MARYLAND COOPERATIVE EXTENSION
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Fact Sheet

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Introduction

In a recent survey of produce buyers in the Baltimore-Washington region, produce buyers expressed a desire to significantly increase their purchases of local produce (Hanson and Rada, 1992). Local produce is fresher and better quality than produce grown outside of the Mid-Atlantic region. Buyers also state that consumers want local produce, and buyers gain a marketing advantage in advertising the availability of local produce. However, for local farmers to increase their produce sales, they must overcome several problems. Buyers are dissatisfied with the manner in which local produce is packed and graded; they also want better service, more reliable deliveries, and professional invoicing. This fact sheet offers ideas for improving these perceived weaknesses. Local farmers raise quality produce; preserving that onfarm quality as the produce moves through marketing channels to the consumer is critical to long-term financial success.

Buyers of produce, whether wholesalers, retailers, or consumers, are increasingly more discriminating in their purchasing practices. They want high-quality, physically attractive produce with a long shelf life. There has been a shift from grading and packing fresh fruits and vegetables at terminal markets to grading and packing at shipping points (How, 1991). For local growers, the shipping point is the farm. This shift is so pervasive across the United States that produce buyers expect it as routine when conducting business.

The importance of properly graded and packed produce can be seen in the operation of a produce retailer. A typical produce department in a supermarket represents approximately 8.5 percent of the store's sales volume, and generates 12.6 percent of the gross profit and 21.3 percent of the net profit. Except for health and beauty aids and general merchandise, no other department equals produce for profit potential (Food Business Associates, Inc., 1987). Most food stores are designed so that produce is the first department shoppers walk into upon entering the store. Much produce is bought on impulse, so this layout sets the shopper's mood for the entire store. Freshness, cleanliness, and appearance are paramount in the success of the store, as well as the produce department. If the produce looks and smells fresh, shoppers will immediately feel positive about the rest of the store. The produce department is the first impression of a store in the consumer's mind; making a good first impression is essential to sales.

In the food service industry, the consumer's preference has shifted to fresh produce rather than processed fruits and vegetables. This change has increased possible menu offerings. Food service produce buyers require yield and consistency of produce. Variations in sizes of fruits and vegetables or in their condition can significantly cut into profits. For example, a curve in a cucumber translates into an approximate 10-percent loss in yield. Adjusting recipes because of variation in produce size is time consuming and expensive. "Portion control" is a watchword for efficiency in the food service industry.

The successful farmer recognizes the importance of these issues to the produce manager

or restaurateur and makes sure that delivered produce meets their needs. When these needs are met, the local grower has enormous advantages over out-of-region competitors, including proximity to the customer so that produce can be delivered quickly, produce picked at its peak of flavor and ripeness so it does not need artificial ripening, a measurable consumer preference for local produce, and a more personal relationship between buyer and grower.

Produce buyers also know that local growers are in a better position to help sell their produce. Twenty years ago, consumers could choose from among 65 different kinds of fresh produce; today, that number approaches 250 kinds (Popcorn, 1991). With constantly changing sources of supply, varying degrees of quality, weekly price changes, and a consumer whose preferences are in constant flux, retailers and restaurants rely heavily on information and ideas from their suppliers. When the local grower is attuned to the challenges faced by the retailer and takes an active role in helping solve retailer problems, the grower benefits also.

This fact sheet covers harvesting and cooling, grading, packing, delivery, and invoicing as they relate to the marketing of fresh fruits and vegetables. Each step is necessary for success in direct wholesaling, but none is sufficient by itself. Rather, they should be viewed as integral parts of a formula for a complete postharvest system. Contact your county Extension office for specific biological requirements for different fruits and vegetables. A list of other publications about postharvest handling appears at the end of this fact sheet.

Harvesting and Cooling

Careful harvesting is the key to the entire postharvest handling process. "If produce incurs physical damage at harvest, there is basically nothing that the best packing, cooling, or shipping can do to re-achieve that initial quality" (South, 1992a). Fruits and vegetables are live products; their peak quality is achieved the moment they are harvested. From that point on, farmers should attempt to manage postharvest conditions so that product deterioration is minimized and quality delivered to the consumer is maximized. The following guidelines should help with harvesting, cooling, and postharvest management of fruits and vegetables:

1. Harvest at optimum maturity. This will vary by commodity and shipping considerations. Immature and overmature produce are more susceptible to decay.
2. Harvest gently and with care. Mechanical damage, such as cuts, bruises, abrasions, and pest damage, can lead directly to postharvest losses and decay. Minimize handling steps, do not underpack or overpack your containers, and avoid drops. Motivate all employees to be concerned with product damage, and emphasize the need for gentle handling to retain high quality.
3. Remove or minimize product field heat. If possible, harvest during the coolest part of the day. Keep harvested products out of the sun; make full use of shading. This is especially important if further sorting, grading, and repack operations are conducted. Prompt removal of the harvested product from field heat by appropriate cooling methods will help to extend its shelf life.
4. Pack in clean, undamaged containers. The use of new or sterilized containers is a must; residues from an old product can infect a new product.
5. Keep the harvested product at the proper temperature and relative humidity throughout the postharvest period. (For more information, see Table 1.) Temperature control and management are the most important factors for controlling product deterioration. Holding fruits and vegetables at their optimum temperatures and humidities increases shelf life and helps maintain quality. Temperatures that are too high speed up the respiration process of the produce; shelf life or storage time decreases as the respiration rate increases. The biochemical reaction of respiration results in the release of energy known as "vital heat." The removal of field heat and the control of vital heat are paramount to temperature management and product shelf life. Temperatures should not be too low either, as this can lead to chilling injury, which causes decay, discoloration, pitting, and loss of flavor and ripening ability.

For small farms that grow a wide variety of fruits and vegetables, cooling methods can be costly and complicated. The grower needs to consider several factors when deciding on a cooling

method. Different vegetables may require alternate methods of cooling to prolong quality and shelf life. A grower might consider crops that require similar cooling methods to maximize the efficiency and justify the expense of the cooling method used. The type of packaging also may play a part when considering cooling methods. High-yield crops might dictate a high flow capacity because of the need to cool large volumes in a short time span. The expense of cooling must be reflected in the produce's selling price as well as other benefits, such as being able to delay entering the market until prices are favorable.

The four most common methods of removing field heat are room cooling, forced air cooling, hydrocooling, and top or liquid icing (Boyette et al., 1989). Room cooling, which occurs in an insulated room with refrigeration units, is most effective for produce that has been precooled or does not need field heat removed rapidly. The design and use of the cooling system evaporator fans are critical for maximum efficiency. Forced air cooling is often used with room cooling and cools produce 75 to 90 percent faster. With the forced air method, fans draw cool air through the packages. Ventilation is necessary to ensure efficient air cooling of boxed produce. Thus, selection of boxes with appropriate vent holes in the ends or sides is necessary. Box manufacturers can recommend proper configurations of ventilation design.

Hydrocooling is a rapid and effective method of precooling by spraying, flooding, or immersing the product in cold water. Typically, water removes heat 15 times faster than air. This method works well on most commodities except for those products where wetting can encourage the growth of micro-organisms; care must be taken to prevent disease development. Strict sanitation is a must and sometimes may require the use of chlorine and other labeled dips.

With top or liquid icing, ice or a slurry of ice and water are added to the top of the package through vents or handholds. This method works well on commodities with high respiration rates, such as corn or broccoli, or cartons that are densely packed and cannot be cooled by forced air. Top icing is not appropriate for fruits because of chill damage. For some high-respiration commodities, top icing is an energy efficient cooling method because 1 pound of ice can cool 3 pounds of produce (South, 1992b).

Grading

Some commodities are bought on the basis of their U.S. Department of Agriculture (USDA) grades, referred to as trading grades; specific commodities bought on grades most frequently include potatoes, tomatoes, and peaches. Other buyers rely heavily on a shipper's or packer's brand. In this case, the shipper's reputation in delivering produce as promised is important. A shipper's brand may differ slightly from the USDA trading grades. For example, the top grade of Washington State apples has color requirements not specified by USDA. A set of packing and grading standards that is stringently adhered to and consistently applied allows a buyer to purchase with confidence from a particular grower.

USDA has developed trading grades for approximately 100 fresh fruits, vegetables, and nuts. The standards vary among products. These grades usually define such factors as color, shape, size, maturity, and number and degree of defects. The range of grade names varies considerably from one product to another. This inconsistency in trading grades has led USDA to establish a policy of gradually phasing in four uniform terms that will be adopted during the normal process of revising existing standards or establishing new ones. Because the bulk of fresh fruits and vegetables is graded at the shipping point, successful growers have adapted their farm operations to include grading. For a local farmer who wants to sell to retailers, farm-site grading is a prerequisite to success.

Local produce buyers use many terms to convey what they expect from local growers' fruits and vegetables (Hanson and Rada, 1992). The word "quality" was used during interviews when more specific terms seemed elusive. "Grading" was sometimes used in place of quality, even though these two terms are not necessarily interchangeable. But quality for many buyers is a matter of "you know it when you see it." As one produce industry executive said, "Simply defined, quality is grade plus condition" (Hanson and Rada, 1992).

While it may be acceptable for buyers to possess an unclear idea of quality and grade, local growers do not have that latitude in their use of terms. Grading may be used either to designate the act of sorting individual fruits or vegetables into relatively homogeneous lots that meet grade

specification or to determine the grade applicable to a particular lot. Quality refers to the physical properties affecting market value, such as color, shape, texture, cleanliness, and freedom from defects. Condition refers to factors that may change with time, such as maturity, decay, freezing injury, shriveling, and flabbiness. Quality and condition are described by the terms fine, good, fair, ordinary, and poor.

Packing

Packing means more than carrying multiples of an object. Packing of fresh fruits and vegetables varies considerably among commodities. The shipping container plays an important role in marketing, since it must hold and protect the product; be easy to handle; stand up under stacking, cooling, shipping, and storage conditions; identify the product and the packer; carry information required by law; and make a favorable impression on the buyer. The temptation to save money on wholesale containers has sometimes resulted in the use of chicken crates, old banana boxes, or used cartons from other shipping areas, with unfavorable effects on future sales. Wooden crates and burlap bags have largely been replaced by fiberboard cartons.

Although cartons used for produce vary from one commodity to another, the gravitation of transportation companies toward palletizing loads in their respective operations has influenced container sizes. The use of a 48- by 40-inch pallet is causing the industry to strive for standard container dimensions so that products in different size cartons can be stacked on the same pallet. Local growers need to recognize certain aspects of the buyer's business practices and adjust their actions accordingly.

Delivery

Moving the harvested produce from the farm to the customer in good condition is important. All efforts up to delivery can be negated if the fresh fruits and vegetables reach the destination in poor condition. The same considerations used when harvesting, cooling, and packing extend to delivery. Temperature, humidity, air flow, and stacking need to be addressed. Ignoring these factors can result in bruised, wilted, or crushed produce. In addition, care should be taken when mixing loads of various fruits and vegetables so that product compatibility factors are not violated. The following compatibilities should be considered:

1. Temperature compatibility—Chill-sensitive products should not be shipped with products that need to be kept near freezing (32° F).
2. Ethylene compatibility—Do not mix produce that generates ethylene with ethylene-sensitive products. Failure to adhere to this rule can lead to premature ripening, discoloration, spotting, and other undesirable side effects (Wallner 1990). Such produce as ripening muskmelons, tomatoes, apples, pears, peaches, and plums give off ethylene and can injure such vegetables as leafy vegetables, cabbage, cucumbers, peppers, squash, and carrots; cut flowers and nursery stock also are damaged when exposed to ethylene. Ethylene damage is reduced at temperatures lower than 45° F. Relative quantities of fruits and vegetables in a load also may affect the damage caused by ethylene, but farmers should proceed with care.
3. Produce odor compatibility—Some vegetables can produce objectionable odors that can damage other produce. This is especially true of celery, garlic, onions, cole crops, potatoes, and other root crops. For example, onions and potatoes should be stored by themselves; celery should not be stored with carrots.
4. Moisture compatibility—Produce with similar moisture requirements (relative humidity) should be packed together.

Delivery trucks, from pick-ups to tractor-trailers, need to be well maintained, clean, and free from offensive odors that could contaminate the produce. Loads should be stacked to permit maximum air flow the length of the load, so that air is circulated on as many sides of the produce as possible. Securing the load to minimize shifting will help maintain free-flowing air movement. Deliveries occur either at night or early in the morning, but they are usually at the convenience of the buyer or manager and sometimes by appointment.

Invoicing

A bill of lading (an invoice) should accompany the delivery of the produce stating the commodity and number of cartons or total weight.

Whether the delivery is made by a wholesaler's or a retailer's truck, it should include an invoice showing the purchase order number, the commodity, number of cartons or weight, and the price in pounds or cartons. The local grower who includes an invoice with this information and payment terms will likely speed up the payment process. It is a normal practice for the retailer's receiver to sign a copy of this document to show receipt of the product and to note any discrepancies between the expected delivery and what was actually received. Duplicate invoices should be presented at the time of delivery—one for the customer, the other for the grower. All information should be filled in so that any discrepancy in pricing, delivery, or condition at time of delivery can be verified.

The sample invoice (Figure 1) is based on accepted industry standards but is only a guide; the food industry is working toward standard formats. The date on the invoice should be the day the order is received. "Arrive by" is the expected date of delivery. "Terms" denotes the payment terms a grower has extended to a buyer. (Many invoices with no stated payment terms are paid when it is convenient for the buyer. A grower who has experienced slow payment might want to change the terms to cash on delivery—c.o.d.)

"Cust. P.O." is for produce buyers who use purchase order numbers. For many large food companies, customer purchase numbers are the only efficient way to keep track of the thousands of purchases made per year. Some companies will refuse to accept a delivery without a purchase order number.

The body of the invoice is straight forward. The first column is for the quantity; the second column contains size of the produce or its unit packaging; a description of the commodity is entered in the third column; the fourth column is for pricing. To eliminate confusion, "per" refers to whether the pricing is by the pound, box, or carton. The total value of the sale is entered in the last column with the extended total at the bottom.

The two disclaimers at the bottom of the invoice are for the grower's protection. Neither disclaimer releases the grower from his or her responsibility to deliver the produce as described at the stated price. However, in periods of wildly fluctuating prices or growing conditions, some buyers may attempt to take advantage of farmers. The invoice states that the grower has limited control over both pricing and quantity and cannot always accept responsibility for unforeseen changes.

This sample invoice should be used by the grower on an order-to-order basis. Some growers and buyers enter into written contractual arrangements in which either price or quantity is set before the harvest. In such cases, growers might need to alter the format of their invoices.

ALL FRUIT AND VEGETABLE FARM

P.O. Box 999 ✻ Anywhere, Mid-Atlantic State 55555

Date	Arrive by	Terms	Cust. P.O.	Sold to:	Deliver to:

Quantity	Size	Commodity	Price	Per	Total

Received by: _____ Total invoice: _____

Any discrepancies between order and delivery, please advise immediately. All orders subject to crop availability. Prices subject to change without notice.

Figure 1. Sample invoice.

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