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ISSUES IN THE DEVELOPMENT AND MARKETING OF REDUCED CHEMICAL AGRICULTURAL PRODUCTS: A LOOK AT DISEASE-RESISTANT APPLE CULTIVARS

Cecile Murphy
and
Lois Schertz Willett

Department of Agricultural Economics
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York 14853-7801

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Motivated by accusations of environmental degradation and threatened with severe declines in public support, the agricultural sector has produced reduced-chemical products. One example of this trend is the development of disease-resistant apple cultivars which require less chemical applications during production. These apples may play a vital role in improving the image of the apple industry, which has suffered due to the Alar scare. Introduction of the disease-resistant cultivars will be successful only if attention is devoted to identifying and surmounting various concerns, such as obtaining complete producer information, satisfying consumer product demands, and meeting market channel requirements. Failure to meet these challenges may prevent successful adoption and marketing of the disease-resistant cultivars. In this report, we identify and discuss specific issues involved in evaluating consumer willingness-to-pay for reduced-chemical agricultural products and issues which arise in the marketing of these products.

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INTRODUCTION

A trend of environmentalism seems to have swept the country. In an effort to cash in on this trend, a new wave of "environmentally-friendly" consumer products have entered the market. Examples range from detergent refills to toilet tissue made from recycled paper. The popularity of environmental concerns has had more serious implications for the agricultural sector than for other industries. Instead of presenting increased sales opportunities for agriculture, environmentalism has meant increased criticism of agricultural practices and products. Increasingly, agriculture has been seen as a source of environmental problems. It now seems that if agriculture is to maintain public support, agriculturalists must become environmentalists.

The agricultural sector, recognizing this, has adopted lower-input growing practices and has developed reduced chemical products aimed at improving agriculture's image. An example of these new products are the disease-resistant cultivars (DRCs), developed through the apple industry, which require fewer chemicals in the production process. The objective of this paper is first to review the motivating forces in the development of reduced chemical agricultural products and disease-resistant cultivars in particular. These forces are reviewed in the sections titled Background and The Development of Disease-Resistant Apple Cultivars. In addition, issues involved in gauging and maximizing possible consumer markets for new products, such as the disease-resistant cultivars, are discussed in the sections titled Evaluating the Future Success of DRCs and Maximizing Consumer Willingness-to-pay for DRCs. The final objective, presented in the section entitled Marketing the Disease-Resistant Apple Cultivars, is to make producers, particularly apple growers, aware of alternative marketing channels which may be used when the product is introduced and after it has been established.

BACKGROUND

Agricultural fundamentalism, the view of agriculture as the fundamental and primary industry, has been a prevailing sentiment for over a century. Agriculture has been seen less as an industry than as a way of life--a way of life that needed and was worthy of public support. The widespread commitment to agriculture has been expressed through extensive preferential treatment by the government with such programs as farm subsidies, the Commodity Credit Corporation, and differential tax laws.

However, agriculture and attitudes are changing. As large corporate farms become more common, public concern over the plight of the traditionally poor family farmer has waned. And as the international community moves closer to capitalism and trade barriers continue to fall, domestic agricultural subsidies are increasingly seen as an unnecessary impediment to free-trade.

Agriculture's positive image has come under fire in recent years; agricultural practices have been criticized as destructive to the environment, and agricultural products labelled toxic and dangerous. As Sandra S. Batie argues in her July, 1988 article in the Southern Journal of Agricultural Economics, "agriculture is increasingly seen as 'the problem'" (Batie, p.1). This negative perception of agriculture has the potential to erode agriculture's favored status, in turn, severely reducing public support for agricultural programs and threatening the viability of agriculture.

Public Concerns Over Agrichemical Use

One major cause of the erosion of public support for agriculture is heightened consumer concerns about the effects of widespread agrichemical use. Reports of groundwater contamination and food safety scares have made consumers aware of threats that agricultural chemicals pose to the safety of their food and drinking water.

Widespread concern over agrichemical use first emerged in 1962 with the publication of Rachel Carson's book, Silent Spring. However, public awareness of specific chemical dangers was not prevalent until the emergence of groundwater contamination as an issue with the 1979 discovery of aldicarb in the groundwater of Suffolk County, New York. Since then, increased inspection and monitoring of groundwater have produced a number of other cases of contamination (Batie, p.2).

Reactions to discoveries of groundwater contamination have taken the form of policy initiatives at the state level. These new laws have been severe in some cases. Connecticut, for example, has a policy of strict liability which finds the pollutant farmer liable for damages in all cases of groundwater pollution--even if

the farmer carefully followed all instructions for chemical application provided by the chemical manufacturer (Batie, p.5). Connecticut's strict liability rule helps prevent groundwater contamination by acting as a deterrent. At the same time, however, it makes agricultural production more difficult and it transforms the profitable farming of land into a legally risky venture.

Food Safety

Another subject of popular concern that has the potential to affect a similar transformation of public sentiment is the issue of food safety. Food safety emerged as an issue in the 1980's and has shown no signs of waning in importance. Food safety covers a number of different subjects, from additives and preservatives, to irradiation, to antibiotics and hormones. But since 1984, chemical residues on foods have topped the list of consumer food safety concerns, according to the Food Marketing Institute's (FMI) Supermarket Trends report. In the 1989 survey, 82% of the shopping public surveyed identified residues (from chemicals such as pesticides and herbicides) as a serious hazard, while only approximately 3% thought that residues were not a hazard at all. Other studies have supported these percentages (Hammonds; Vance), some even showing significant percentages of respondents motivated by their concern: a Redbook survey found 39% of those surveyed had changed their buying habits because of chemical concerns (Aylsworth, p.13), and two-thirds of the respondents in a U.S. Department of Agriculture study stated they would be willing to pay 5 to 10% higher prices in order to have no pesticide residues on their produce (Ott, p.593).

Consumer concerns over food safety pose a serious threat to agriculture. Frightened consumers mean reduced purchases of traditional agricultural products and less profit. In addition, legislators react to consumer perceptions. Consumer fears concerning agrichemical use can lead to restrictive legislation which could greatly complicate agricultural production. Such negative repercussions of consumer concerns are possible even if these concerns are unfounded. The agricultural industry cannot afford attacks on the safety of its products. The potential losses, in terms of lost efficiency of production from increased regulation and lost profits due to frightened consumers, are far too high.

It is necessary for agriculture to be aware of consumer concerns and to be aware especially of the sources of consumer perceptions of issues such as food safety. Using this information, agriculture may correct false information and eliminate the sources of true agricultural problems.

Origins of Consumer Perceptions

In her article, "How Much Food Safety Do Consumers Want?", Eileen van Ravenswaay details three hypotheses regarding the formation of consumer

perceptions and concerns. The first explanation is that consumer concerns are perfectly logical in that they parallel the concerns of the scientific community on subjects such as food safety. The second hypothesis states that consumer concerns are a reflection of how frequently, recently, and memorably consumers have been exposed to information linking negative effects to certain substances. Her third hypothesis suggests that consumer concerns are related to the acceptability of risks incurred through contact with a particular substance (van Ravenswaay, pp.97-101).

A critical look at these three hypotheses of the origins of consumer concerns is helpful in evaluating possible reactions of the agricultural community to both founded and unfounded negative consumer perceptions of agriculture. Based on current data, the first hypothesis is not accurate. As stated previously, the number one consumer food safety concern is chemical residues, while experts in the field (e.g. the Food and Drug Administration) rate microbial contamination as their first concern, with chemical residues ranking significantly farther down the list. In addition, in a 1986 report of focus group food safety discussions performed by the Rand Corporation, participants who purchased organic foods rated the annual risks of dying from chemical residues on food as higher than the annual risk of respiratory cancer (500 in 1 million), while the report estimated the annual risk as 0.2 in 1 million. Even consumers of commercial produce overrated the risks of death from chemical residues on food (1 in 1 million) (Hammitt, pp.68-69).

Furthermore, since the federal government relies on information from scientific experts for formulation of its food safety policies, if the first hypothesis were correct, a high proportion of consumers should trust and rely on the government to ensure the safety of their food. Surveys show, however, that consumers do not trust the federal government to regulate food safety. The 1987 FMI Trends report noted that in response to the question, "whom do you rely on most to be sure that the products you buy are safe?", only 25% of respondents named the federal government. The most common response (45%) was "yourself as an individual". The third most popular response (15%) was consumer organizations, up 6% from the previous year and more than twice the percentage cited four years earlier(FMI, p.29).

The widespread reliance on sources other than the federal government for food safety issues is due to a number of factors. The federal government must make food safety decisions based on a very limited body of evidence regarding the effects of human consumption of agricultural chemicals in doses commonly found on food. Thus, the government is hesitant to make specific pronouncements on the safety or danger of eating certain foods. Consequently, the public is often left in an information vacuum regarding a number of food safety questions. This vacuum is frequently filled by such sources as consumer groups and the media.

The high level of consumer dependence on non-governmental sources for food safety information leads us to the second hypothesis, which focuses on consumer exposure to negative publicity about certain substances. This explanation seems to be at least partially supported by evidence. For instance,

it has been found that consumer concerns about a particular food safety issue usually parallel the frequency, recency, and memorability of media coverage of the issue (van Ravenswaay, 1988 pp.97,99).

If this hypothesis is correct, media and consumer group coverage of agricultural issues would wield the most power over agriculture's image. This situation might be appropriate if it could be proven that consumer groups and the media have access to more definitive information about food safety issues than the government and if these groups were accurate in their reporting of the facts. However, neither consumer advocacy groups nor the media have more conclusive data than the government, and, in fact, both groups have distinct motivations to sensationalize, if not outright lie about, food safety issues.

Dr. Roberta Cook explains in a paper written for the 1990 Annual Agricultural Outlook Conference that consumer groups may be motivated to exaggerate because "advocacy groups have an incentive to create concern and fear. Without concern, people do not contribute to these groups or in other words, buy their product" (Cook, p.329).

Regarding the media, there is the popular notion that the media is run like a business, so that what gets printed or aired are stories which will sell, and what sells is often an exaggeration of the truth. There are also other influences which result in media bias and misinformation. First, there are cases where the media sources themselves are victims of misinformation--misinformation they then pass on to the public. Secondly, sometimes what gets reported depends more on chance than on facts. As one reporter states in an article in American Fruit Grower, "A lot of the time whose story gets told comes down to who returned a phone call while the story was being written" (Stockwin, p.34). There are a number of examples of inaccurate media reporting. In an article in Supermarket News, an example is cited of a California TV newscast which reported that 60% of the produce sold in the U.S. in 1987 was above pesticide tolerance levels. "'The actual figure [was] more like 1-1.5%, but the reporter's numbers went unchallenged'" (Zwiebach, p.28).

Often, these cases of misinformation regarding food safety and pesticide residues portray agriculture negatively. An extreme example of the negative effects of media and consumer group misinformation is the Alar scare. Alar is the trade name for the plant growth regulator daminozide. Scientists are still arguing over the potentially harmful effects of human consumption of daminozide in the quantities present in residues on apples and apple products. But the Natural Resources Defense Council report on CBS 60 Minutes in February, 1989, and subsequent articles detailing the dangers of apples and apple products left little doubt in the minds of the public as to the effects of Alar consumption. The resulting public outcry led to the cessation of Alar production and a loss by the apple industry of millions of dollars (Buxton, p.18).

Fortunately for the agricultural sector, media control of consumer concerns does not seem to be the complete explanation for the origin of consumer perceptions. Hypothesis three, the explanation that consumer concerns are dependent upon the acceptability of risk involved, seems to be another factor in the formation of

consumer perceptions. One need only to look around to know that people do not treat all risks equally, but what makes a risk acceptable or unacceptable? In one risk study, researchers found that, "risks perceived to be least acceptable tended to be borne involuntarily, perceived as uncontrollable, and seen to have delayed effects" (Weinstein and Quinn, p.663).

In his article "Consumer Demand for Safer Foods," David Smallwood gives a possible explanation as to why food safety issues may present involuntary and uncontrollable consumer risks. Smallwood points out, "many safety attributes remain unknown even after purchase and consumption." (Smallwood, p.9) Food safety is not a visual, quantifiable characteristic. Chemical residues are no exception; they are invisible and the instruments needed to detect them are intricate and expensive. In addition, the negative effects of chemicals are usually seen as delayed, often arising later in life in forms such as cancer. Perhaps sometime in the future every household will be equipped with a residue detector, but for the meantime consumers must rely on government testing, an unpopular alternative for many.

Efforts to Maintain Agriculture's Positive Image

Once the determinants of consumer perceptions are known, the agricultural industry can profit from this information by identifying and addressing those concerns which can be assuaged by the agricultural sector, either through information to correct misperceptions or through changes in agricultural production to eliminate sources of accurate concerns.

Information about agricultural issues from sources other than the media has been found to be effective in shaping consumer perceptions. In one study which tested consumer perceptions regarding irradiation of foods, consumer attitudes towards irradiation were overwhelmingly more positive after the presentation of additional information which included an explanation of the process (Terry and Taber, p.79). Another study of the effect of a safety scare on consumer demand found that positive product advertising may be an "effective tool to offset in part a change in demand elasticity [the ratio of the percentage change in the quantity of a good demanded to the percentage change in the price of the good] resulting from a pesticide residue incident" (Brown, p.678). In such cases, it is extremely important publicly to correct media misstatements.

Furthermore, there is evidence that consumers are lacking information which, if known, would benefit the agricultural industry and which would enable consumers to make more informed judgements regarding chemicals and food. For instance, a 1983 Kansas State University study found that many people were confused about the benefits of pesticide use. Common respondent misperceptions included beliefs that pesticides served no purpose and that pesticide use increased food prices. One author, discussing the study, concludes, "more research and better communication of the results are needed to ease the [food safety] controversy" (van Ravenswaay, 1989, p.19).

In addition to efforts to increase information exchange, there are changes in agricultural production to reduce chemical use being explored and adopted in an effort to lessen consumer food safety concerns. The most well-known of these efforts is probably Integrated Pest Management, a program which combines natural means of pest control with reduced chemical applications to maintain profits while simultaneously reducing the amount of chemicals used in production. Another development in this area is the use of disease-resistant crops. These crops are bred to be resistant to many diseases. Thus, they eliminate the need for preventive chemical applications for these diseases.

THE DEVELOPMENT OF DISEASE-RESISTANT APPLE CULTIVARS

The Apple Industry's Chemical Concerns

One agricultural industry which is taking steps to preserve and, partially, to restore its positive public image is the apple industry. The apple industry is particularly concerned about chemical use in production. This is true for four primary reasons.

The most widespread concern of the apple industry is to avoid a repeat of the Alar scare. The Alar scare proved that their pure and natural image make apples susceptible to extremely negative public reaction when they are linked in the media with a potentially dangerous chemical. In February 1989, four years after the controversy over Alar began, the Natural Resources Defense Council appeared on CBS's 60 Minutes and reported findings they had of cancer risks to children from Alar and other pesticides in food. Other reports followed, public concern escalated, and in June 1989, Uniroyal, the maker of Alar, decided to voluntarily halt sales of Alar (van Ravenswaay and Hoehn, 1990 pp.3-4).

By this time, however, the apple industry had already suffered a tremendous blow. Following the initial news reports, shipping-point apple prices dropped from 9 to 20% and remained depressed for many weeks following. The loss for just the Washington state Red Delicious apple industry totalled more than $23 million for the first 9 weeks alone (Buxton, p.18). Total losses for the apple industry have been estimated at over $100 million.

Apple growers were also hit hard by the loss of Alar as an important production chemical. Alar was used as a growth regulator and allowed for a more extensive and orderly harvest. Until the apple industry had a chance to adapt, the loss of Alar was difficult, particularly because while consumers demanded Alar-free apples, they would not accept apples of less than top quality (Iannacci, pp.54-55).

In fact, consumer fears and avoidance of apples did not subside until many months after the withdrawal of Alar from the market. Gary L. Miguel, a farmer who lost his orchard due to the Alar scare, states in the May 1991 issue of American Fruit Grower, "Though it has been two years since the CBS 60 Minutes program, the shock still prevails" (Acuff, p.36). Indeed, the suit filed by 11 Washington apple growers against the NRDC and CBS will probably not be resolved for months, and maybe years. It is obvious why the apple industry would be particularly concerned about chemical use in an effort to avoid a similar situation.

A second reason for the apple industry's concern about reducing chemical use stems from recent governmental actions concerning the registration of agricultural chemicals, and recent changes in chemical regulation. Fungicide use in apple production is extremely important, especially in the Northeast. One

recent publication points out that, "[f]uture fungicide options may be jeopardized. . .due to the development of fungicide resistance and to economic and environmental factors that may lead to the loss of some fungicides that are now considered essential" (USDA N.E. LISA Project, p.1).

One example of this process is the current situation regarding the ethylene bisdithiocarbamate (EBDC) group of fungicides. Anticipating a ban of the fungicides' use on apples by the Environmental Protection Agency (EPA), the major registrants of all EBDC fungicides dropped apples from the 1990 label (Cooley, Wood and Schneider, p.41). Growers have been faced with difficulties as a result of the drop, as they find themselves with limited or no fungicide substitutes, or substitutes that are scheduled for EPA review and may also be removed from use (Chitwood, p.9).

Another example of the movement to ban certain agricultural chemicals was the Big Green, a "multi-faceted environmental initiative" that was on the 1990 California voting ballot and which would have greatly restricted chemical options for growers. The Big Green initiative was defeated by a margin of 64%. However, this does not reflect an overwhelming state-wide support for agriculture; CAREFUL, a counterinitiative backed by agriculture, failed by a higher margin, 70%. Agriculture industry officials expect that Big Green issues will be reintroduced as smaller measures in the future. As one agricultural attorney stated, "Food safety as a political issue is not going to go away" (Moore, p.9).

In addition to federal and state government bans, a June 21, 1991 Supreme Court ruling makes it legal for towns and localities to set their own rules for pesticide use. This ruling has the potential to lead to increased confusion, as farmers attempt to comply with federal, state, and local pesticide regulations, and to unfair advantages for those farmers living in less regulated areas. In addition, as a grower association officer points out, local governments "may just react out of emotion over a particular chemical" (Waterfield, p.1a). Growers must be on the lookout for possible regulatory problems concerning chemicals used in their operations. Reductions in the number and quantities of chemicals used in production would lower a farmer's chance of being hurt or inconvenienced by a government ban of a chemical.

Apple growers have a further reason to reduce chemical use if possible. Chemicals cost money, approximately 10-12% of establishment and production costs of a midsize apple orchard (USDA N.E. LISA Project, p.5). Logically, if growers could avoid these costs without incurring greater costs, they would.

The fourth and final motivation for chemical reduction applies to all agricultural producers. While scientists have yet to identify the precise effects of human intake of chemicals, it seems probable that large doses of concentrated chemicals can have negative effects on humans. And since growers are the ones who handle the chemicals in their most concentrated form and are exposed to them most frequently, any negative effects of agricultural chemicals would affect farmers first and most extensively.

The Apple Industry's Response to Consumer Concerns

These four reasons have motivated the apple industry to address the issues of chemical use and consumer perceptions. Apple industry efforts include both increased information and changes in production. When the 60 Minutes report was aired, the International Apple Institute reacted immediately, demanding equal time on the program to tell the apple industry's side of the story. In addition, the industry launched a national advertising campaign with the theme "Why An Apple A Day Is Still A Good Idea". This campaign featured the health benefits of apples, a theme which is still being stressed in apple promotion.

On the production front, the apple industry has reacted with new growing practices and research projects. Growers adapted to the loss of Alar with the help of closer management of their harvest and storage (Moses, Sept. 1987, p.18). In addition, research in the area of disease-resistant apple cultivars (DRCs) was expanded. The U.S.D.A. Northeast Low-Input-Sustainable-Agriculture (LISA) Apple Production Project is analyzing a number of different DRCs. These cultivars are all "field immune" to apple scab and have varying degrees of resistance to powdery mildew, cedar apple rust, and fire blight, but are not resistant to insect damage (USDA N.E. LISA Project, p.9). Disease-resistant cultivars reduce grower costs of production by approximately 2.5% by eliminating fungicide costs (Rosenberger).

Two particularly promising cultivars are Freedom and Liberty. Freedom is resistant to mildew and fire blight, but is susceptible to cedar apple rust. It is "precocious", has reliable red fruit, and has scored well in taste tests. Liberty is resistant to mildew, fire blight, and cedar apple rust. It also is "precocious", very productive, and may require thinning. It maintains high quality in CA (controlled atmosphere) storage and also has scored well in taste tests (USDA N.E. LISA Project, p.13).

While the future of these disease-resistant cultivars looks bright when one reads their descriptions, their success is not guaranteed due to the fact that up until now almost all of the research involving the DRCs has been production oriented, with little or no attention being devoted to marketing. This may seem logical--you need to have a product in order to market it--but there is not much logic in producing a product when research has not been done on whether it will sell, who will buy it, and how it will be sold (through what channels). While the economic research so far has discussed breakeven points, breakeven analysis only tells growers how many apples they must sell to make a profit. Growers need advice on how to sell the apples. The 1988 Yearbook of Agriculture lists five questions which a farmer should answer before committing dollars and time to a new venture. The number one question is, "Is there a market for this new enterprise?" (USDA, 1988 p.80). Producers can attempt to answer this question by eliciting information from a number of sources. For example, producers may ask wholesalers, marketers, and extension agents about potential retail markets for the new product. Another possible source of information about potential markets for new products are market research studies. Although developed markets do not exist for a new products, market

research studies can help producers identify product characteristics important to consumers in new markets. Disease-resistant apple cultivars will not help solve the apple industry's chemical problems until they are widely grown and marketed. In order for this to happen, growers must have access to information which shows viable markets for the new varieties, either from recommendations from apple marketers or from relevant market research.

EVALUATING THE FUTURE SUCCESS OF DRCs

The first step in marketing a new product, ascertaining if it will sell, is done by reading market research which has been conducted on the new product or, if none exists, performing the necessary market research. A large portion of existing market research of new products measures consumer willingness-to-pay (WTP) for product attributes.

Willingness-to-pay Studies

The most accurate measure of consumer willingness-to-pay for a product would be observable and direct; it would entail consumers' actual purchases of the product being tested. Unfortunately, for new products, these conditions are rarely attainable, due to the fact that new products are usually not produced in large quantities when the research is performed. Therefore, it is necessary to employ a different measure of WTP.

The two most widely used measurements of consumer willingness-to-pay are contingent valuation (CV) and revealed preference (RP).

Contingent Valuation

The contingent valuation method is hypothetical and direct. Consumer WTP is discovered by directly asking consumers hypothetical questions about how much they would be willing to pay for a new product or for specific product attributes. A contingent valuation survey usually consists of three parts:

(1) A detailed description of the good(s) being valued and the hypothetical circumstance under which it is made available to the respondent.
(2) Questions which elicit the respondents' willingness to pay for the good(s) being valued.
(3) Questions about respondents' characteristics (for example, age, income), their preferences relevant to the good(s) being valued, and their use of the good(s) (Mitchell and Carson, p.3).

The last step allows the researcher to examine respondent characteristics and preferences in order to see if any of them serve as accurate predictors of consumer willingness-to-pay.

Contingent valuation studies of new products usually take one of two forms

which differ only by step (2), the type of questions used to elicit consumer WTP. The first elicitation method, iterative bidding, is modeled on an auction. The interviewer in the survey starts off by suggesting an initial bid for the good being valued. Depending on whether the respondent refuses or accepts the bid, the interviewer adjusts the bid, down or up. This process continues until an amount is found that is the most the respondent is willing to pay for the good.

In the second form, dichotomous choice or the take-it-or-leave-it method, respondents are asked to accept or reject a single dollar offer for the item being valued. Respondents answer yes or no; they do not state dollar values (Boyle and Bishop, pp.20-21).

Revealed Preference

The second major measurement of consumer willingness-to-pay is revealed preference. Revealed preference is observable and indirect; it involves indirectly calculating consumer WTP from analysis of actual consumer market behavior. Revealed preference is based on an hedonic market approach, "which views market commodities as bundles of attributes (taste, texture, color, and pesticide content, for example)." By observing consumer purchasing patterns, this approach allows the researcher to calculate the implicit price paid for each product attribute (Hammitt, p.vi).

Many revealed preference studies have focused on measuring such things as: wage rate premiums for dangerous occupations as a way of calculating implicit values of life; differences in home values in neighborhoods with high and low air pollution as a way of finding implicit value of avoiding air pollution; and the time and effort expended to use a particular resource (e.g. a state park) as a measure of its value (Hammitt, p.2).

In the realm of agricultural products, studies have been done using revealed preference to measure consumer willingness-to-pay to avoid chemical residues on their food by examining the price differences between organic and conventional produce (Landfeld and Seskin, p.557).

Biases In Willingness-to-pay Studies

Contingent valuation and revealed preference studies can be valuable predictors of consumer willingness-to-pay. Their value, however, is dependent upon both the researcher and the reader being aware of the shortfalls and the biases inherent in the studies and both parties being critical in interpreting the results.

Biases in Contingent Valuation Surveys

Mitchell and Carson, in their book, Using Surveys to Value Public Goods: The Contingent Valuation Method, identify four principal sources of bias in contingent valuation surveys.

The first source of bias is the use of a scenario that contains incentives for respondents to misrepresent their willingness-to-pay amounts. This category includes both strategic bias and compliance bias.

Strategic bias occurs when respondents deliberately shape their answers in an attempt to influence the outcome of the survey. "If, on the one hand, respondents believe that they will be assessed amounts equal to their WTP, they may deliberately understate their WTP. . .If, on the other hand, respondents do not believe that they will be assessed according to their WTP, they may overstate their WTP in an attempt to promote the provision of a public good." For example, if a respondent is a strong opponent of using chemicals in food production, he may exaggerate the actual amount he would be willing to pay for a reduced-chemical apple. The hypothetical nature of contingent valuation studies makes strategic responses possible (i.e. if respondents lie, they do not have to follow through and their answers are not tested). Strategic bias can be "exacerbated by wording that emphasize[s] the importance of the respondents' answers to policymakers" (Mitchell and Carson, p.238).

Compliance bias occurs when respondents shape their answers in an effort to please or gain status in the eyes of either the survey's sponsor or the interviewer. It is more prevalent when a respondent does not have a strong interest in the survey topic. Without strong opinions about the subject, respondents may more easily be tempted to give answers that they believe will please the interviewer. For example, a respondent who, in reality, has no preference between regular and reduced-chemical apples, but who believes the interviewer strongly supports reducing chemicals in apple production may express a preference for the reduced-chemical apple in an effort to please the interviewer. Compliance bias can be minimized by using a neutral sponsor and experienced interviewers (Mitchell and Carson, p.238).

The second set of sources of bias in contingent valuation studies is implied value cues. These biases result "when elements of the contingent market are treated by respondents as providing information about the 'correct' value for the good" (Mitchell and Carson, p.236). Some examples of implied value cue biases are starting point, range, and importance bias.

Starting point and range bias can occur in the iterative bidding form of willingness-to-pay elicitation. In iterative bidding, the starting bid and the limited bid range chosen by the interviewer can influence the respondents' final WTP amount. A respondent with little knowledge of his own valuation of the good in question may interpret the starting bid as an approximation of its value. In addition, the range used in the bidding process (e.g. $1 intervals from a low of $0.00 to a high of $25.00) may lead to bias if the respondent's actual WTP does not lie within the range (e.g. $27.00, $6.50, or even -$3.00). Range bias can be

minimized by choosing as extensive a range as is feasible. Unfortunately, no one has found a way to remove starting point bias from the iterative bidding procedure, so the only way to avoid it is to use a different elicitation method, i.e. dichotomous choice.

Importance bias is due to survey features which emphasize the importance of the good being valued. It is also due, in part, to the experience of taking part in a contingent valuation survey. The topic of the survey can take on added importance simply because it is the topic of a survey. For instance, a survey eliciting consumer willingness-to-pay for reduced-chemical apples would emphasize to the consumer the importance of chemical use in apple production just from its subject. In order to minimize importance bias, "the scenario must be so designed that respondents who are not willing to pay anything for the amenity feel comfortable in giving that response" (Mitchell and Carson, p.245).

The third group of sources of bias in CV surveys is scenario misspecification. This occurs when the respondent incorrectly perceives some aspect(s) of the contingent market and the good to be valued. The misperception can result from either inaccuracies in the interviewer's descriptions in step (1) of the CV survey process, or from misinterpretation by the respondent of the true facts. Mitchell and Carson state that, "Biases caused by respondent misperceptions are among the most important and most problematic sources of error in CV surveys" (Mitchell and Carson, p.247). This condition is exacerbated when the interviewer must describe to the respondent a product or scenario with which they are not familiar. Scenario misspecification bias might occur in a willingness-to-pay survey for reduced-chemical apples if the respondents do not understand the term "reduced-chemical" or if they are unaware of other characteristics of the apples which might be affected by their reduced-chemical nature, such as appearance or shelf-life. Clear, accurate descriptions of both the good and the circumstances, especially aspects that may be unfamiliar to a respondent, would help minimize scenario misspecification biases.

The fourth set of biases Mitchell and Carson identify involve biases arising from errors in the survey. Three common survey errors are sampling errors, nonresponse bias, and selection bias. Sampling errors arise when the sample of people surveyed does not match the population it is meant to represent. This can happen in two ways. First, if the system used to choose the sample from the population does not work, a nonrandom sample will be chosen. Secondly, if the population used in the survey does not match the actual population, again, a nonrandom sample will result. This second scenario can result if, as is true of many surveys, the survey sample is chosen from the phone book. In this case, the survey population does not represent the full population because it excludes people without phones and those with unlisted numbers (Edwards and Anderson, p.169).

Nonresponse bias is another common source of survey error. It occurs when the survey data are not adjusted to allow for differences between respondents and nonrespondents. This step is important because "nonrespondents often differ significantly from respondents on age, educational level, socioeconomic status and, of particular concern to environmental economists, interest and

participation in the subject of the survey" (Edwards and Anderson, p.169). Extensive follow-ups to ensure significantly high survey response levels would help minimize nonresponse bias.

Selection bias occurs when certain groups are censored from inclusion in the survey data. This bias can result from researchers censoring "outliers", results which fall beyond the range of expected values, or from nonrespondents censoring themselves (Edwards and Anderson, p.170).

Furthermore, problems can result in analysis of survey data. For example, readers of CV surveys using dichotomous choice should be aware that the analysis of yes/no answers "requires more sophisticated statistical procedures" than does analysis of numerical answers (Boyle and Bishop, p.21).

The final bias to be discussed, hypothetical bias, is possibly the most common criticism of contingent valuation estimates of willingness-to-pay. Critics assert that the necessarily hypothetical nature of CV surveys reduces incentives for accurate responses, and they point to cases of CV responses which did not match actual respondent behavior. Contingent valuation proponents have responded to these criticisms.

The controversy hinges on the relationship between attitudes and behavior. The suggested causal chain is as follows: attitudes imply intended behaviors which imply actual behavior. Critics of CV claim that the studies only measure attitudes, and therefore are of little relevance in predicting actual behavior. Proponents of CV reject the relevance of the attitude-behavior issue, asserting that CV surveys are composed of well-framed questions which measure intended behavior, not attitudes (Cummings, Brookshire, and Schulze, p.65). For instance, a contingent valuation survey of reduced-chemical apples would be a better measure of probable consumer behavior if it asked respondents how much they would pay for a reduced-chemical apple if they saw it at their grocery store, and not how they valued reduced-chemical fruit. The former question would be more likely to measure intended behavior, while the latter would only measure consumer attitudes.

The next relevant question is--How can the interviewer ensure that the questions used in the survey are well-framed and will elicit the respondents' intended behaviors? Fishbein and Ajzen, in their work on contingent valuation, identify three factors that enhance the ability of survey questions to predict behaviors: correspondence, proximity, and familiarity (Mitchell and Carson, p.182).

The principal theme of correspondence is specificity. The more specific the survey is concerning the good being valued, the hypothetical buying situation and procedure, and details such as time of purchase, the more likely that the survey will elicit accurate measures of future behavior. The second factor, proximity, emphasizes the importance of measuring consumer WTP as far along the causal chain as possible--i.e. it stresses the increased accuracy from measuring intended behavior as compared to measuring attitudes. Familiarity, the third requirement, is less likely to be met in surveys measuring consumer

WTP for a new product. The general rule in this case is: the more familiar the behavior, the more likely the respondent's behavioral intention will predict that behavior. Thus, using CV results as a predictor of consumer purchases of a new product will most likely not be perfectly accurate, due to hypothetical bias from lack of familiarity. It would be difficult to design questions to eliminate possible hypothetical bias from consumer estimations of willingness-to-pay for reduced chemical apples unless the consumer was familiar with them. The factors of correspondence and proximity, however, can be applied to make the WTP estimates more accurate; questions in the survey could precisely describe the reduced-chemical apple and the process of purchase, etc. In addition, the survey results would be most useful if they were applied to the short-term decision as to whether to market the apples and if the survey asked specific questions regarding intended consumer behaviors. These factors would help to satisfy the requirement of proximity.

While it is important to look for evidence of hypothetical bias in CV surveys, it is also important to keep in mind that not all discrepancies between CV responses and actual behaviors are the result of this bias. Hypothetical bias is not an issue "*unless* the information underlying the proposed behavior *is identical* to the information leading to the actual behavior" (Brookshire and Crocker, p.239).

Contingent valuation consumer willingness-to-pay studies can be an important part of market research for a new product such as the disease-resistant apple cultivars. A positive consumer WTP response can convince a farmer to grow, just as a negative WTP response can convince the farmer not to grow, a new product. Close examination of the accuracy of contingent valuation studies is important.

Here is a partial checklist of possible errors and biases, based on the previous discussion, which can be helpful in evaluating contingent valuation willingness-to-pay estimates:

(1) INCENTIVES TO MISREPRESENT WTP

Strategic bias:	Is the study worded in a way that emphasizes the importance of respondents' answers to policymakers or others they might wish to influence?
Compliance bias:	Does the study have a neutral sponsor? Was the interviewer experienced in discouraging this bias?

(2) IMPLIED VALUE CUES

Starting point bias:	Does the study use iterative bidding to elicit consumer WTP? If so, be aware that starting point bias will necessarily exist.
Range bias:	Was the range of accepted values extensive enough? Were the intervals between bids in iterative bidding sufficiently narrow?
Importance bias:	Did the survey unnecessarily emphasize the importance of the subject or the survey? Were there respondents who felt comfortable registering willingness-to-pay amounts of zero?

(3) SCENARIO MISSPECIFICATION

Interviewer inaccuracy:
Were the interviewer's descriptions of the good and the circumstances accurate?

Respondent misperception:
Were the interviewer's descriptions clear, especially those regarding subjects unfamiliar to the respondent? Is there any evidence that respondents misunderstood any aspect of the survey?

(4) SURVEY ERRORS

Sampling errors: Was a random system used to choose the samples? Was the survey population equal to the actual population?

Nonresponse bias: What was the response level for the survey? Did the characteristics of the nonrespondents differ from the characteristics of the respondents and, if so, was this adjusted for in the survey results?

Selection bias: What was the researchers' treatment of outliers? Were they disregarded or adjusted for?

(5) DATA ANALYSIS

Dichotomous choice:
If this method of WTP elicitation is used, the reader should be aware of the increased difficulty in interpreting the results of the study.

(6) HYPOTHETICAL BIAS

Attitude-behavior relationship:
Do survey questions seem to measure intended behavior or consumer attitudes? Are the questions specific? How many aspects of the survey are unfamiliar to the respondents?

(7) EXTRAPOLATION OF SURVEY RESULTS

Time frame: Are the survey results recent enough to be applicable?

Conditions: Was the study performed in a representative area? Are the hypothetical purchasing conditions in the study similar to actual purchasing conditions? Is the good described in the survey sufficiently similar to the good being considered?

Biases in Revealed Preference Studies

It is also important to be aware of the sources of bias in the other major method used to measure consumer WTP, revealed preference. An apple grower, for example, may read a revealed preference study which measures consumer willingness-to-pay for fewer chemicals in their food from the price differential between conventional and organic produce. The grower may then use the WTP amount from the survey in her decision as to whether or not to grow the new

apple DRCs which use reduced amounts of chemicals. In order to use this information wisely, the farmer must be aware of possible problems in the survey.

For example, in one such study measuring WTP for fewer chemicals, researchers were unable to control for quality differences other than chemical use, such as color, consistency, taste, and freshness. Thus, price differentials based on chemical use cannot be separated from price differentials based on other product characteristics (Hammitt, p.19). It is possible that consumers were willing to pay more for organic produce because it looked or smelled better, and not because it was grown without chemicals. Thus, an apple grower who uses the results of this particular study to gauge consumers' WTP for reduced chemical foods could be using faulty information.

Also important to note are issues dealing with extrapolation of survey data. Those issues listed above for contingent valuation surveys, such as time and circumstance similarity, apply equally to revealed preference surveys.

If, after critical evaluation, market research studies seem to indicate a market for the new product, it is the responsibility of the grower to create as marketable a product as possible. This can be done by examining the components of consumer willingness-to-pay, and by satisfying those product aspects most important to consumers.

There are three sets of factors which determine willingness-to-pay: factors of the shopping environment; factors within the consumer; and factors/characteristics of the product. The first set of factors, factors of the shopping environment, are almost completely out of the hands of agricultural producers. These factors are mostly concerns at the retail supermarket level, such as check-out line length and adequacy of parking.

Factors within the consumer, the second set of factors, can be important to the producer in terms of his relationship with managers on the retail level. Consumer factors include demographic, attitudinal, and exposure measures (Zellner and Degner, p.7).

Demographic measures include the proportion of consumers in each variable group, e.g. household income, household size, age, educational level, sex, and household age distribution, that purchase the farmer's product. Consumer attitudes about such topics as food safety and chemical residues are usually important to retail produce managers considering the addition of a chemical-reduced product. Finally, high exposure levels to the problems of food safety/chemical residues can influence consumers' willingness-to-pay. These three consumer factors can be gathered from studies on WTP, once the accuracy of the studies has been established.

Although the grower cannot maximize these factors in the sense of changing the consumer so that she will like the product better, if the grower deals directly with retailers, the grower can pass on knowledge regarding consumer factors related to her particular product. Such information can be helpful on the retail level for target marketing to certain consumer groups. Such marketing ultimately benefits growers in the form of higher demand for their product.

The first two sets of factors are not easily, if at all, influenced by farmers. A farmer, however, does have a limited amount of control over the third set of factors, characteristics of the product. The farmer can try to enhance profits by satisfying those product characteristics important to consumers.

Product Quality

Above all, consumers want quality products. One definition of quality is, "the composite of those characteristics that differentiate individual units of a product,

and have significance in determining the degree of acceptability by the buyer" (Shewfelt, p.99). Obviously, the characteristics that are deemed important will vary with different regions and with different products.

A consumer's decision to buy a product hinges on the acceptability of the product in reference to the consumer's standard of quality for that item. A consumer's quality standard for an item is comprised of external and internal quality characteristics and of perceptions of less tangible quality characteristics. External quality characteristics are those that can be seen or felt, such as color, size, and firmness. These characteristics, combined with previous experiences which enable the consumer to recall internal quality characteristics such as taste and texture, determine consumer decisions to purchase a product. Also involved in the purchasing decision are consumer perceptions of less tangible factors such as product safety, nutritional value, and wholesomeness (Shewfelt, p.99).

All three quality categories vary depending on the product. Microwave pizza, for example, has very different quality characteristics than cake mix or breakfast cereal. Regarding the new disease-resistant apple cultivars, it is helpful, in attempting to maximize their possible market success, to examine apple quality characteristics that are important to consumers and to try to maximize as many of these characteristics as possible in the DRCs.

Much research has been done on quality characteristics of produce. The results of studies concerning apple quality characteristics stress the importance of a number of different attributes. Watada *et al.* published an often-cited chart plotting the data from 10 apple quality attributes, half taste and flavor attributes and half textural attributes. The desirable attributes included: fruitiness, acidity, sweetness, juiciness, crispness, and firmness (Watada and Abbot, pp. 64-65). All of these attributes, with the exception of firmness, depend upon previous experience. The importance of previous experience and the importance of appearance were emphasized by a 1983 study which surveyed consumers on their attitudes towards selected fruits. The study found that 52% of households bought apples on the basis of texture and appearance, 20% bought apples on the basis of size, and 28% listed various attributes such as color, variety, and juiciness (Schoorl and Holt, p.87). This emphasis on external quality characteristics was reinforced by a study measuring how color of Red Delicious apples affects their sales. This study found that retail sales of highly colored apples were significantly greater than sales of partly red apples (Smith and Frye, p.iv).

An apple grower has an extensive list of important product characteristics to maximize: size, color, firmness, lack of blemishes, taste (fruitiness, acidity, sweetness), texture (juiciness, crispness). Add to this list characteristics demanded by marketing channels (discussed in a later section) such as long shelflife and a well-known variety name, and intangible characteristics such as food safety and nutrition, and it is clear that even under the best of circumstances, maximizing all these characteristics would be a difficult task.

Tradeoffs Between Product Quality Characteristics

Even given optimum circumstances, however, once consumer desires have been identified, it is not a simple process of maximizing the desired product characteristics; tradeoffs are involved:

> The consumer seeks more fresh or fresh-like product of good visual quality that is full-flavored, nutritious, convenient to prepare and serve, pesticide-free, and available year round at a reasonable price. At the current state of the art, some of these goals are mutually exclusive, and the marketplace will decide which goals will predominate (Shewfelt, p.105).

There are a number of examples of how tradeoffs apply to apples. For instance, emphasis on year-round availability of apples has resulted in more apples going into storage after harvest. While consumers are now able to have apples in June, studies have shown that the taste and texture of these apples are less acceptable than apples purchased at harvest time (Watada and Abbot).

Another important tradeoff in apple production involves appearance and safety. Chemicals can assist the farmer in producing large, blemish-free, highly colored apples. But if chemicals are used in excess, they can threaten the safety of the grower, the grower's neighbors, and ultimately, the consumers of the apples. Some critics claim that this tradeoff is influenced too much by unreasonable cosmetic standards for produce which result in excessive use of dangerous chemicals (Supermarket News Sept. 26, 1988). Higher profits for more attractive fruit may cause some producers to cross the line between safe and dangerous chemical use.

Since growers cannot maximize all quality characteristics important to consumers, it is important that they identify consumer tradeoff patterns regarding quality characteristics for their product. They can then either maximize those characteristics which appear to be most important to consumers, or they can somehow attempt to change consumer tradeoff patterns.

One possible method of changing consumer valuation of particular quality characteristics is through labelling. The Institute of Food Technologists' expert panel on food safety and nutrition suggests that,

> Brand labeling of fresh produce. . .may provide the necessary vehicle for changing consumer orientation from an emphasis on appearance to less pesticide use, particularly if the label can serve as a guarantor of consistently high consumption quality (Shewfelt, p.105).

This conclusion is reinforced by a study on consumer preferences for commercial and organic produce. This study found that information identifying a product as organically grown, as compared to the same product without the

information, resulted in higher acceptability ratings for some produce items (Schutz and Lorenz, p.70). In order for produce branding to be successful, however, branded produce must have consistently high quality, service advertising, promotional support, and a strong image (Geoghegan).

After identifying, and possibly altering, consumer preferences, the farmer uses this information to maximize the acceptability of her product. Once the grower has chosen which quality characteristics to maximize, she can use objective measurements to ensure that sensory quality characteristics are being maximized. For apple quality, objective measurements of flesh firmness, titratable acidity, soluble solids, and starch content have been found to be highly correlated with consumer acceptability based on flavor, texture, and overall quality (Wills, Bambridge, and Scott, p.252). Thus, the apple grower must be aware of pre- and post-harvest influences on objective quality measurements (Watada and Abbot) so that quality may be maintained at a high level.

MARKETING THE DISEASE-RESISTANT APPLE CULTIVARS

Marketing Agricultural Products

Once the product is ready, the farmer's next step is marketing. Marketing has been defined by the American Marketing Association as "the performance of business activities that direct the flow of goods and services from producer to consumers or final user" (Cramer and Jensen, p.316). When applied to agriculture, marketing is the performance of activities that deliver agricultural goods from farmers to consumers in the desired forms and at the desired times. Thus, marketing involves such activities as transportation, processing, and storage.

Out of every dollar consumers spend on food products at the retail level, 25¢ is returned to producers and 75¢ goes for marketing costs. This amount, the difference between what consumers pay for the final product and what the producers receive for the raw product, represents the marketing margin (Cramer and Jensen, p.326). The marketing margin is divided among the performers of marketing activities, the middlemen. Its size depends upon the number and costs of marketing functions they perform (Kohls and Uhl, p.213).

The marketing chain is made up of the sequence of marketing functions. Marketing functions add value to raw commodities. They do this by producing time, place, and form utility (Cramer and Jensen, p.316). Marketing allows consumers to receive food products when they want them (e.g. September apples in January), where they want them (California avocados in New York), and how they want them (potatoes as frozen french fries).

There are three major marketing functions: assembly, processing, and distribution. Assembly primarily involves transportation from producers (farms) to consumers; it adds place utility. Processing transforms raw agricultural commodities into finished food products; it adds form utility. The third function, distribution, is carried out on the wholesale and retail level and includes both transportation and storage of food products; it adds place and time utility (USDA, 1982, pp.137-140).

Marketing functions are performed at different parts of the marketing chain. The pathways that agricultural products follow through the marketing system are called marketing channels. Agricultural products follow many different marketing channels. A producer may sell his product to an assembler, to a wholesaler, to a retailer, or even directly to consumers. The marketing channel chosen by the farmer depends upon the number of marketing functions the farmer performs. The more marketing functions the farmer performs, the higher the farmer's costs and the higher the percentage of the marketing margin that is returned to the farmer.

Regardless of the number of marketing functions he performs, in order to attain maximum profits, it is advisable for every farmer to develop a marketing plan. A

marketing plan should begin with the farmer's goals and objectives. The next step is to assess the marketing opportunities. This involves making an assessment of the market in an effort to understand the influences on supply and demand for the particular product to be produced. In addition, assessment involves examining a farmer's own financial situation and evaluating possible marketing alternatives (USDA, 1988, pp.33-34). The information gained from an assessment can allow a farmer to plan strategies to attain his goals.

Marketing Fresh Produce

Fresh produce marketing involves special functions due to the perishable and bulky nature of fruits and vegetables. Functions such as rapid transportation and specialized storage are very important in fresh produce marketing. Often, the perishable nature of produce prompts the shortening of marketing channels in an effort to get the product to the consumer in its freshest form. Thus, fresh produce is sometimes sold directly to retail stores (Rural Enterprise, Winter 1987, pp.30-31). It is also commonly sold through roadside stands and other outlets where farmers sell directly to consumers.

Marketing Apples

A United States Department of Agriculture marketing bulletin begins with the question, "Are you marketing your apples or just putting them on the market?" (Morrison, p.3). The question of marketing is particularly important for the apple industry. Max Brunk, a retired marketing specialist, points out the apple industry's lack of emphasis on marketing, stating: "Our industry has long had a tendency to overemphasize volume of production relative to other factors" (Derr, p.6). This emphasis on production volume has resulted in recent annual national apple crops which have averaged around 240 million bushels and which continue to grow. As more apples are produced, marketing increases in importance.

There are a number of functions that apple marketers perform. Apples are stored, washed, graded, waxed, packaged, transported, priced, and promoted. These functions can be performed at many different levels of the marketing chain. Growers, packers, assemblers, wholesalers, retailers, and even consumers perform some or all of these functions depending upon which marketing channel is employed. Again, the more marketing functions a grower performs, the higher her costs and the higher her returns.

In an article in the American Fruit Grower, Derl I. Derr, the president of the International Apple Institute, offered his keys to success for the apple industry: "active promotion; high quality standards; and offering new products (new varieties or modifications of existing varieties and packages. . .)" (Derr, p.7).

In the United States, active apple promotion is performed by the International

Apple Institute and by various regional and state promotional organizations. These organizations promote apples through efforts such as National Apple Month (Alemian, Sept. 1988), press releases, media apple tours, and television and radio advertisements (Alemian, Sept.1987, p.12). State promotional organizations are often funded by state marketing orders.

The second key to success, high quality standards, is achieved by growing high quality apples and by maintaining strict quality control throughout the apple marketing chain. It is in the best interest of growers, once they have grown quality apples, to ensure that other links in the marketing chain, e.g. shippers and retail produce clerks, treat their products with care and maintain their quality.

New apple products, Derr's third key to success, have been developed in both areas he mentions, new packages and new varieties. New packaging experiments include new bulk packaging, such as the twelve-pack (Moses, Sept.1988), and single-apple packages for outlets such as convenience stores. New varieties of apples have been introduced from other countries, such as the Fuji variety from Japan, and new varieties have been developed, such as the disease-resistant apple cultivars, Freedom and Liberty.

Derl Derr's stress on new varieties is especially important in the Northeast. The Farm Credit Bank of Springfield's report on the Northeast apple industry states: "The Northeast has several apple varieties with unique taste and other attributes that enjoy strong reputations in the market and are not widely produced elsewhere" (Putnam, p.13). Climate is a major force in determining which apples are produced in which areas. For example, some apples which have heat or sunburn disorders in Washington or California are grown without such problems in the Northeast (Merwin). Furthermore, while Washington State is the dominant state in U.S. apple production, new varieties may give the Northeast an advantage. A Washington State extension agent stated:

> I do not encourage growers to deviate too much from Red and Golden Delicious plantings because the conditions in Washington are best suited for those apples. In addition, the Washington State industry (and Extension Service) has built up a body of knowledge about these varieties, and we are therefore best suited to manage only these varieties (Anderson, p.57).

Thus, certain new varieties allow the Northeast to compete with Washington without competing head-to-head by producing varieties for which Washington has a comparative advantage in growing conditions and knowledge.

The apple industry's interest in growing new varieties is coupled by their previously discussed interests in reducing chemical use. Given these two issues, the apple industry would do well to encourage apple growers, especially Northeast growers, to grow new apple varieties, particularly disease-resistant apple cultivars such as Liberty and Freedom. However, this encouragement should be accompanied by information concerning the

differences and difficulties of marketing a new apple variety, and specifically one with reduced chemicals.

Marketing A New Apple Variety

The establishment of a new variety in retail and consumer circles is a long process, taking at least 5 to 10 years (Guerling). The experience of the Empire apple variety is worth noting in this respect. The Empire apple was introduced to market in 1966, and it is only recently, more than twenty years later, that it has become widely accepted (Bisset, p.6).

New varieties are developed in experimental laboratories where horticulturalists and plant pathologists alter the genetic composition of existing apples in an attempt to produce improved apple cultivars. One possible improvement is the resistance to apple scab found in the cultivars Liberty and Freedom. At the labs, every new apple variety is given an identification number. If the apple is promising, the breeder may decide to release or introduce the apple. In the United States, apple varieties are introduced and publicized in journals of horticultural science (Aldwinckle).

Prior to introduction, however, a new variety must be named. New apple varieties are named by their breeders, or inventors. Often, the breeder will consult with scientific colleagues and members of the apple industry when deciding upon a name. At some labs, committees are organized to help with the naming process (Aldwinckle).

In New York, names of new apple varieties are often associated with the state. For example, Cortland and Liberty are both towns in New York, and the Empire apple alludes to New York as the Empire State. In addition, apple names can refer to specific variety attributes. The names of the two disease-resistant cultivars previously mentioned, Liberty and Freedom, were chosen to connote, among other things, a freedom from disease (Aldwinckle). After a new variety is named and introduced, the new apple stock is made available to producers.

If an apple grower decides to grow a DRC, after the apples are harvested the grower cannot sell them as he would if they were an established apple variety. This is mostly due to retail store requirements. American supermarkets carry an average of three to six major fresh apple varieties (Putnam, p.47), and competition for the limited shelf space is stiff. Supermarkets want varieties that have high-volume movement, and they often associate an established variety name with brisk sales (Rosenberger). This relationship leaves little room for the introduction of a new variety at the retail level.

A second reason new varieties are not widely sold in retail stores is insufficient supplies. Supermarket chain stores require enough fruit for at least a six week long introduction of a different apple variety (Guerling). At approximately 1,000 pieces/week, this requirement is difficult to meet with a fledgling variety.

One way some apple industry participants avoid these marketing barriers is by selling new varieties under the names of similar established varieties. A number of industry participants have indicated that this has often been the case with Empire apples which have been substituted for McIntosh apples. Despite the widespread use of this tactic, both federal and state laws prohibit substituting one apple variety for another.

Federal law states:

> Barrels packed with apples shall be deemed misbranded. . . [i]f. . .the barrel bears any statement, design, or device indicating that the apples contained therein are "Standard" grade and the barrel fails to bear also *a statement of the name of the variety*, the name of the locality where grown, and the name of the packer or the person by whose authority the apples were packed and the barrel marked (21 U.S.C.A. § 22). [Italics added.]

State law is more specific. New York State law states:

> Each closed package of apples, when sold, exposed for sale or transported for sale, shall be plainly and conspicuously branded to show:
> (1) Variety.
> (2) Grade.
> (3) Minimum diameter or numerical count.
> (4) Quantity of contents.
> (5) Name and address of packer or repacker.

It goes on to say:

> It the true name of the variety is not known to the packer or repacker, the statement shall include the words "variety unknown" in place of the name of the variety (New York Agriculture and Markets Law § 158, amended 1956).

Finally, under a section on sale of apples, the law states:

> No person shall sell, expose for sale, or transport for sale, apples, either in open or closed packages, if the package containing them or the label on them shall bear any statement, design or device regarding the apples which shall be false or misleading in any particular (New York Agriculture and Markets Law § 159, amended 1976).

In light of these laws, some industry analysts have suggested that using parts of the names of popular apple varieties in the naming of new varieties could be the key to faster penetration of retail markets. One extension agent proposes naming one of the DRCs with similar properties to a McIntosh, "MacSF", with SF

standing for scab free (Rosenberger). One plant pathologist, however, commented that the SF would likely be dropped and the apples would by sold as McIntosh apples (Aldwinckle). Should the McIntosh name be applied to this brand without qualification, legal problems would again arise. Further research into this area should be undertaken, especially concerning issues of legality and the economic consequences of naming a new cultivar after an established cultivar.

One development which may present a solution to these problems is currently being explored at Cornell University's Agricultural Experiment Station in Geneva, New York. Apple researchers are searching for a way to develop varieties with new characteristics through the alteration of one gene. Of great interest right now is the development of disease-resistant cultivars in this manner. The idea of changing only one gene is important because if breeders take an established variety and change only one gene they are permitted to name the resulting variety after its parent. Thus, a single gene-alteration of the Empire apple might be called Royal Empire. Someone working on this project indicated that this development is only a matter of time (Aldwinckle). Once this is achieved, it is possible that growers will be able to market new varieties to retail stores immediately.

For now, however, a grower of a new apple variety must use marketing channels other than traditional retail sales until the variety's name has been established and enough of the variety is being grown for it to be introduced in retail stores. Growers should first market the DRCs through roadside stands to build awareness of the new variety before trying to market to chain stores (Rosenberger). Other outlets such as "farm markets, ethnic stores, truckers, and other specialty food retailers will be a more fertile market for new apple varieties" (Putnam, p.47).

These alternate marketing channels offer better opportunities for the introduction of a new variety because the requirements for marketing are not as strict; variety names are less important and required volumes are often smaller. In addition, these channels allow increased contact between the consumer and the marketer, especially if, as in direct marketing, the farmer is the marketer. The marketer can use this increased communication as an opportunity to educate the consumer about the unique aspects of a new variety. Such increased consumer knowledge can lead to higher levels of sales for a new variety through these channels.

After the new variety has been marketed for a while through alternate channels, a small group of consumers will become aware of the variety's name and attributes. At this point it is possible to initiate procedures for introducing the variety on the retail level. This process is most successful when it is researched and organized by the state and local apple promotional organizations. These organizations target regions for the introduction of the new variety and then they develop promotional materials and an advertising strategy.

New varieties have traditionally been introduced through target marketing. For instance, when the Empire variety was introduced, New York apple promotional

organizations targeted one chain of retail stores in one area for the introduction (Guerling). Once retail stores in a single area have successfully adopted the new variety, the variety may be introduced in other areas. Again, the availability of sufficiently large supplies of apples is very important when a new variety is being introduced.

Another extremely important factor is promotion. Promotional organizations must aggressively convince chain stores to sell the new variety. In order to market the new variety through chain stores, promotional organizations: develop point-of-purchase promotional materials encouraging consumers to buy the new varieties, and they offer chain stores promotional money to do their own advertising and promotion (Guerling).

In addition, apple promotional organizations conduct extensive advertising campaigns featuring the new variety. In a 1989 telephone interview of sixteen grocery retail buyers of apples, the retailers "were nearly unanimous in their attitude that consumers are not sufficiently aware of new apple varieties. Three specifically mentioned Empire apples as an example" (Anderson, p.51). If, more than twenty years after its introduction, Empire is still not a well-known variety, it is clear that increased advertising of non-traditional varieties is necessary. Advertising should create consumer awareness of varietal attributes and uses (Anderson, p.52).

One question arises when the new variety being promoted is a disease-resistant cultivar: Should the reduced-chemical nature of the apples be mentioned in promotion and advertising? The answer may seem to be an obvious "yes" because it would be a selling point. However, it could have detrimental effects on sales of other apple varieties which would be hurt by consumer comparisons (Rosenberger). Further research should be done in this area to ascertain whether this observation is accurate. One aspect which merits further research is discovering a way to present the reduced-chemical apples as possessing something valuable rather than as missing something harmful. This might help minimize consumer fears regarding the chemical content of other apple varieties.

Traditional Apple Marketing Channels And Their Requirements

Once the DRCs have been introduced and marketed on the retail level, growers will have more market channels open to them. Marketing opportunities vary by geographic region, but they generally involve the same channels. In most areas, apple growers can sell their apples to wholesalers, retailers, or consumers. Each of these channels involves the performance of certain marketing functions and each has its own requirements from the grower.

Marketing to Wholesalers

Apple growers normally must first have their apples packed. If a grower is a packer also, the grower may sell directly to wholesalers. Retail chain stores often buy all their produce from the regional or national market. In order for growers to break into this market they must sell their apples through a wholesale produce dealer. Produce dealers are divided into two general classes: selling dealers and buying dealers. Selling dealers, such as grower's agents, selling brokers, and commission merchants, help growers sell their produce. Buying dealers, such as buying brokers and shippers, purchase produce from the grower and resell it to retailers (VanSickle, p.8). Reputable, licensed dealers can be found through the State Department of Agriculture-Division of Marketing, trade magazines, and trade journals (VanSickle, p.10).

Growers wishing to sell through wholesale produce handlers must satisfy certain requirements. In a four-state survey of produce handlers, the factors rated most important were consistent quality, dependable supply over some necessary period of time, and an adequate volume. In addition, high U.S. quality grades were cited as important (Brooker et. al., p.13). In an interview, one apple marketer listed quality, condition, color, pack, and weight as the primary selling points of the apples he markets (Mandy). The viability to a particular grower of the wholesale market will depend on the grower's capabilities and the wholesaler's exact requirements.

Marketing to Retail Stores

Another possible marketing channel for some growers is direct marketing to retail stores. As stated above, most retail chain stores buy their produce regionally or nationally. However, some chain stores use field buyers to purchase local produce which will stay fresh longer on retail shelves. Supermarket field buyers are primarily concerned with obtaining high quality produce and receiving the shipments when promised. Other possible grower requirements include improved washing, cleaning, grading, and packaging equipment for the performance of those marketing functions (Rural Enterprise, Winter 1987, pp.30-31).

In order to attract a supermarket field buyer initially, a grower must have the necessary volume. If the grower cannot produce the necessary volume, a few local growers can pool their produce, and form a marketing cooperative which would be able to supply retail volume requirements (Rural Enterprise, Winter 1987, pp.30-31).

If selling to a retail chain store is not a possibility, growers may wish to try to sell to a local retail store. A grower's ability to market through a local retail store is often dependent upon his ability to persuade the store owner. The owner of a local chain store "is interested in obtaining a dependable, stable supply of good quality produce" (VanSickle, p.5). The advantage of this channel (and of selling to a supermarket field buyer) is that more of the marketing margin goes to the

grower. However, a local retail store may not require a large enough volume to exhaust a grower's total supply (VanSickle, p.5).

Direct Marketing to Consumers

The marketing channel which allows the grower to receive the highest proportion of the marketing margin is direct marketing to consumers. Growers can sell to consumers through farmers' markets, roadside stands, and pick-your-own (PYO) operations. One author states that,

> These avenues work better for small growers, for the portion of a crop that cannot be sold to wholesalers, for growers who have time to devote to marketing activities, for specialty items and for other similar situations (Hinson, p.111).

Studies have shown that consumers react favorably to direct marketing. One reason for this may be that in direct marketing, while the farmer takes over many marketing functions usually performed by middlemen, so do consumers. For example, a farmer may sort, clean, grade, and store, but a consumer often provides transportation. This results in higher margins for the grower, but also lower prices for consumers (Nyankori and Courter, p.72). Each direct marketing method has different requirements, advantages, and disadvantages for the farmer.

Farmers' markets are central locations in urban areas where many different farmers sell their goods. Requirements for selling at farmers' markets include crop diversity and--as with all direct marketing methods--an interest in meeting and talking with consumers. There are many advantages in selling produce at farmers' markets, such as cash sales, an additional outlet for crops, and an increased ability to educate consumers about crops (Vaupel, p.30). In addition, the farmer does not have to worry about personal advertising to draw people to travel to the farm stand. Disadvantages include the cost of renting a stand at the market, which varies, and the cost of transporting the produce from the farm to the market, which the farmer must pay (VanSickle, p.7).

A roadside stand is a retail business which is located in a producing area, such as on a farm. A good location, close to a large urban population center with a high percentage of year-round residents, is one of the most important requirements of a roadside stand (VanSickle, pp.6-7). Other requirements include a diversity of produce and goodwill towards customers. Avoidance of middleman costs and the shift of transportation costs to consumers are two advantages of a roadside stand. The farmer faces disadvantages in the form of possible liability suits (Ernst) and the need for the farmer to promote and advertise in order to draw people to the stand.

A pick-your-own operation is a farm where many marketing functions, including harvest, packing, and transportation, are performed by the consumer in return

for reduced-cost produce. Similar to other direct marketing methods, PYO requires a good location, as described above, and a desire to have close contact with consumers. The advantages of PYO are obvious: the costs of many of the marketing functions are transferred to the consumers, often with a disproportionately low reduction in grower returns, leaving farmers with healthy profits (Fosgate, p.29). Along with the transference of marketing functions, there are also a number of additional costs. Farmers may need to provide additional capital investment and management to prevent damage to their fields and to provide for fee collection. In addition, farmers must provide "insurance, advertising, traffic control, pricing, and supervision of pickers" (VanSickle, p.6).

Alternative Apple Marketing Channels And Their Requirements

In addition to traditional marketing channels, alternative marketing channels for apples and other agricultural products have expanded in recent years and now represent important market outlets.

The Food Service Industry

The largest of these outlets is the food service industry, often abbreviated HRI for hotels, restaurants, and institutions (Rhodes, p.423). One half of every consumer food dollar is spent on food service (Scharlau, p.13). It has been estimated that the food service industry purchases nearly one-quarter of all fresh produce in the United States. The growth in food service produce purchases is a result of the food service industry's response to consumer interest in fresh, healthful foods (McLaughlin, p.127-8). Marketing to the food service industry can be advantageous to growers because of the stability of food service as compared to retail. "Food service can help stabilize and create a permanent selling base for [a grower]. . ." (Scharlau, p.13). A grower can market to the food service industry through a distributor or, in some cases, directly. The hotel and restaurant sector and the institutional sector require different marketing approaches from the farmer.

The hotel and restaurant segment is a major market for fresh produce. There are more than 700,000 restaurants in the U.S. with sales exceeding $158 billion in food and nonalcoholic beverages (Yager, p.13). Fast food restaurants are now ranked as the strongest competitor to the supermarket industry for consumers' food dollars (McLaughlin, p.131). Restaurants are primarily serviced by distributors, but there are opportunities for direct marketing to restaurants. The key person to contact to initiate a direct marketing arrangement with a restaurant is the chef. In approaching the chef, growers should explain what they have to offer, how their product is better or different (e.g. explaining that disease-resistant apple cultivars are grown with less chemicals); also, growers should bring samples. Chefs are concerned with price, taste, quality, consistency, dependability, and year-round supply. They also "look for organic produce grown without pesticides, or specialty produce

not available in wholesale markets" (Gibson, p.5). One thing for an interested grower to keep in mind is that the volume needed by a restaurant will most likely be small, so the grower may have to service several restaurants (Yager, p.14).

Another possible marketing channel for fresh produce is the institutional sector. Institutions include colleges, hospitals, schools, correctional facilities, business and industry feeders, and the military. One Georgia study of opportunities for marketing fresh produce to the institutional sector surveyed four different institutions (state correctional institutions, county correctional institutions, school systems, and military installations) about their produce sources and marketing requirements (McHugh and Epperson). All four groups of institutions listed independent wholesalers as their most frequent source of fresh produce, comprising 100% of state correctional institution produce purchases. Local growers were listed as a frequent source of fresh produce for county correctional institutions and school systems (23.08 and 30.77% frequency, respectively). The largest barrier to direct marketing to institutions was the prevalence of contract bidding in state correctional institutions and military installations. Thus, growers wishing to penetrate these markets must market through an independent wholesaler.

When asked to identify factors which influence their decisions to purchase fresh produce from their current supply sources, institutional buying agents listed convenience, availability of suppliers, good service, variety, quality, volume, dependability, and packaging (McHugh and Epperson, pp.13-14). Growers should be aware that this study was conducted in Georgia and reported in 1984; study results may or may not be relevant today or applicable to other areas of the country.

One important institutional market for fresh produce is the school market. School market trends have included increased purchasing of fresh produce and concentrated efforts towards educating school children about produce. "And those newly educated students. . .will be the consumers of tomorrow" (Winands, p.95). In addition, the newly educated students will bring their new knowledge home and possibly alter their household's fresh produce consumption patterns.

One way that school children are educated about fresh produce is through promotion programs featuring specific fruits and vegetables. For example, one school promoted apples during National Apple Month. The entire effort was publicized to the media, and the students, teachers, parents, and the community were all aware of the promotion. The school received free promotional materials from the International Apple Institute (Foster, p.67). Such promotions can increase awareness and sales of produce items.

Other Alternative Marketing Channels

Other alternative marketing channels which successfully have been used by fresh produce growers are direct mail marketing, marketing through certified pesticide-residue free produce companies, and marketing to specialty stores.

Direct marketing of produce by mail can be an extremely profitable enterprise. Many such companies market their own and other growers' produce to upscale and "gourmet-conscious" consumers (Arthur, p.34). Mail marketers must offer a selection of varieties and qualities not found in supermarkets. Extras such as hand picking and selection of produce, a money-back satisfaction guarantee, and an attractive catalog are elements which will attract more consumers.

Marketing through certified pesticide-residue free (CPRF) produce companies is controversial in produce circles. Supermarkets who use CPRF companies, such as Nutriclean, defend their use, saying that consumers want less chemical residues and that government testing is inadequate. Opponents attack the programs, saying that they promote unfounded consumer fears about food safety. If a grower decides to market through one of these companies she may use pesticides in growing her produce, but the produce must have no detectable residues after harvest. While growers may receive higher prices for the residue-free produce, they must pay the company for the cost of testing (McMinn, p.30).

In addition, produce growers whose produce differs in some way from traditional supermarket produce (e.g. unusual apple varieties) may choose to market through a specialty store. These stores are looking for good quality and selection, and many like to buy produce from local farmers. For example, Phil Cosentino, owner of Cosentino's market in San Jose, believes that the small farmer "has pride in the quality of his crop, a hands-on attitude that makes his produce better than that grown on corporate farms" (Dyer, p.72). Specialty stores would be a natural market for the disease-resistant apple cultivars, particularly before they are established.

SUMMARY

More and more, in cases such as groundwater pollution and food safety scares, agriculture is being identified as the problem. This trend holds serious implications for agriculture. Policy changes created in reaction to these concerns could create strict regulations of agricultural practices, making production more difficult and more complex.

Agriculture is correct in taking a pro-active stance on such issues through the dissemination of important information and through the adoption of safer growing practices and reduced chemical products. These efforts can be an important factor in the preservation of agriculture's good name and image.

In this paper, issues involved in the development, adoption, and marketing of new, reduced chemical agricultural products were discussed, with particular attention being paid to the new disease-resistant apple cultivars. Issues which lead to interest in and development of reduced chemical agricultural products and specifically the development of the DRCs were identified. Issues involved in the adoption of a new chemical reduced variety by a producer were evaluated. Finally, issues concerning marketing a reduced chemical product and marketing options available to growers of such products at the product's introduction and after its establishment were explored.

Much important research and hard work goes into the scientific development of new, safer agricultural products. Without the proper follow-up steps of market research and identification of market barriers and opportunities, however, the future of a new product is uncertain and its contribution to the preservation of agriculture's positive image is necessarily limited.

Safer agricultural products may help maintain public support for agriculture, but only if agriculture takes a holistic approach to their development. New products must be researched and developed from their start in orchards or plant laboratories all the way to their place in consumers' homes and diets. The "greening" of agriculture will occur only when biological researchers, marketing experts, cooperative extension agents, and producers work together to assure success of "environmentally-friendly" agricultural products.

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