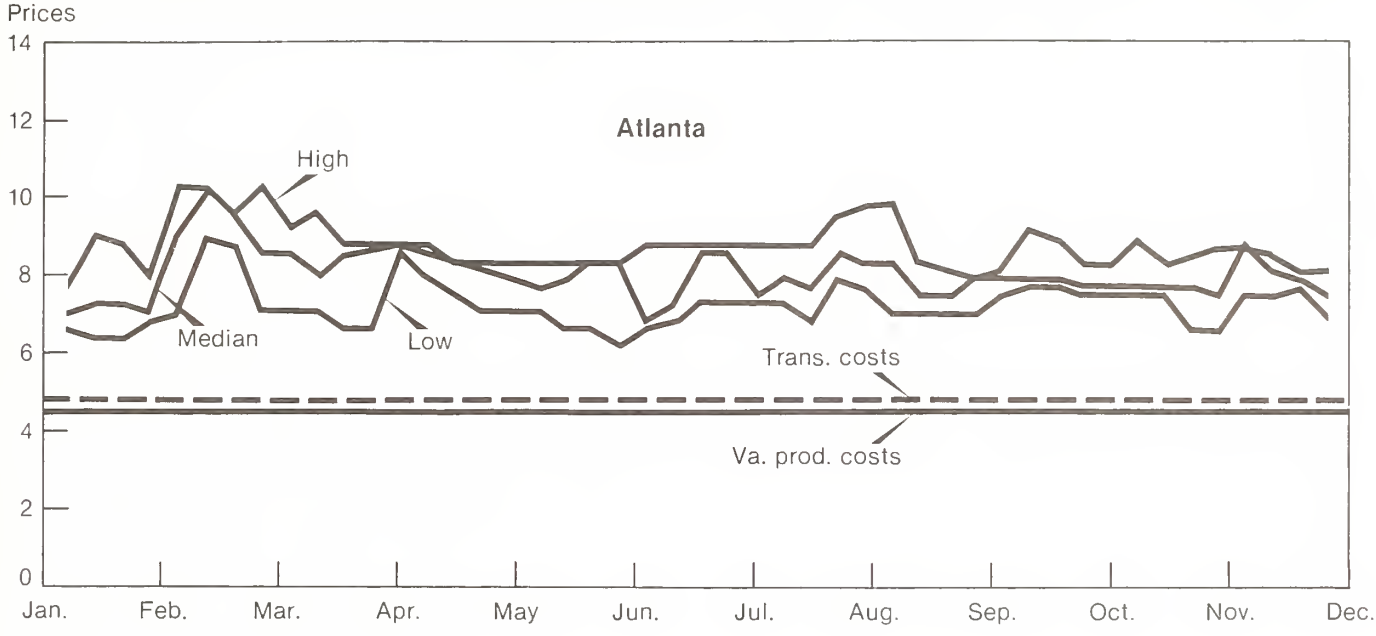
Cantaloupes.—According to the analysis there are no windows in either the Atlanta or the Baltimore-Washington terminal markets for cantaloupes during the August-September harvesting season in Virginia (figs. 7 and 8). These results imply that if Virginia cantaloupe growers want to sell to dealers on either of the two terminal markets, they need to find ways to reduce their production and harvesting costs in addition to developing a merchandising strategy. This implication can be further strengthened by the fact that both terminal markets received the majority of their shipments from California and Texas.

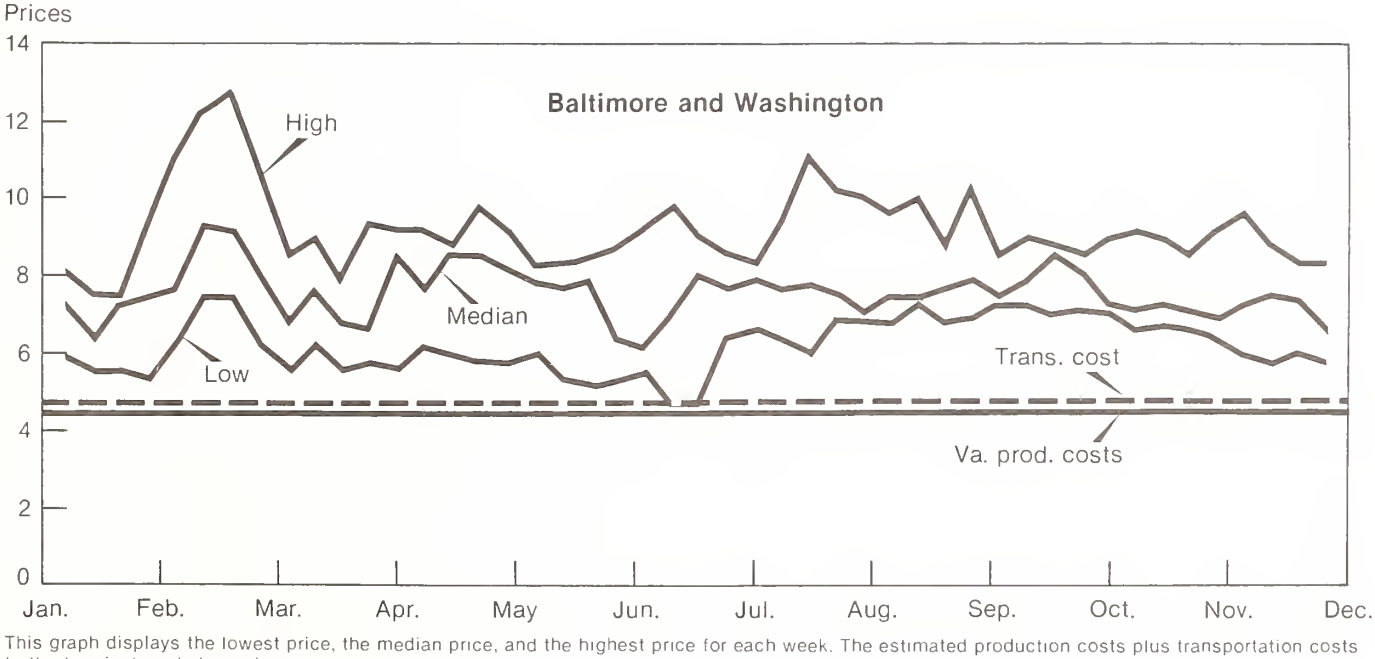
Cauliflower.—Based on the analysis of the price data, there are windows for Virginia-grown cauliflower at both the Atlanta and Baltimore-Washington terminal markets (figs. 9 and 10). In fact, there are year-round windows for cauliflower at both markets. The area between the minimum price and the production plus transportation cost lines is greater for the Atlanta terminal market than for the Baltimore-Washington terminal market. This implies there is a potential for greater grower returns by shipping Virginia-grown cauliflower to the Atlanta terminal market.

An analysis of the unload data for cauliflower at the Atlanta and Baltimore-Washington terminal markets revealed California to be the point of origin for most of the cauliflower being sold on these markets. Only one other point of origin was discovered for cauliflower shipments to Atlanta—Florida. For Baltimore-Washington, the points of origin (in addition to California) were Arizona, New Jersey, New York, and Texas. Because most of these points of origin are more distant from Atlanta than the Virginia grow-

Figure 3

Wholesale Terminal Market Prices of Broccoli, 1979-1981



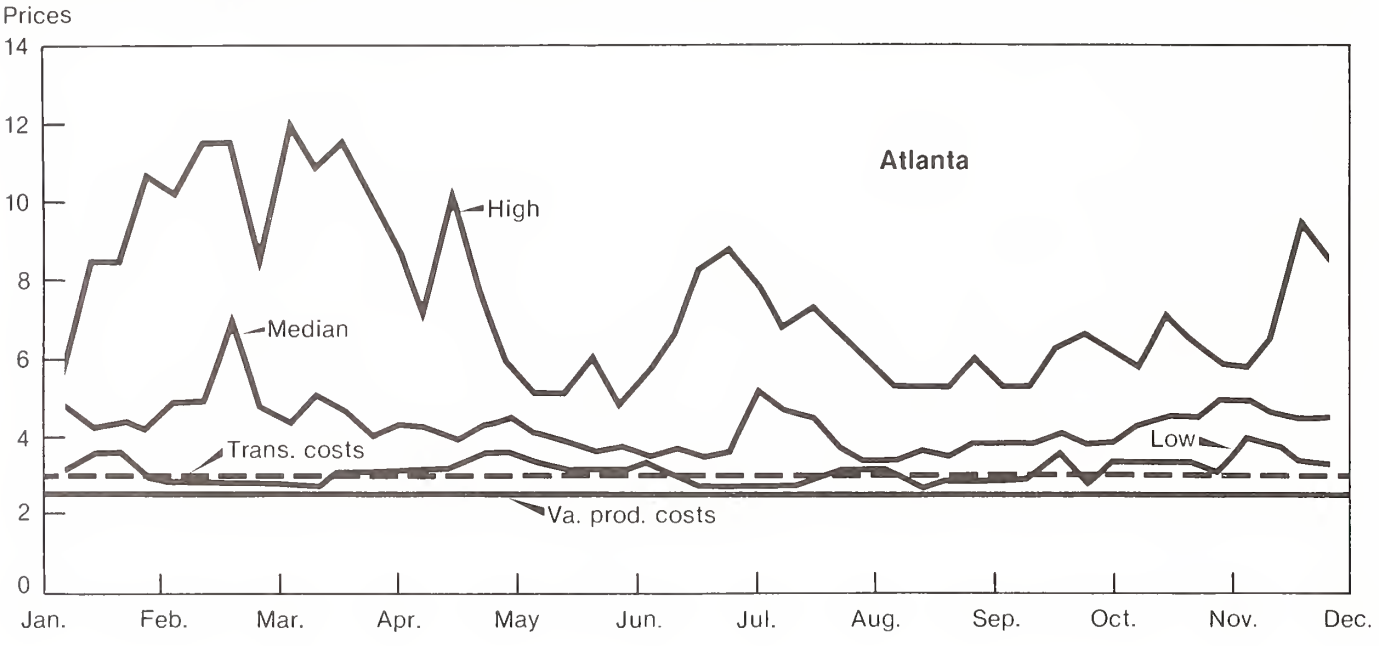


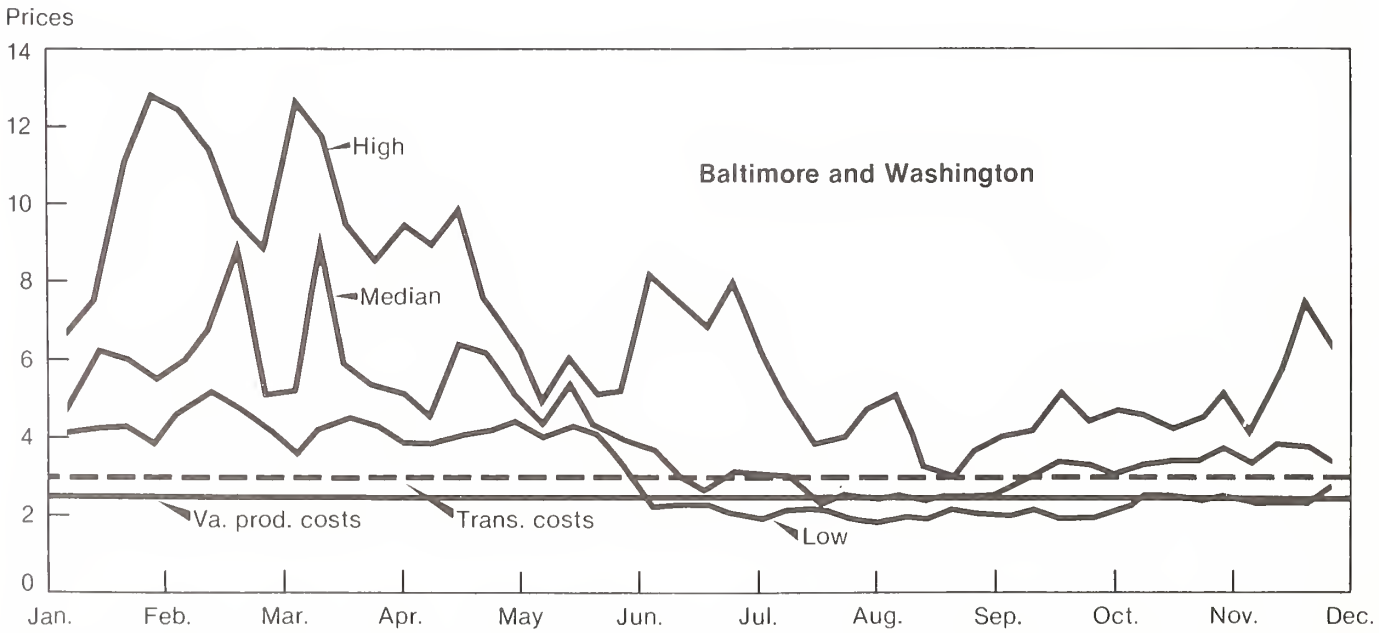
This graph displays the lowest price, the median price, and the highest price for each week. The estimated production costs plus transportation costs to the terminal market are shown.
Source: USDA and VPI&SU.

Figure 4

Figure 5

Wholesale Terminal Market Prices of Cabbage, 1977-1981



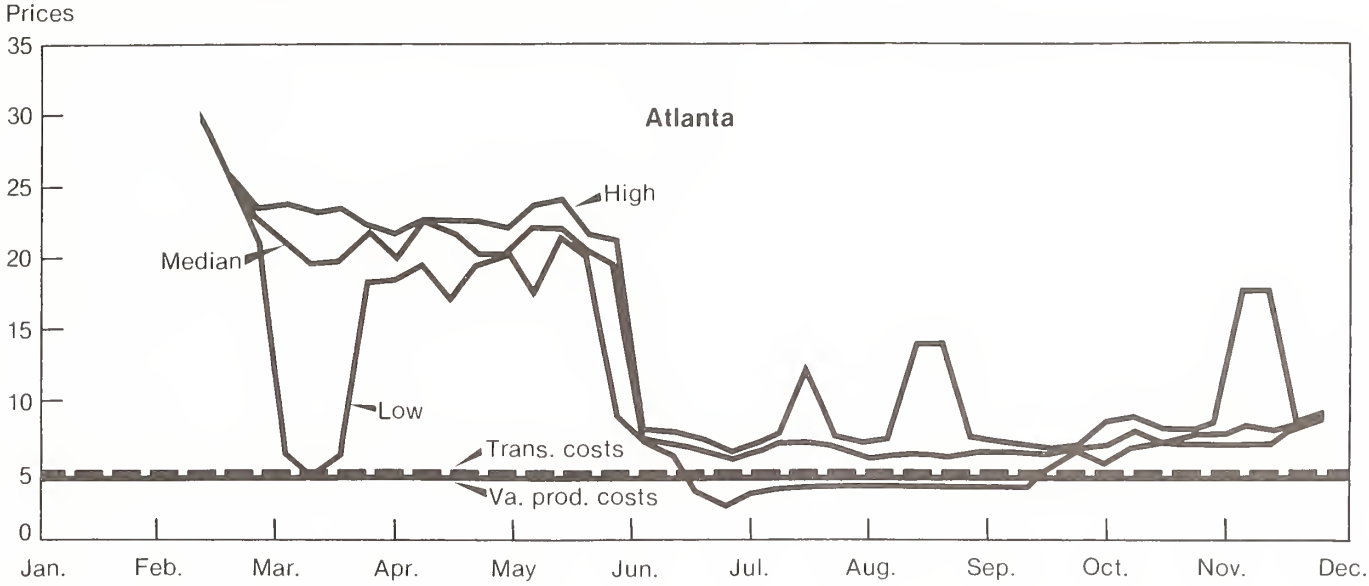


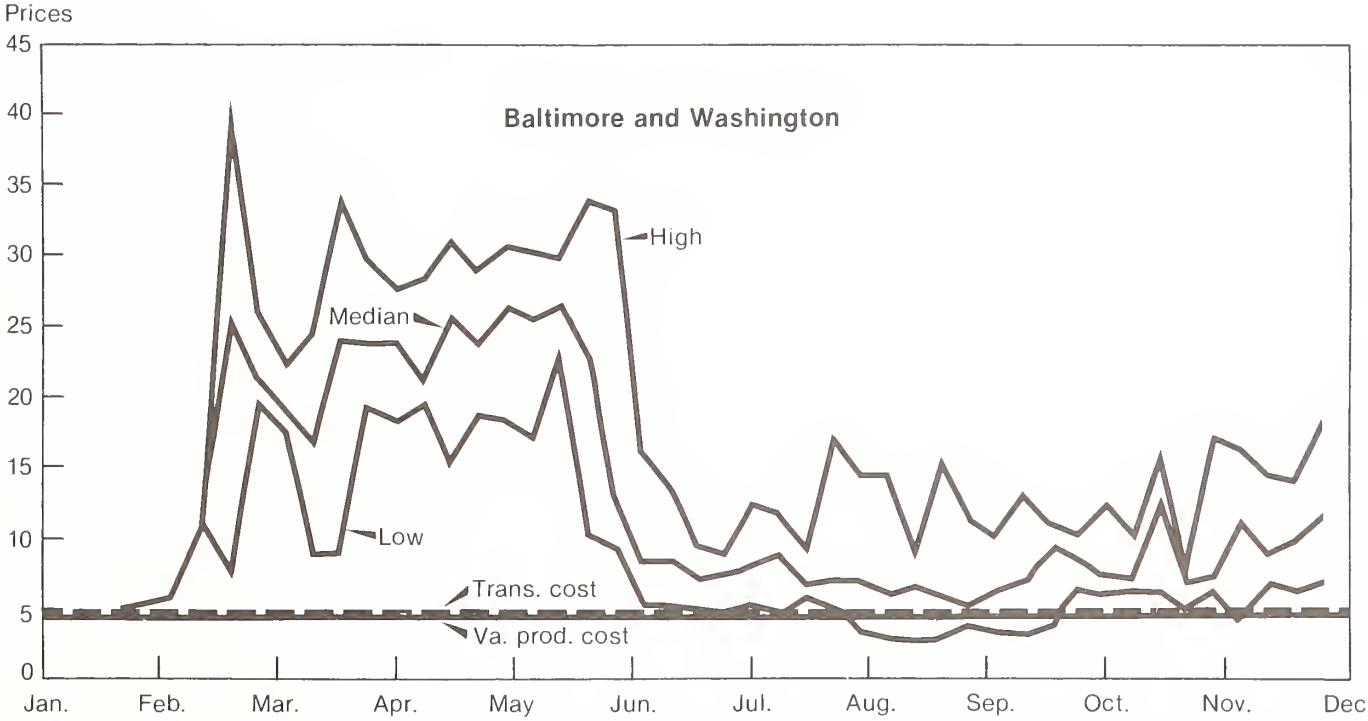
This graph displays the lowest price, the median price, and the highest price for each week. The estimated production costs plus transportation costs to the terminal market are shown.
Source: USDA and VPI&SU.

Figure 6

Figure 7

Wholesale Terminal Market Prices of Cantaloupe, 1977-1981



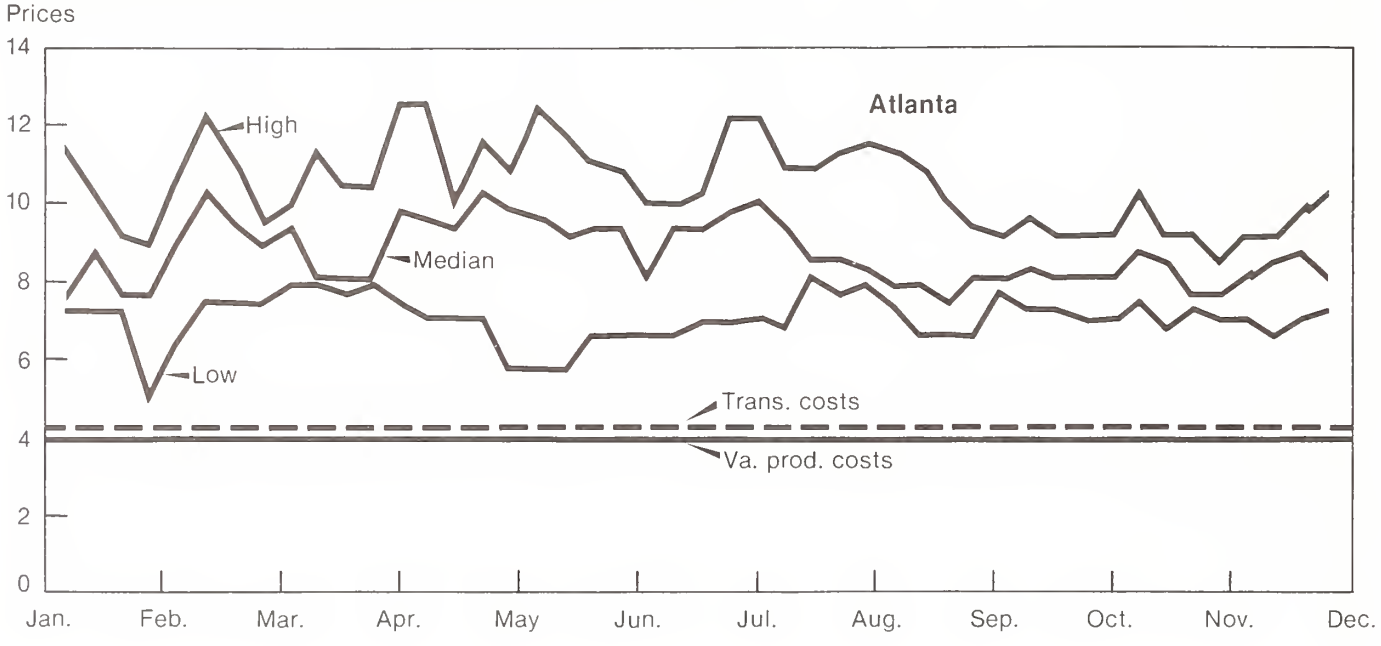


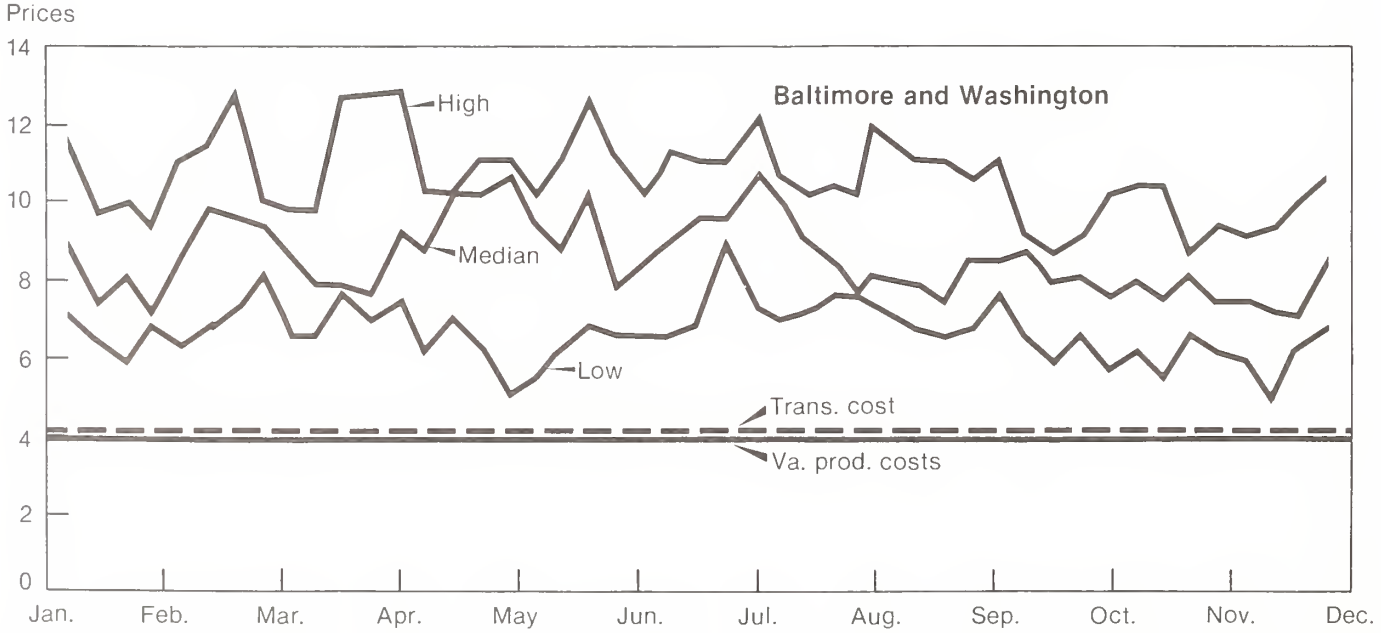
This graph displays the lowest price, the median price, and the highest price for each week. The estimated production costs plus transportation costs to the terminal market are shown.
Source: USDA and VPI&SU.

Figure 8

Figure 9

Wholesale Terminal Market Prices of Cauliflower, 1977-1981





This graph displays the lowest price, the median price, and the highest price for each week. The estimated production costs plus transportation costs to the terminal market are shown.
Source: USDA and VPI&SU.

Figure 10

ing area, it would appear that growers have a competitive advantage on the basis of lower transportation costs (all other things being equal).

Summary of Terminal Market Analysis

Based on the above analysis, the following conclusions can be drawn:

1. A very limited market window exists for Virginia-grown bell peppers at the Atlanta terminal market; none exists at the Baltimore-Washington terminal market.
2. Market windows exist at both the Atlanta and Baltimore terminal markets for Virginia-grown broccoli.
3. A market window exists at the Atlanta terminal market for Virginia-grown cabbage, but none exists at the Baltimore-Washington terminal market.
4. There are no market windows for Virginia-grown cantaloupes at either the Atlanta or Baltimore-Washington markets.
5. Market windows exist at both the Atlanta and the Baltimore-Washington terminal markets for Virginia-grown cauliflower.
6. In order to take advantages of these potential market windows, Virginia growers must be prepared to merchandise their products to satisfy the dealers on the terminal markets.

Once local and terminal market opportunities have been established, the potential for producing the crops for the markets must be determined. Production potential should be regionalized in order to make the results as applicable as possible to a specific area. The objective, therefore, of this part of the study was to develop a method for determining production potential and any possible obstacles to obtaining the potential.

Although estimating potential acreage is very important, other factors such as age of potential operators, inventory of available equipment, sources of labor and capital, and management awareness are also important in determining production potential. Many buyers of fresh vegetables prefer stable and lasting buyer-producer relationships. Therefore, middle-aged operators would seem to be more attractive potential producers. Potential growers would also be more receptive to growing vegetables if they could use their currently owned equipment rather than invest in additional equipment. The production process for many vegetables is labor intensive during some phase(s) (planting, cultivating, harvesting, and/or packing) which means some source(s) of labor must be readily available. Since the bulk of vegetable production costs usually occur at planting and/or harvesting rather than being spread out during the growing season, a source of capital is very important to most growers. Finally, the growers' and potential growers' awareness of the management practices required to successfully produce and market fresh vegetables determines the intensity of the educational process the extension service must develop.

Research Method

Local agricultural extension agents and an extension specialist at Virginia State University administered two surveys in 10 counties. One survey was administered to those who were currently growing vegetables (current growers) and a different survey was admninistered to those who were not currently growing vegetables but had expressed an interest in growing them (potential growers).

An attempt was made to follow a stratified random sampling plan for conducting the surveys with the potential growers' group, and to sample the total current growers' group. However, due to resource limitations, time constraints, and a reportedly inherent farmers' suspicion of surveys, the sampling could not be conducted on a purely scientific level. Nevertheless, the data from the 99 usable survey forms (69 potential growers and 30 current growers) provided adequate insight to determine production potential.

Analysis

For purposes of this analysis the survey results were summarized according to general information (applicable to both potential growers and growers), information related specifically to potential growers, and information related specifically to current growers.

General Information

The average age of the potential growers was 49 years (range = 18 - 79) and of the current growers was 46 years (range = 20 - 72). The ages of the two groups imply that the groups have stability and that there is opportunity for longrun relationships between growers and commercial buyers.

The 99 current growers and potential growers reported they would be willing to grow approximately 14,500 acres (about 10,700 acres by potential growers and 3,800 by current growers) of vegetables for the commercial market. Most of the potential acreage reported by those in the survey would be obtained through leasing. The large amount of potential acreage implies there is a large production base available if financial returns become sufficiently attractive.

Both groups were asked to list the vegetable or vegetables they preferred to produce. The responses indicated a strong willingness on the part of those surveyed to grow any vegetables. This response implied growers would consider alternatives presented by commercial buyers and therefore might become an attractive source of supply.

Finally, both groups were asked to indicate the source of labor required to produce vegetables (potential growers) or to expand current vegetable production (current growers). Twenty-five percent of those responding indicated they would use family labor, 22 percent indicated they would hire locally, 20 percent indicated a combination of family and locally hired, and 10 percent indicated foreign/migrant labor sources. These results imply there is a good local labor source (either real or conceived), at least in the short run.

Potential Growers

The potential growers were asked to describe the equipment they owned (had in their possession). According to their answers, all potential growers had the tilling equipment, and many also had the spraying equipment, required for growing most vegetables. Therefore, growing vegetables would not cause the potential growers to incur a large equipment (capital) debt and possibly discourage them from producing vegetables. Eventually irrigation and specialized harvesting and handling equipment may be required to assure adequate moisture levels and improve efficiency as growing operations expand.

In addition to renting or leasing land, additional land for growing vegetables could be obtained as follows: (1) 35 percent of the potential growers indicated they would take land away from corn production; (2) 30 percent indicated they would take land away from tobacco production; and (3) 13 percent indicated they would take land away from pasture and/or hay production. The reasons given for diverting land from production of these crops were low profits. The shortrun implications that can be drawn from the reasons land would be diverted to vegetable production are that as long as profits from corn, tobacco, and hay/pasture continue to be considered too low, vegetable production may be considered. However, if the profit picture for corn, tobacco, and pasture/hay improves, the longrun implications are highly questionable, depending on the relative profitability of vegetable production.

Because a large percentage of the potential growers' population is in an area highly committed to tobacco production, potential growers were asked to indicate any constraints on planning for vegetable production. Only 33 percent of the respondents indicated tobacco placed limits on vegetable production and 65 percent of the respondents said there were no production (time) limits on potential vegetable operations. These results are revealing because 72 percent of the respondents indicated they produced tobacco. The responses to this question imply the potential growers who are currently growing tobacco are thinking of vegetables that will not interfere with tobacco production and harvesting (usually the months of May, August, and September), they plan to have vegetable production replace their tobacco production, or a combination of both.

Potential growers were asked a series of questions to determine their level of management awareness and in turn the level of intensity needed in an educational (extension) program. Seventy (70) percent of the respondents indicated they were not familiar with the individual enterprise planning budgets prepared by their state university's agricultural extension staff. Seventy-nine (79) percent of the respondents indicated they had not discussed the selection of a vegetable crop with their local agricultural extension personnel. Sixty-eight (68) percent of the respondents indicated they were not aware of the marketing institutions (brokers, truckers, wholesalers, etc.) they must use to market vegetable crops. Sixty-two (62), 68, 82, and 83 percent of the respondents indicated they were not familiar with production, harvesting, packing, and cooling requirements, respectively, for vegetables. These results imply that the extension specialists will have to prepare an intensive educational program, but the potential growers should be very receptive and fairly easy to educate. As one extension specialist said concerning an experience with a grower producing a

crop for a demonstration plot, the farmer had never grown the crop before so he followed every instruction and recommendation we gave him.

The final area potential growers were asked to respond to concerned sources and amount of financing. In response to what sources of production financing they would use, 34 percent of the respondents indicated they would finance themselves, 22 percent indicated Production Credit Association (PCA), 12 percent indicated bank, and 10 percent indicated they did not know. In response to how much production financing they thought would be required, 42 percent of the respondents indicated they did not know and 22 percent indicated none. These results imply additional education is required to familiarize potential growers with enterprise planning budgets and capital requirements. If potential growers do not know how much production financing will be required, identifying a source of financing becomes very difficult.

Current growers

The 30 current growers surveyed produced 610 acres of vegetables in 1982. Cabbage accounted for most of the acreage (551 acres or about 90 percent), followed by peppers (11 acres), tomatoes (5 acres), and beans (4 acres). The size of production unit ranged from over 100 acres of cabbage to 1.5 acres where 5 or 6 different vegetable crops were grown. The cabbage and pepper growers' primary markets were the commercial fresh markets (wholesalers); the other growers either sold on a farmers' market or at roadside.

The surveys from the current growers provided considerable information on prices received and harvest seasons that was required for the market opportunity sections of the study. Also some of the information obtained from current grower surveys has been reported under general information. Therefore, the discussion of the current growers survey results will focus on hindrances to increasing production, and marketing problems and potentials.

The current growers were asked to indicate to what extent (severely, moderately, little, none) land, labor, and capital limit their production and marketing. The respondents indicated capital was the most limiting factor for production (74 percent answered severely or moderately), followed by labor (50 percent answered severely or moderately and 50 percent answered little or none), and land (44 percent answered little or none). No determination was made as to whether capital availability or cost was the cause of the limitation. More than 50 percent of the respondents indicated land, labor, and capital did not limit their marketing. These results imply: (1) Production potential can only be achieved by reducing the capital limitation; (2) there is some concern among current growers over the production labor situation; (3) land is available for expanding vegetable production; and (4) grower marketing is not limited by land, labor, and capital.

The current growers were asked to indicate what they thought were the major marketing problems facing them, since marketing problems may hinder growers' willingness to increase production. The growers were asked to rank the following list of marketing problems as extreme, moderate, little, or none: (1) Market outlets; (2) low prices; (3) fluctuating prices; (4) lack of storage facilities; (5) lack of processing facilities; (6) lack of market and price information: (7) lack of quality control, and (8) other (please specify). Based on the responses, low prices were considered to be the most major problem followed by market outlets, fluctuating prices, and lack of quality control. The ranking order of the problems based on responses is not too surprising given the depressed agricultural economy at the time of the survey, and the fact that cabbage growers (who made up 46 percent of the sample) send every head they harvest to market with little or no attention to sorting or grading. The current growers did recognize they were at a disadvantage because there were very limited marketing outlet alternatives for their product. In other words, the growers were facing either a monopsony or oligopsony market condition.

Current growers were also asked to indicate what they thought were their greatest marketing opportunities, to compare their thinking with information obtained from the secondary source analysis of market potential. The results of the comparison would then be used as part of the grower-education program. Those surveyed were asked to rate the following marketing opportunities as either excellent, good, fair, or poor: (1) roadside stands; (2) pick-your-own; (3) farmers' markets; (4) direct to wholesale (produce wholesalers); (5) conventional wholesale; (6) processing; and (7) other (specify).

According to the responses, direct to wholesale was considered the greatest marketing opportunity, followed by farmers' markets, conventional wholesale, roadside stands, processing, and pick-your-own. These results were to be expected for at least two reasons. First, most of the growers in the survey were either selling directly to wholesalers or on a farmers' market. The second reason was that most of the growers surveyed were located a great distance from a population center and most of the local population had large family gardens, thereby eliminating most direct to consumer sales. The results did imply that most of the current growers surveyed had at least limited experience in meeting the requirements of large-sized buyers.

Another way to improve the commercial marketing of products and thereby encourage growers to strive for their

potential is to pool small shipments from many growers into a semitrailer load. Large buyers usually have many sources of supply available to them and, all other things equal, they prefer to deal with those who can supply truckloads at one easily accessible location.

The growers surveyed were asked to respond to three questions to indicate their willingness to cooperate (under a formal arrangement) with each other to fulfill buyers' requirements:

(1) Were they willing to enter into a cooperative arrangement with other growers to pool products so economical size lots could be developed for larger volume buyers? Ninety percent of the respondents indicated yes to this question.

(2) Were they willing to enter into a cooperative arrangement to provide packing, cooling, and storage operations and facilities? Eighty percent of the growers surveyed responded positively to this question.

(3) Were they willing to support cooperative arrangements by committing their total vegetable production to the cooperative and by helping finance the capital requirements and operating costs? Sixty-two percent of the growers surveyed responded positively to this question.

In addition to indicating that current growers were aware of the benefits of some type of cooperative arrangement, the responses to these questions showed that potential growers realized they needed to have a cooperative organization in place at the beginning of their venture into commercial vegetable production.

Summary of Production Potential

Growers in the study area have a definite interest in producing vegetables for the commercial market. The ages of those growers surveyed imply stability or commitment to farming and, therefore, provide an opportunity for longrun relationships between growers and buyers. Development of relationships between growers and buyers is essential in the produce industry, where there are no written contracts. The openmindedness of both growers and potential growers concerning selection of vegetables to grow is an asset, as far as commercial buyers are concerned.

The local labor source appears to be adequate in the study areas. Such a labor source will be required until production units become large enough to justify mechanized operations. An extension-education program must be developed to teach potential growers production, harvesting, and marketing management practices and techniques. A program should also be developed to help current growers keep up with new and/or improved practices and techniques. One type of extension education program used in the study area was a fall broccoli enterprise demonstration. For these demonstrations, extension specialists provided the actual transplants and cultural practices information. The information on cultural practices was a result of 4 years of varietal and cultural studies at the Horticultural Research Farm, Virginia Polytechnic Institute and State University.[2]

[2]For additional information contact Charles R. O'Dell, Extension Horticulturist, Department of Horticulture, Virginia Polytechnic Institute and State University, Blacksburg, VA. 24061.

Throughout the conversations with vegetable buyers, the importance of proper handling and packing of harvested vegetables was stressed. The buyers, especially food retailers, want vegetables that will stay fresh looking for several days (have shelf life). To achieve the length of shelf life the retailers demand requires properly timed harvesting, cooling to remove field heat, proper packing, and, for most products, refrigerated, ice-packed, or top iced transportation.

Given the above, the purpose of this section is to present alternative handling and packing operations for vegetable growing and shipping operations in the study area. Fulfilling the purpose was complicated by the many small-sized production units scattered over a wide geographical area. However, a small vegetable washing and packing line being successfully operated by the Smyth County (Virginia)Vegetable Growers' Association was available to serve as a model for the alternative handling and packing operations conceptualized.

Alternative Packing Operations

Based on the small size of many production units and their spatial separation, two alternative packing operations were developed. One of the proposed alternatives is a conceptualized mobile packing operation and the other is a scaled-down version of a conventional packing operation (permanently sited packingline).

Packingline Equipment

Although the alternative packing operations are different, they employ similar packingline equipment. Starting with product receiving, both operations require a receiving belt or powered conveyor to move the products from the delivering vehicle to the packingline. The receiving belts or conveyors should be smooth rubber and the sides of the belt enclosures should be flared. The products will move from the receiving belt(s) to a rubber discharge plate that will carry them to the next station — a washer. The washer allows a packer to process wet or dry produce, so that packing can be done directly from a wet orchard or field, or from cold storage.

After washing, the produce should be moved through a water absorber to remove excess water as it leaves the washer and to permit continuous processing. These absorbers usually use 7 to 10 donut-style rolls cut from extra-firm super sponge. The produce then moves to a sizing unit fitted with a side conveyor. A sizing unit should be used to eliminate undersized produce before packing. Various sizes of chain belt can be installed. Entrance and discharge plates should be rubber covered to protect produce from damage. The sizer should be fitted with a rubber-lined side discharge chute.

The washed, dried, and sized produce moves to a power-driven rotary packing table (5-foot diameter) that constantly moves the produce from the sizer to the packers to eliminate congestion and traffic in the packing area and to improve efficiency and productivity. A series of roller conveyors should be used to move the packed cartons of produce from the rotary table into the over-the-road vehicle or into a refrigerated storage area.

Mobile Packingline

In addition to the equipment described above, two basic pieces of equipment required by this conceptual packingline are used: a 40-foot, flatbed trailer and a used, 40-foot, noninsulated, dry freight trailer van. A small packingline (overall length of 19 feet) is mounted on the flatbed

Figure 11

Mobile Packingline

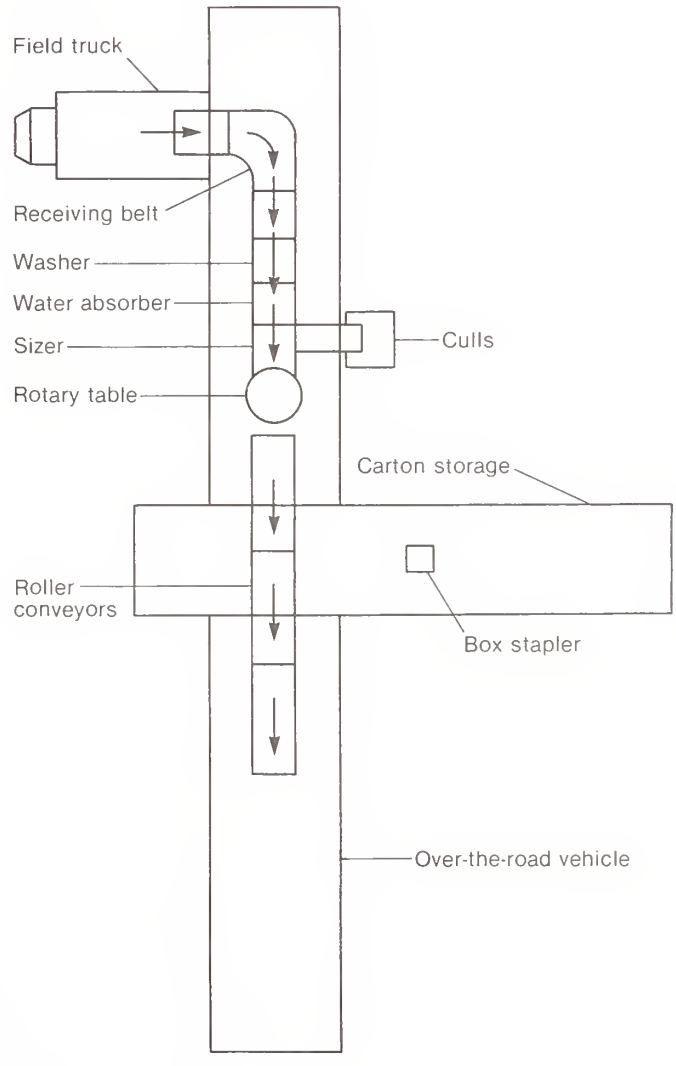


Table 5.—Mobile packingline: Estimated initial and annual equipment and alterations costs plus 25 percent contingency allowance[1]

Item	Initial cost	Annual cost
	Dollars	
Receiving belt[2]	895.00	295.35
Packingline (receiving belt, washer, water absorber, sizer, rotary table)	4,555.00	1,503.15
Pallet bin (for culls)	37.40	18.83
Box stapler (electric)	1,775.00	630.12
Skatewheel conveyors (10 feet long)	407.25	109.98
Three stands	75.00	20.25
Flatbed trailer (used)	3,500.00	1,175.00
Dry freight trailer (used)	4,000.00	1,307.50
Tractor (used)[3]	4,800.00	3,702.00
Alterations	2,000.00	590.00
Total equipment and alterations	22,044.65	9,352.18
Contingency[4]	5,511.16	248.00[5]
Total estimated costs plus contingency	27,555.81	9,600.18

[1]Source—equipment manufacturers and calculations for initial costs and table 11 in the appendix for annual costs.
[2]A second receiving belt (in addition to the one included in the packing line) is required because the packingline is higher than the level of the vehicle being unloaded.
[3]For transporting packingline trailers.
[4]Twenty-five percent of equipment and alterations costs; will not be used unless required.
[5]Interest at 9 percent assuming all of contingency fund is required.

Table 6.—Mobile packingline: Estimated labor costs per unit of output at various levels of annual output

Workers	Total hourly rate	Total annual costs	Annual costs per unit of output			
			10,000 units	25,000 units	50,000 units	100,000 units
			Dollars			
On site (8):						
Feeder—receiving belt (1)	4.00	—[1]	0.0444	0.0445	0.0445	0.0444
Packers (3)	12.00	—	.1332	.1334	.1334	.1333
Conveyors (1)	4.00	—	.0444	.0445	.0445	.0444
Stackers (2)	8.00	—	.0888	.0890	.0890	.0888
Carton maker (1)	4.00	—	.0444	.0445	.0445	.0444
Total	32.00	—[2]	.3552	.3559	.3559	.3553
Full season (2):						
Lineman/driver (1)	5.00	6,500[3]	.6500	.2600	.1300	.0650
Supervisor (1)	7.00	9,100[3]	.9100	.3640	.1820	.0910
Total	12.00	15,600	1.9152	.9799	.6679	.5113

[1]Vary with level of output and is reflected in per unit costs.
[2]Will vary with output:
10,000 units cost $3,552.00 for on-site labor (111 hours)
25,000 units cost $8,896.00 for on-site labor (278 hours)
50,000 units cost $17,792.00 for on-site labor (556 hours)
100,000 units cost $35,552.00 for on-site labor (1111 hours)
[3]Full-season employees are to be assured of 2,300 hours per year.

trailer and permanently fastened to the trailer bed. The enclosed van is modified to allow the packed product to pass through and into the transport vehicle. A box-making station is located near the carton storage area at the rear of the van. Figure 11 illustrates the movement of the harvested product from the field truck, up the receiving belts to the packingline, along the packingline where the product is washed, dried, sized and packed, and onto roller conveyors that move the packed product into the transport vehicle.

Modifications to both pieces of transport equipment are basic to the mobile packingline. In addition to mounting the packingline on the flatbed trailer, the trailer must be wired so that only one external electrical power source will be required for all of the packingline equipment and lights. The incoming and outgoing water for the washer will have to be accommodated so that adequate water will be supplied and waste water can be discharged without interfering with the functioning of the line. Storage space will be available at the forward end of the trailer.

Consideration should be given, although it is not addressed in this analysis, to a cover for the packingline so that operations can be conducted in all types of weather. The rear one-third of the enclosed van trailer will be used to store empty cartons. An electric carton stapler should be mounted near the center of the trailer van. Finally, doors should be installed on either side near the front of the trailer to create a passageway for the roller conveyors moving the packed produce from the end of the packingline into the transport vehicle. The enclosed trailer will also have to be wired for overhead lighting and for fans to remove heat during the summer. The forward end of the enclosed trailer can be used for storage of movable pieces of equipment while the packingline is being moved between sites.

Equipment costs.—The estimated initial and annual costs of equipment and alterations plus a 25-percent contingency allowance for the mobile packingline are shown in table 5. The contingency allowance is included as a hedge against any unforeseen expenses. Also shown in the table is the cost of a second receiving belt (one belt is included in the packingline). Two receiving belts are required to transfer the products from the delivery vehicle to a second receiving belt because the height of the picking line is above the level of the vehicle being unloaded.

To be more meaningful, the annual costs shown in table 5 should be based on a per unit of output (average cost) basis. For purposes of this analysis, the units of output used were 10, 25, 50, and 100,000 boxes or crates per year. Based on 10, 25, 50, and 100,000 units per year, the annual costs before the interest for the contingency fund were $0.9352, $0.3740, $0.1870 and $0.0935, respectively, and including the interest charge for the contingency fund were $0.9600, $0.3840, $0.1920, and $0.0960, respectively.

Table 7.—Mobile packingline: Total estimated equipment, labor, and materials costs and interest costs for the contingency allowance at various levels of output

Element	Cost per unit of output			
	10,000 units	25,000 units	50,000 units	100,000 units
	Dollars			
Equipment	0.9647	0.3860	0.1931	0.0964
Labor:				
On-site	.3552	.3559	.3559	.3553
Full season	1.5600	.6240	.3120	.1560
Materials	.8500	.8500	.8500	.8500
Total equipment, labor, and material	3.7299	2.2159	1.7110	1.4577
Interest on contingency allowance	.0248	.0100	.0050	.0025
Total	3.7547	2.2259	1.7160	1.4602

Labor costs.—A crew of 10 workers would be needed to fully staff this packingline but it could be operational with a crew of eight. Two of these workers are termed full-season employees and would move with the unit from site to site. One would be responsible for moving the shed and setting up the packingline and the other would be responsible for overall operations and staffing. The other eight workers would operate along the packingline, assemble cartons, and load vehicles. The estimated per unit labor costs for the mobile packing shed at various levels of output are shown in table 6.

Shipping containers costs.—The final element of operating costs is the shipping containers themselves. Fiberboard cartons can range from about $0.70 to $1.60, depending upon the amount of wax applied and the strength of the fiberboard used. An adequately waxed, 1-1/9-bushel container with board strength that will acceptably accommodate the handling and transporting stresses should cost about $0.85 per carton.

Total costs.—The total estimated equipment, labor, and material costs and interest costs for the contingency allowance are shown in table 7.

Concluding remarks.—A major point of consideration concerning the implementation of this concept is that it will require a vast amount of well-timed and coordinated effort to make it into a functioning reality, assuming that a mobile packingline would already be a physical reality. The grower must get the product to the packingline at the proper time and correct location. The broker must be able to get feedback from the line so that the carrier can be there when the produce is being packed out. After contact with the broker, the carrier must move his rig to the packing site to pick up the load. Not only does the carrier have to find the site, he has to be there on time! Packaging materials have to be delivered to constantly changing locations. The packingline itself must be moved periodically to follow the harvests.

Following is a list of advantages and disadvantages of the mobile packingline. These should be weighed when deciding whether or not to adapt this concept.

Advantages

1. Transport is minimized from harvest to packing.

2. Fresher packout can result in better arrivals and longer shelf life.
3. Investment is lower per grower serviced.
4. Utilization of the packing equipment is greater—more hours, more growers, more locations, etc.

Disadvantages

1. Coordination network is so large that the potential for problems is great.
2. Equipment is more prone to breakdowns because it is being moved.
3. Availability and adequacy of labor supply will vary from site to site.
4. Power and water at the numerous sites could be undependable.

Permanently Sited Packingline

The basic idea behind this type of packingline is to convert an existing structure (a barn, garage, etc.) into a packingshed having refrigerated storage with a minimum of expense and time. The fixed location can alleviate many of the potential coordination problems that are inherent in the mobile packingline.

The same packingline that was used in the mobile operation is used for this operation, with minor changes (fig. 12). Because this packingline is on the same level as the incoming field truck, only one receiving belt to move product to the line is needed, compared to two with the mobile line. The permanently sited line is below the level of the outgoing vehicle and requires a power conveyor to raise packed cartons from floor level up and into the transport vehicle. Refrigerated storage in the form of a 10- by 30-foot walk-in cooler located outside the line itself has been added to provide refrigerated storage for about one full truckload. The type of refrigerated storage unit suggested stands outside and comes fully assembled and wired and needs only to be plugged in. The building may require slight electrical work to increase the service for the lights, stapler, packingline, and cooler, but this need will have to be assessed from site to site.

Figure 12

Permanently Sited Packingline

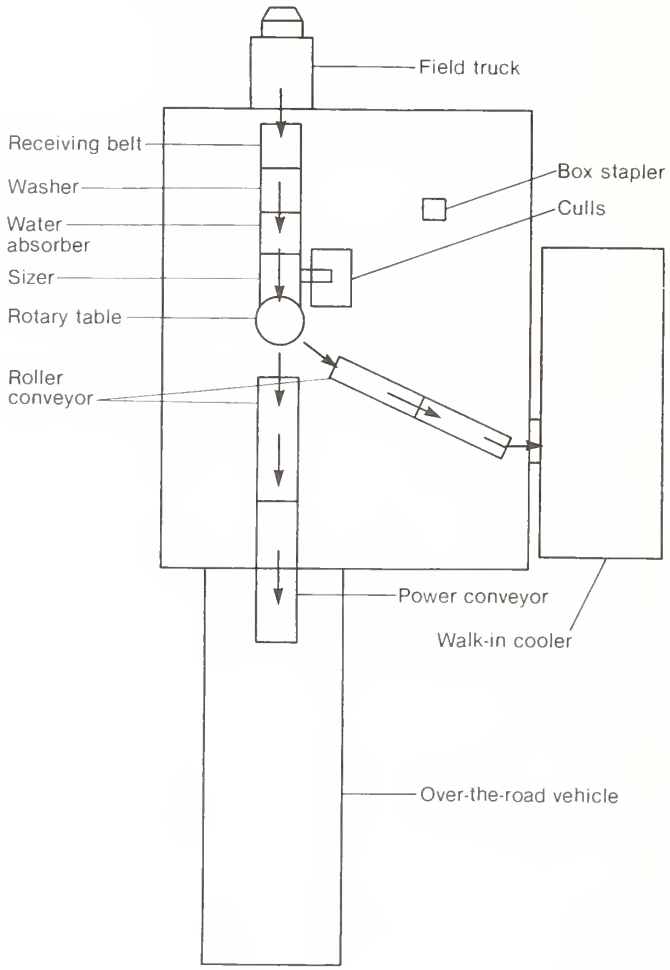


Table 8.—Permanently sited packingline: Estimated initial and annual equipment costs plus 25 percent contingency allowance[1]

Item	Initial cost	Annual cost
	Dollars	
Packingline (receiving belt, washer, water absorber, sizes, rotary table)	4,555.00	1,503.15
Pallet bin	37.40	18.83
Carton stapler (electric)	1,775.00	630.12
Skatewheel conveyors (3)	407.25	109.98
Stands (3)	75.00	20.25
Walk-in cooler	11,680.00	4,847.20
Power conveyor	750.00	247.50
Pallet truck (manual)	750.00	252.50
Total equipment	20,029.65	7,629.53
Contingency[2]	5,007.41	225.33
Total estimated equipment and contingency	25,037.06	7,854.86

[1]Source—equipment manufacturers and calculations for initial costs and table 11 in the appendix for annual costs.
[2]Will not be used unless required.

Equipment Costs.—The estimated initial and annual costs of equipment plus a 25-percent contingency allowance for the permanently sited packingline are shown in table 8.[3] The per unit of output costs, excluding interest costs for the contingency fund, for the permanently sited packingline amounted to $0.7629, $0.3054, $0.1528 and $0.0764 respectively, for annual outputs of 10, 25, 50, and 100,000 units; and $0.7854, $0.3144, $0.1573, and $0.0786, respectively, when interest costs for the entire contingency fund were included.

Labor Costs.—This packingline would require a crew of nine workers, but it could be operational on a limited basis with a crew of seven. One of these workers would be a supervisor of operations who would be employed for the full season's operations. The other eight workers would work along the packingline, assemble cartons, move the cartons either into storage or into a vehicle, and load outgoing loads. The per-unit labor costs for the permanently sited packingline at various levels of output are shown in table 9.

[3]A cost for obtaining the facility to house the packingline will have to be included in the final analysis. This cost was excluded from this analysis because of wide variations depending on locations, conditions, and other related circumstances.

Table 9.—Permanently sited packingline: Estimated labor costs per unit of output at various levels of annual output

Workers	Hourly rate units	Total annual units	Annual cost per unit of output			
			10,000 units	25,000 units	50,000 units	100,000
			Dollars			
On-site (8):						
Feeder-receiving belt (1)	4.00	-[1]	0.0444	0.0445	0.0445	0.0444
Packers (3)	12.00	-	.1332	.1334	.1334	.1333
Conveyor (1)	4.00	-	.0444	.0445	.0445	.0444
Stackers (2)	8.00	-	.0888	.0890	.0890	.0888
Carton makers (1)	4.00	-	.0444	.0445	.0444	.0444
Subtotal	32.00	-[2]	.3552	.3559	.3559	.3553
Full season (1):						
Supervisor	7.00	9,100.00[3]	.9100	.3640	.1820	.0910
Total	39.00		1.2652	.7199	.5379	.4463

[1]Vary with level of output and reflected in per unit costs.
[2]Will vary with output:
10,000 units cost $3,552.00 for on-site labor (111 hrs)
25,000 units cost $8,896.00 for on-site labor (278 hrs)
50,000 units cost $17,792.00 for on-site labor (556) hrs)
100,000 units cost $35,552.00 for on-site labor (1111 hrs)
[3]Full season employees are to be assured 1,300 hours per year.

Shipping Container Costs.—As was mentioned under the discussion of the mobile packingline, costs for shipping containers can vary from $0.70 to $1.60 per carton. A very adequate carton for use in these operations would probably cost $0.85.

Total Costs.—The estimated total equipment, labor, and materials costs and interest costs for the contingency allowance are shown in table 10.

With the permanently sited packingline, two major concerns should be addressed before implementation. First, packaging materials do not store well over extended periods of time, especially in inhospitable environments. Therefore, a dry and well-ventilated area must be set aside for storage of fiberboard cartons. Second, proper disposal of the waste water can be a problem from numerous points of view. One major consideration is that small-scale sheds will probably not have paved driveways or parking areas. Thus waste water could present a practical problem by making the surrounding area a quagmire and seriously hamper the operation of vehicles around the shed. Another major consideration is that waste water will contain a multitude of decay and rot-causing fungi and bacteria that must be carried away from the shed and produce. The danger of infestation which in turn will reduce the quality and shelf life of the product could increase with the proximity of this waste water.

Table 10.—Permanently sited packingline: Total estimated equipment, labor, and materials costs and interest costs for the contingency allowance[1]

Element units	Cost per unit of output			
	10,000 units	25,000 units	50,000 units	100,000
	Dollars			
Equipment	0.7629	0.3054	0.1528	0.0764
Labor:				
On-site	.3552	.3559	.3559	.3553
Full season	.9100	.3640	.1820	.0910
Materials	.8500	.8500	.8500	.8500
Total Equipment, labor,and material	2.8781	1.8753	1.5407	1.3727
Interest on contingency allowance	.0225	.0090	.0045	.0022
Total	2.9006	1.8843	1.5452	1.3749

[1]Does not include costs for housing packingline.

Hydrocooling[4]

Hydrocooling is a method of precooling fruits and vegetables used in most of the major producing areas. Its effectiveness is attributable to the capacity for water to rapidly remove heat from the surface of a substance. When a film of cold water (32 degrees Farenheit recommended) is made to flow briskly and uniformly over the surface of a warm substance, the temperature on the surface of the substance promptly becomes essentially equal to that of the water.

Hydrocooling is accomplished by flooding, spraying, or immersion. Flooding uses overhead perforated flood pans and an abundance of cold water. Spraying is accomplished by overhead nozzles. Immersion cooling is accomplished by submerging the product in agitated chilled water.

Commercial hydrocoolers are usually of the flood type or bulk type. The flood type is designed to cool a packaged product by flooding while it is moved through a cooling tunnel. Adaptations consist of conveying the product through the tunnel in loose bulk or bulk bins. The bulk-type uses a combination of immersion and flood hydrocooling. Loose product is dumped into cold water and remains immersed halfway through the cooling tunnel. An inclined conveyor gradually lifts the product out of the water and subjects it to overhead flooding. Other types include long conveyor tunnels where water is sprayed over partly submerged packages, tanks of agitated chilled water, and holding rooms employing overhead nozzles to spray cold water on palletloads of produce in bulk bins or packages.

When hydrocooler water has been recirculated for some time, there is certain to be an accumulation of decay-producing organisms. The addition of mild disinfectants such as chlorine or approved phenol compounds will reduce the buildup of bacteria and fungus spores, but will not kill infections already in the products or sterilize either the water or the product surfaces. The main problem in the maintenance of uniform concentrations in ice-refrigerated equipment is the constant dilution from melting ice.

[4]ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Guide and Data Book, 1966-67, pp. 697-699.

Summary of Postharvest Handling and Facilities

Two options for vegetable packinglines were discussed—one mobile and the other permanently sited. Layouts, equipment, labor, and material costs, and advantages and disadvantages for each option were presented. Potential users must select which option or combination of options will best fit their needs as set forth by their buyers.

A brief description of hydrocooling was presented to alert growers to the need to cool vegetables at the time of packing and to give them some information concerning a widely used and accepted method of cooling products. Buyers of fresh vegetables will insist that the field heat be removed from products before they are loaded into the vehicles for shipping to stores and warehouses.

Proper postharvest handling is essential in the fresh vegetable industry.

As soon as possible after data collection has been completed, a meeting with growers, potential growers, extension personnel, and other interested parties should be scheduled to present a summary of the results of the analysis. One of the more important parts of the meeting is to tell how the results and recommendations should be implemented. In other words, the question "Where do we go from here?" must be answered. The answer to the question involves several steps.

First, determine local interest. At this point those growers and/or potential growers who are genuinely interested in growing vegetables for the commercial market should be identified. In addition to ascertaining who will produce, the resources (land, labor, capital, and management) available among and for the interested growers must be determined. The resources represent the factors that will limit the potential production of the vegetable crops.

Second, select key people from those interested to organize, lead,and coordinate the production and marketing efforts. These key people must be able to work together and with others, be willing to follow all the recommendations from specialists, and have the respect of other growers.

Third, hold meetings of leaders and potential vegetable buyers. Ask the potential buyers to attend a meeting of the interested growers. The leaders should challenge both the potential buyers and the interested growers prior to the meeting. The potential buyers should be challenged to present their lists of desired crops, and describe the way they expect the product(s) to be grown, harvested, packed, cooled, and handled, what the penalties are for not following buyers' expectations, and what the benefits are for meeting the expectations of buyers. The interested growers should be challenged to listen to the potential buyers because the buyers have many alternative supply sources. In other words, it is a "buyers' market."

Fourth, on the basis of potential buyers' suggestions, market window analysis, and horticulturists' recommendations, select crops that can be grown in the area. Demonstration test plots developed in the Virginia areas by Charles R. O'Dell, extension horticulturist, proved to be very beneficial in crop selection and are highly recommended.

Fifth, emphasize to growers the importance of using recommended horticultural practices. Proper methods of plant or seed selection, soil preparation, planting or seeding, irrigation, cultivation, and pest control must all be implemented to grow marketable vegetables successfully.

Sixth, fulfill the harvesting, packing, handling, and marketing requirements specified by the buyers. As mentioned above, growers must satisfy the buyers' expectations.

Finally, establish a task force to develop long-range plans to guide production and marketing efforts.

Discussions with produce buyers and growers in Virginia have raised a number of unresolved problems that may require research. Although finding solutions to these problems may require a multidisciplined approach, most require expertise in one of three disciplines: horticulture, economics, or engineering. In the following discussion of future research needs, projects are not listed in order of priority because requirements will vary among growers and within regions.

Horticulture

1. Growers need to know how to estimate yields 4 to 10 days before planning to harvest. Estimating yields involves being able to predict quantities at a given size and level of maturity. It also implies being able to predict the length of time required for the commodity to advance from one stage of maturity to the harvesting stage, given average or typical weather conditions for the area.
2. A common retail buyer complaint is that local growers wait to harvest the product until it is too mature. Retailers need adequate product shelf life to be able to get the product into the system and on display for a few days. Thus growers must know when to pick in order to have the needed product life for retailers. Fully mature product is satisfactory for direct to consumer sales at farmers' markets and roadside stands, but not for other outlets.
3. Visual aids are needed that depict various levels of maturity and preferred commercial market sizes and grades. These visual aids would be useful in training growers, pickers, graders, and packers.
4. The preferred varieties or cultivars must be identified that will do well in specific localities such as southwest Virginia and be readily acceptable or sought by both retailers and consumers.
5. New growers must know the timing, cultivation, fertilization, irrigation, and pesticide requirements of vegetables in order to grow specific commodities to the right stages of maturity when desired.
6. Based on any market opportunities identified in the full study, localities must be identified that have the production capabilities to capitalize on the opportunities for specific crops.
7. Storage is another unresolved problem area. Research is needed to determine how long and under what conditions (including controlled atmosphere) products can be stored.

Economics

1. The cost/benefits of dealing directly with wholesale buyers, and/or chain store buyers at different volume levels versus dealing directly with individual supermarkets or other direct marketing approaches need to be determined for specific localities.
2. The cost/benefits of joining together in pooling shipments either through voluntary associations or cooperatives must be determined for different volume levels.
3. The cost/benefits of pooling associations or cooperatives versus individual growers providing product cooling, washing, grading, packaging, storing, and marketing services needs to be determined. For example, is it economically feasible to store a low-volume commodity like cabbage for the winter market windows?
4. Procedures for developing good estimates of regional market demand for specific vegetables are needed to help quantify market opportunities.

Engineering

1. The effectiveness of using non-refrigerated ground water for hydrocooling various produce items must be determined. A design should be developed for hydrocooling by spraying or flooding for use in areas such as southwest and/or southside Virginia, where many small-sized production units are located.
2. Plans should be developed for a medium-sized (1,000 cartons per hour output) packing facility to be located in areas having production units similar to southwest and/or southside Virginia. Capacity for hydrocooling, refrigerated storage, palletized hydrocooling, refrigerated storage, palletized handling, and automatic box making should be incorporated into this design. Costs to build this facility or to convert an existing structure should be estimated.
3. The feasibility of locating an assembly-point market with the packing facility developed above should be studied. If economically feasible, the location in southwest and/or southside Virginia should be determined and a design developed for an assembly-point vegetable market (similar to Pompano Beach, Florida, or Vineland, New Jersey).
4. The feasibility of the "mobile packingline shed" concept should be explored.

Multidisciplined Efforts

1. Packing methods for effective product merchandising to both direct sales outlets and retail buyers should be determined and demonstrated.
2. Answers must be found to questions regarding the special treatments and handling methods needed to enhance the appearance and shelf life of the produce, e.g., waxing cucumbers; sprays to inhibit spoilage; whether to wash or not wash certain crops. The costs and/or benefits of performing these treatments and methods and their importance for buyer acceptance should be studied.
3. Effort must be made to determine the best (most economical) ways to remove field heat from most commodities when heat removal is necessary to provide adequate shelf life. What volumes are needed to make different methods of heat removal economical?

Table 11.—Development of per unit ownership and operating costs for equipment inputs for the mobile packing shed and the permanently sited packing shed

Equipment	Initial cost	Estimated life	Annual depreciation [1]	Insurance and taxes [2]	Interest [3]	Total fixed costs	Power [4]	Maintenance [5]	Total variable	Total annual	Cost per unit of output			
											10,000	25,000	50,000	100,000
	Dollars	*Years*	*Dollars*							*Dollars*				
Packingline	4,555.00	10	455.50	227.75	409.95	1,093.20	273.30	136.65	409.95	1,503.15	0.1503	0.0601	0.0301	.0150
Box stapler (electric wire)	1,775.00	8	221.87	88.75	159.75	470.37	106.50	53.25	159.75	630.12	.0630	.0252	.0126	.0063
Conveyor, skatewheel	135.75	10	13.58	6.79	12.22	32.59	-	4.07	4.07	36.66	.0037	.0015	.0008	.0004
Stand	25.00	10	2.50	1.25	2.25	6.00	-	.75	.75	6.75	.0007	.0003	.0002	.0001
Walk-in cooler	11,680.00	8	1,460.00	584.00	1,05l.20	3,095.20	1,401.60[6]	350.40	1,752.00	4,847.20	.4847	.1939	.0969	.0485
Power conveyor (10 ft wA1 and ht adj)	750.00	10	75.00	37.50	67.50	180.00	45.00	22.50	67.50	247.50	.0247	.0099	.0049	.0025
Pallet bin	37.40	3	12.47	1.87	3.37	17.71	-	1.12	1.12	18.83	.0019	.0008	.0004	.0002
Pallet jack (manual)	750.00	6	125.00	37.50	67.50	230.00	-	22.50	22.50	252.50	.0252	.0101	.0050	.0025
Receiving belt (l0 ft)	895.00	10	89.50	44.75	80.55	214.80	53.70	26.85	80.55	295.35	.0295	.0118	.0059	.0029
Flatbed trailer (used)	3,500.00	8	437.50	175.00	315.00	927.50	-	247.50[8]	247.50	1,175.00	.1175	.0470	.0235	.0117
Dry freight trailer (used)	4,000.00	8	500.00	200.00	360.00	1,060.00	-	247.50[8]	247.50	1,307.50	.1307	.0523	.0261	.0131
Tractor (other, used)	4,800.00	8	600.00	240.00	432.00	1,272.00	1,925.00[7]	505.00[7]	2,430.00	3,702.00	.3702	.1481	.0740	.0370
Additions	2,000.00	8	250.00	100.00	180.00	530.00	-	60.00	60.00	590.00	.0590	.0236	.0118	.0059

[1]Straight-line depreciation.
[2]Insurance and taxes at 5 percent of initial cost.
[3]Interest at 9 percent of initial costs or 18 percent of the undepreciated balance.
[4]Power at 6 percent of initial costs.
[5]Maintenance at 3 percent of initial costs.
[6]Power for cooler at twice the power cost of the other equipment.
[7]Assumed 5,000 miles per year exclusive use for this operation at 38.5 cents/mile for operating costs.
[8]Tires and miscellaneous costs at 9.9 cents/mile and trailers to be used for 2,500 miles per year.

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