Staff Paper

Using Ecolabeling to Encourage Adoption of Innovative Environmental Technologies in Agriculture

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Abstract or Summary
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Abstract

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This paper examines the potential of ecolabeling to create economic incentives for adoption of environmental technologies in agriculture. Ecolabeling programs are described and the necessary economic conditions for them to generate incentives are derived. The extent to which these conditions might be met in agriculture is investigated using data on producer costs and consumer demand for environmentally friendly products. Since there is little empirical work on this subject, a key question is whether it would be worthwhile to undertake more definitive research on the prospects of ecolabeling. The main conclusion is that the conditions for generating adoption incentives are probably met for some crops, but not others, so more definitive research would be beneficial.

Using Ecolabeling to Encourage Adoption of Innovative Environmental Technologies in Agriculture

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Incentives that encourage adoption of innovative environmental technologies can be created by either reducing a firm's costs or increasing its revenues from adoption. Costs of new technology adoption can be reduced by subsidizing inputs, providing technical assistance, and providing research on and development of new technologies. Revenues can be increased by creating or facilitating markets for the firm's output, promoting its output, subsidizing output consumption, and government purchase of the output.

Deciding which combination of approaches is best requires knowledge of how effective they are in encouraging adoption per dollar spent. For example, if technical assistance were to be provided, we would want to know how much more adoption of innovative environmental technologies would likely occur and how much it would cost to provide the technical assistance.

Historically, technical assistance has been the most commonly used policy alternative for encouraging the adoption of new agricultural technologies. However, the effectiveness of this approach has mainly been due to the fact that most new agricultural technologies have reduced production costs. Unfortunately, many agro-environmental technologies increase costs either by reducing yields or increasing input costs. Consequently, technical assistance is unlikely to be an effective strategy for increasing adoption of environmental technologies in agriculture unless accompanied by other cost-reducing or revenue-increasing policy alternatives.

This paper examines the potential of ecolabeling as a means for enhancing revenues from the adoption of environmental technologies in agriculture. First we explain what ecolabeling programs generally involve and legal constraints on such programs in the U.S. Next we analyze the necessary conditions for an ecolabeling program to generate revenues sufficient to encourage technology adoption. We then look at empirical information for assessing the extent to which these conditions might be met in agriculture. We do this by looking at some new ecolabeling programs in agriculture and their potential costs and benefits to producers. Since there is little empirical work on this subject, the paper identifies a number of areas where research is needed.

1. Ecolabeling Programs

More than 20 countries and the European Community have adopted public ecolabeling programs to encourage the development of manufacturing processes and products with less environmental impact (U.S. EPA 1993a, 1993b, 1993c, 1994). In the U.S., there are several private nonprofit ecolabeling programs (e.g., Green Seal and Scientific Certification Systems) and voluntary environmental labeling programs supported by the government (e.g., EPA Energy Star Program). These programs have been facilitated by the development of environmental marketing rules at the state, federal, and international levels (Grodsky, Kuhre 1995, 1997, Lamprecht, van Ravenswaay 1996).

An ecolabel identifies environmentally preferable products based on an environmental impact assessment of a product compared to other products in the same category. An important feature of this impact assessment is that it is not limited to the environmental impacts from use and/or disposal of the product. It also includes impacts from production of the product. The impact assessment is done by a third-party, either public or private.

Ecolabeling is only one form of environmental labeling seen in markets today. Two other common forms are government-mandated labels and self-declarations (Kuhre 1997). Examples of government mandated environmental labels are the fuel efficiency ratings required on new automobiles, the energy use guides required on household appliances, and environmental hazard warnings required on pesticides and products containing CFCs or toxic substances. Examples of self-declarations are manufacturer claims about recyclability, recycled content, solid waste reduction, biodegradability, and nonuse of certain chemicals (e.g., no phosphates).

Two key features differentiate ecolabeling from these other forms of environmental labeling. Unlike government-mandated labels, ecolabels are voluntary. Unlike self-declarations, ecolabels involve standard setting and enforcement by a third-party.

Ecolabels are much like a seal of approval. They are awarded by a public or private nonprofit organization that establishes environmental standards for product categories and certifies that products meet those standards. Thus, an ecolabel is like a seal of approval because it is a signal of high standards as well as a signal that products meet standards.

An ecolabeling organization performs three key tasks: standard setting, certification, and marketing. Standard setting determines the environmental standards a product must meet to qualify for the ecolabel. Certification determines whether a given product meets those standards. Marketing develops customer awareness of and trust in the claim.

For example, Green Seal is a private ecolabeling program operating in the U.S. Green Seal develops environmental standards for product categories (e.g., paper, fluorescent lamps, household cleaners, paint) that pertain to the product's characteristics (e.g., energy efficiency) and how it is to be made (e.g., the type of de-inking and bleaching process that may be used for recycling paper).[1] The task of certifying whether a product meets those standards is contracted out to Underwriters Laboratories. If a product is certified to meet its standards, Green Seal licenses its mark to the product manufacturer, subject to various contractual terms such as periodic monitoring (US. EPA 1993b, pp.72-76). Green Seal also identifies potential customers for products with the seal.

Ecolabeling programs vary substantially in terms of the comprehensiveness of their environmental standards.[2] Some ecolabels concern themselves with a single environmental impact within a single stage of the lifecycle of a product. For example, the Flipper seal of approval on tuna is concerned only with the impact of tuna fishing on dolphins, and the EPA Energy Star program focuses only on energy conservation in the use of computer equipment. In contrast, ecolabeling programs like Green Seal and those of many European countries consider multiple environmental impacts throughout the stages of the lifecycle of a product.

Ecolabeling standards based on reducing environmental impacts throughout the full life cycle of a product use a method known as life cycle assessment (LCA). LCA is defined as involving four sets of tasks (U.S. EPA 1993c). The first task is to define what constitutes the life cycle of a product. This includes extraction of raw materials, manufacturing, distribution, product use, and disposal. The second step involves an inventory of environmentally significant inputs (e.g., energy, water) and outputs (e.g., emissions to air and water, solid waste) throughout the various life cycle stages. The third step is to assess the impacts of environmental inputs and outputs on ecosystems, human health, and natural resource stocks. Of all these steps, this is the most controversial because there is still great scientific

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[1]Further information on Green Seal is available at their web site (http://www.greenseal.org).

[2]A detailed description of ecolabeling programs is contained in a series of four reports commissioned by the U.S. EPA (1993a,b,c and 1994).

uncertainty about the fate and effects of various pollutants. The final step is to evaluate options for reducing environmental impacts throughout the product's life cycle.

In most ecolabeling programs, private or public, the standard setting process is very lengthy and usually involves some variation of the following steps. First a product category is identified by the ecolabeling organization, typically through proposals from industry or environmental groups. The next step is to develop a description of some or all the stages of a product's life cycle and the kinds of environmental impacts associated with each stage. In practice, it is impossible to examine all impacts, so most programs try to identify those impacts which differ the most across different companies' products. Standards are then proposed for reducing these environmental impacts. These standards are made available for public review and comment. The standards are revised to reflect public comment and then finalized. A scientific review panel and an appeals process may also be part of the standard setting process. Finally, periodic review may be included to ensure that standards reflect technological progress.

To see the implications for agriculture, suppose that a major food processor wanted to obtain a Green Seal for its product. Green Seal would look at all the stages of the life-cycle of the product, not just at the production practices of the food processor. To qualify, the food processor would need to ensure that the raw agricultural commodities it uses were produced in an environmentally friendly manner. This would include an assessment of the energy used to produce, pack, and ship the commodities, as well as the impact of agronomic practices on water quality, soil quality, biodiversity, and the like.

Ecolabeling may become important in competing in foreign as well as domestic markets. The International Standards Organization (ISO) has proposed and will soon adopt international standards for environmental labeling known as ISO 14020,14021, 14022 and 14023. These labeling standards are part of the broader set of standards on environmental management systems and environmental audits known as ISO 14000 (Kuhre 1995, 1997, Lamprecht). The Global Ecolabeling Network (GEN), a voluntary organization of national and multinational "Ecolabel Licensing Organizations," is trying to establish an ecological criteria databank which could be used by members in setting standards.[3] The United Nations Task Force on Environmental Labeling is facilitating discussion of principles of equivalency in ecolabeling environmental criteria and potential international trade issues such as mutual recognition of ecolabeling schemes.

Would an organically produced commodity qualify in an ecolabel program? The answer is probably yes, once the national organic standards required by the 1990 Organic Foods Production Act (OFPA) are promulgated.

The OFPA authorizes the U.S. Department of Agriculture (USDA) to develop specific organic production and handling standards and permit use of a USDA seal on products that have been certified by a federally accredited certifier to meet those standards. Although the Act does not specifically use the term, it implicitly requires lifecycle analysis of environmental impacts because it states that organic standards be based on consideration of environmental impacts during manufacture, use, and disposal of inputs.[4] The Act also requires that human health impacts be considered. Technical advisory panels consisting of experts in agronomy, entomology, health sciences and other relevant disciplines are required to provide scientific evaluation of the materials used in production. To be certified organic, a grower or handler must submit an Organic Farm Plan or an Organic Handling Plan which details all growing or

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[3]Further information about GEN and its ecolabeling members can be obtained at the GEN web site (http://www.interchg.ubc.ca/ecolabel/gen.html).

[4]The text of the Organic Food Production Act is available online at the following web site: (http://freenet.macatawa.org/org/ogm/Chap94/6518.htm).

handling methods and materials.[5] A certification agency assesses whether these methods and materials comply with the national organic standards and annually inspects site operations and farm records.

Does the creation of a national organic standard preclude the development of another form of ecolabeling in agriculture? While there is little evidence to go on, the experience in the Netherlands suggests that there may be a market for another agricultural ecolabel so long as the price is lower. In the Netherlands, there is both an organic label (EKO) and an ecolabel (Milieukeur) on agricultural products (Matteson et al.). The Milieukeur label is a national ecolabeling program for nonfood products which was extended to foodstuffs in 1995. It is described to consumers as intermediate between conventional and organic production in terms of environmental impact.

If alternatives to the organic label are developed, they will have to comply with Federal Trade Commission (FTC) anti-deception rules on environmental marketing claims (U.S. Federal Trade Commission, 1992). These rules specify that firms must maintain credible scientific evidence for proving the truth of an environmental claim about a product. These rules help protect consumers from deceptive claims, but also raise the costs of making a claim. In addition, the FTC rules favor use of specific rather than general marketing claims. For example, the recycled content in products is a specific claim, whereas the use of sustainable farming methods in growing produce is a general claim. Thus, the use of general claims such as “integrated pest management” or “sustainable farming” may require statutory authority such as that provided for organic claims.

2. Necessary Conditions for Creating Adoption Incentives

In this section we describe the necessary economic conditions for ecolabeling to create adequate incentives for firms to adopt innovative environmental technologies. To simplify the discussion, we

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[5] A description of the organic certification process is available in the web site (http://www.cfarm.com/nosb/guide/4Certification.html)

initially assume that there is only one type of ecolabel and that it only affects environmental impacts, but not the safety or nutritional characteristics of food.

In standard economic theory, uncompensated environmental damage is usually treated as a negative production or consumption externality. In other words, the environmental damage is assumed to be borne by a party external to the product market who is unable to seek compensation from the market's participants. Consequently, the damage is not accounted for by consumers or producers in the product market and not reflected in the equilibrium price and quantity.

The premise behind ecolabels is that some of the uncompensated disutility from the environmental damage associated with production or consumption of the product is experienced by the market's consumers. We will call this uncompensated disutility an "internality."

For example, suppose production or consumption of a product results in wastes that harm the environment. If the consumer believes that she suffers from this environmental harm and will not be compensated, she will experience an internality in the form of disutility from consumption. Thus, she faces a tradeoff between the marginal utility she derives from additional consumption and the marginal disutility she derives from additional uncompensated environmental damage.

Why might the internality premise be plausible? There is much greater appreciation today of the interdependency of ecosystems elements. Environmental science shows us that what we once regarded as separate, independent elements of the ecosphere are in fact highly interdependent. Thus, a change in one element may have many indirect effects that are only now coming to be appreciated and, thus, are not accounted for in the current set of property rights governing goods traded in markets. Thus, consumers are learning that money is not the only thing they sacrifice to acquire goods.

Assuming for the moment that all other product qualities remain unchanged and that all production results in some type of uncompensated environmental damage, the consumer's problem can be expressed more formally as:

(1) Maximize $U(X,Q(X,E))$

s.t. $PX=M$

where U is a quasi-concave utility function, X is quantity of goods purchased, Q is environmental quality, E is an exogenous amount of environmental damage, P is the price of X, and M is income.[6] The internality is captured by the effect of X on Q. The effect of Q on utility is strictly positive ($\partial U/\partial Q>0$). The effects of X and E on Q are negative ($\partial Q/\partial X<0$; $\partial Q/\partial E<0$). Thus, the marginal utility of X may be positive or negative depending on the relative magnitude of the direct ($\partial U/\partial X>0$) and indirect ($\partial U/\partial Q\cdot\partial Q/\partial X<0$) effect of X on utility.

This model can be used to capture the effects of internalities caused during either production or consumption. Since we are interested in the potential effect on producer adoption of environmental technologies, we only consider the producer internality here.[7]

Suppose that some producers adopt an innovative environmental technology that does not change any of the performance characteristics of X (i.e., no changes in product safety or quality), but reduces the amount of environmental damage created per unit of output. Assume for the moment that the firm truthfully advertises the relationship between X' and Q compared to that between X and Q, and that the

[6]Since both food and environmental quality are necessary for life, subsistence levels of both may be incorporated by using the Stone-Geary form of the utility function.

[7] Many of the consumer externalities associated with a product involve the use of complements such as waste disposal services, energy use, and water use. This can be incorporated into the specification of the production function for environmental quality, Q. The main result is that the producer will reformulate the product if the difference in marginal costs is less than or equal to the difference in marginal willingness to pay.

consumer is aware of and fully understands it. Because the technology raises marginal costs, X' is sold at a higher price P'. The consumer's problem becomes:

(2) Maximize $U(X,X',Q(X,X',E))$

s.t. $PX + P'X' = M$

If X and Q are additively separable and corner solutions between X and X' arise, the first order conditions for a maximum are:

(3) $\partial U/\partial X + \partial U/\partial Q \cdot \partial Q/\partial X - \lambda P \leq 0$ and if $\partial U/\partial X + \partial U/\partial Q \cdot \partial Q/\partial X - \lambda P < 0$ then $X=0$

$\partial U/\partial X' + \partial U/\partial Q \cdot \partial Q/\partial X' - \lambda P' \leq 0$ and if $\partial U/\partial X' + \partial U/\partial Q \cdot \partial Q/\partial X' - \lambda P' < 0$ then $X'=0$

$M - PX - P'X' = 0$

Since by assumption $\partial U/\partial X = \partial U/\partial X'$, the first order conditions imply that if

(4) $P' - P > \{\partial U/\partial Q(\partial Q/\partial X' - \partial Q/\partial X)\}\lambda$

the consumer will not purchase any X'. Thus, the necessary condition for ecolabeling to create an adoption incentive for firms is that the difference in marginal costs of the new method of production does not exceed the marginal value of the environmental improvement to the consumer of the last unit sold.

This condition is illustrated in Figure 1. The demand for X is represented by curve D, and the demand for X' is represented by D'. The marginal costs of supplying X and X' are represented by MC and MC'. In the Figure, the difference between the marginal costs is less than the difference in demand. Consequently, both consumer and producer surplus is greater with X'. Obviously, however, if not all firms face identical costs and not all consumers value environmental improvement the same, a market with both kinds of products would likely result.

Since consumers are not omniscient and it is costly and difficult for them to observe whether or not a producer has truly improved environmental quality, the model developed so far is too simple. Some account must be given to consumer trust in the ecolabel claim. Since trust determines the consumer's expectation of the relationship between X, X' and Q, the trust variable can be incorporated by weighting the Q production function by a probability function P(Q). Thus, (2) becomes:

(5) Maximize $U(X,X',(Q(X,X',E)P(Q))$

s.t. $PX + P'X' = M$

where the producer's claim is represented by the Q function and the trust in the claim is represented by the probability weighting function P(Q).

Perceived truthfulness will depend in part on producers' reputation for truthfulness as well as on the perceived effectiveness of anti-deception laws in ensuring truthful labeling. In other words, P(Q) is conditional on reputation (R) and perceived effectiveness of anti-deception laws (A) or

(6) $P(Q;R,A)$

There are various actions the producer can take to increase R. For example, they may seek national standards such as those being developed for organic products. They may use a third-party labeler/certifier who is widely known for being accurate and truthful, perhaps because their profits depend on this reputation (e.g., Underwriters Laboratory) or because their revenue comes from protecting the environment or consumers (e.g., Consumers Union). This investment increases marginal costs of production, but also increases the marginal benefits to consumers. So long as the extra costs do not exceed the extra revenue earned, firms and consumers are better off with the labeler.

The model developed so far is too simple in two other respects. The model is based on the assumption of only two "brands" of product, namely, conventional and ecolabeled. In agricultural markets, we must take into account the existence of the organic label as a potential substitute. Also, since production practices affecting environmental quality may also affect the safety and quality attributes of the final product, these factors must be taken into account. Since a number of theoretical models of demand for food safety and quality already exist (van Ravenswaay and Hoehn, 1996), this theoretical issue will not be pursued here.

3. Producer Costs of Agricultural Ecolabels

We now turn to the empirical issue of what the difference in marginal costs would likely be if an agricultural ecolabel other than the organic label were developed.

To evaluate the potential costs, it is necessary to make assumptions about how such programs would be designed. There is a wide range of possibilities depending on: (1) the comprehensiveness of the environmental standards, and (2) the precision with which certification of environmental improvements is determined. A comprehensive standard would consider all potential environmental impacts associated with production of an agricultural commodity including use of energy resources, soil quality, water quality, biodiversity, solid waste, toxic waste, and other agro-ecosystem attributes. The least comprehensive standard would focus on a single category of environmental impact. Precise measurement of environmental improvements would involve extensive sampling of relevant environmental media. A less precise approach would be to draw inferences about environmental impacts using simulation models based on data on site characteristics, production practices, and inputs use. The least precise approach would be to simply record the extent to which certain "best management practices" are used with no attempt made to measure or estimate actual impacts.

Because there are few agricultural ecolabeling programs, there is little empirical information about how ecolabeling costs would vary with comprehensiveness and precision. Consequently, this section describes some of the new agricultural ecolabeling programs that are now being developed and then discusses the major categories of costs.

New Agricultural Ecolabels

Ecolabels used on agricultural products have been or are in the process of being developed by Stemilt's Responsible Choice Program in Washington, the Massachusetts-IPM Partners With Nature program, the Core Values Program for apple farmers in the Northeast, Wegmans Food Stores using standards created by the New York-IPM Program, and California Clean Growers.[8] The stated goals of each program are basically the same: to produce high quality agricultural products in such a way that the environmental impact from farming on the surrounding ecosystem is minimized and economic competitiveness is maintained. Each program is developing or has developed its own set of standards for the products it labels or the goals it has set forth. In each case, these are designed to instruct growers in what they need to do to qualify for that particular label. Each program requires an application and documentation procedure from its participating growers.

Stemilt's Responsible Choice Program

Stemilt Growers, Inc. of Washington State was organized in the 1960's to handle, store, pack, and market premium grade fruit.[9] Currently, Stemilt contracts with over 250 fruit growers in the Northwest. Their fruit stickers and box labels show the name Stemilt Growers, Inc. in a circle with a ladybug symbol and the registered trademark, Responsible Choice®.

The Responsible Choice® program requires all growers to follow European Integrated Fruit Production (IFP) guidelines. Growers may not exceed a point goal for each fruit crop. Points are given for each pesticide used on a particular crop based on eight attributes including pesticide efficacy, leaching

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[8]Much of the information in this section was obtained in discussions with the following individuals: Molly Anderson, Tufts University; Paul Buxman, California Clean Growers; David Granatstein, Washington State University; Larry Gut, Washington State University; Curtis Petzold, Cornell University, Geneva Agricultural Experiment Station; Bill Pool, Wegmans; William Coli, University of Massachusetts, Amherst; Joe Kovach, Cornell University, Geneva Agricultural Experiment Station.

[9]Stemilt's website is (http://bing.televar.com/stemilt/)

potential, pre-harvest interval, soil half-life, and biological disruption. Although not incorporated into the point system, growers are encouraged to reduce use of irrigation water and to use smaller fertilizer applications.

Stemilt provides technical assistance to growers. A nine member staff works one-on-one with growers and there are grower meetings and newsletters. Stemilt also tests new growing techniques.

The Core Values Program for Northeast Apple Growers

The Core Values program was assembled in 1996 under the leadership of northeastern apple growers and the consumer group, Mothers and Others for a Livable Planet. The Core Values program requires growers to follow the Northeastern Stewardship Alliance (NESA) Guidelines. Like Stemilt's, these are based on the European system of Integrated Fruit Production (IFP).

The Guidelines require up-to-date training of farm managers in all aspects of IFP, and their attendance at regular training, updating and review meetings. They also require the minimization of herbicide use by using alleyways or travel lines between tree rows, pruning and training trees, using chemicals based on the lowest ecological disruption, keeping sprayers maintained, and only labeling fruit of high quality.

In additional to following the guidelines, farmers must demonstrate that they are protecting the integrity of the orchard environment, working towards improving their crop quality, keeping an accurate log book of all major farm activities throughout the year and attending regular NESA grower meetings. They must turn in their log books to the Alliance and permit at least one scheduled visit by representatives of the NESA for educational purposes.

As of yet, Core Values has no formal certification process. They are considering basing standards on a point system.

California Clean Growers

California Clean Growers (CCG) supports farmers who abide by the following guidelines: 1) use of ecologically sound practices, 2) strengthening farm soils through programs of natural enrichment, 3) arrangement of farms in ways that encourage wildlife to take up refuge, 4) encouragement of natural biological pest controls, 5) creation of good working conditions for workers, 6) a commitment to deliver produce with superior taste and nutrition, and 7) good communication with consumers (California Clean Growers Marketing Group). Theirs is more of a philosophically based program than the others and this philosophy in part revolves around the lifestyle of small farmers. Therefore, their criteria go well beyond set procedures that a grower must follow.

CCG emphasize farmer participation in creating and maintaining the objectives set forth as well as participation in the organization's development. They have developed general growing practices that cover all crops and help farmers achieve the guidelines. These include growing varieties of produce which have a record of natural disease and pest resistance, using crop rotations, staying as diversified as possible in crops and habitat, continually striving to build and balance soil, using cover crops whenever possible, and only intervening with a farm's natural ecology when necessary. They generally prohibit any material or practice that is known to be hazardous to public health including those that are identified as hazardous by state and federal agencies and other scientific bodies because they cause chronic health effects. Several of the practices set forth are quite general and may make environmental assessment of CCG farmers a more difficult task than for those who follow more clearly defined standards of other programs.

Massachusetts IPM-Partners With Nature

Partners with Nature is a Massachusetts state-level program that recognizes state farmers who practice IPM. Program standards are based on the Massachusetts Integrated Pest Management Guidelines. These guidelines cover several different crops and were developed in conjunction with farmers. During their development, crop specialists were consulted to assist with standard formation, and these were then reviewed by specialists in the field and growers.

For each crop, guidelines are specified for every aspect of production addressed under IPM. A point system exists for each set of guidelines and corresponds to whether or not an included guideline was followed that is specific to that crop. In order to qualify, farmers must attain 70% of the possible points for that crop. Points must be earned in each specified category, and practices must be documented by written records. Examples of production categories for apples include soil and nutrient management and cultural practices, pesticide application and records, insect management, disease management, weed management, vertebrate management, weather and crop monitoring, and education (Hollingsworth et. al). Under such a system, Partners encourages the best known management practices with some flexibility given to the farmer in how they earn the required percentage of total points.

Wegmans's Food Stores

New York IPM guidelines are currently being used in the marketplace at Wegmans Food Stores through the collaboration of several different parties. Wegmans, based in Rochester, NY, recently decided that they wanted to include IPM-grown canned produce on their shelves and label them as such. They have contracted with Comstock Foods in Michigan to grow for them chosen food items using IPM as recommended by extension faculty at Cornell University. Comstock has been given the responsibility of choosing the specific growers to use, collecting appropriate data, enforcing and collecting grower records, and making sure that what is in the can is a product grown using IPM techniques. Comstock growers are required to meet 80% of the points required by the New York IPM Guidelines for each crop.

Wegmans and Comstock have contracted a private consultant in New York state to inspect grower records and determine whether or not the criteria have been met. Thus, the consultant serves the main function of certifying that products are indeed produced using IPM techniques. A licencing agreement was signed between Wegmans and the Cornell Research Foundation to use the Cornell IPM Logo on Wegmans products. The agreement stipulates how the logo should be used on the product, how the Comstock growers should be educated and trained, and what documentation and monitoring processes Comstock should use.

Wegmans has already started selling IPM-labeled sweet corn, and has instituted a consumer education program within the store and over various media channels. This includes brochures, short in-store videos, and employee training. Other products are expected this year including canned peas and snap beans. Interestingly, this is a case where the food store has taken on the extra costs of providing environmentally labeled food.

Costs of Ecolabeling

The relevant producer costs include labeling fees, meeting record keeping requirements, higher input costs, and the risk of reduced yield (Grant et. al., 1990, Agnello et. al., 1994). Additional producer costs that may occur but are not considered here are the transaction costs involved with changing suppliers (e.g. search costs, costs of a new contract) and lost productivity from equipment that can no longer be used under label standards.

Ecolabeling Fees

Agricultural ecolabeling programs are so new that they are either waiving the fees or have set an arbitrary one not necessarily based on actual costs. The fee under the Partners with Nature Program, for example, is $20 for the first crop and $15 for every one after that. Some programs such as California Clean Growers are not charging producers as of yet in order to stimulate participation. Green Seal and other national programs of non-agricultural items and organic certifiers base their fees on a percentage of firm revenue. In California, for example, organic growers pay yearly registration fees between $25 and $2,000 depending on gross sales (Klonsky and Tourte).

Since these fees do not adequately represent what growers are likely to face, we examine labeler costs to get some idea of the fees likely to be charged to growers. The major costs to the labeler include research on and development of environmental standards, grower training programs, collecting and analyzing certification information on each producer for each submitted crop, and marketing and consumer education.

The costs of setting ecolabel standards depend on how comprehensive the environmental performance standards are and how precisely they are measured. The fact that existing programs in the U.S. are based on input or process standards (e.g., best management practices) rather than performance standards (i.e., environmental impact) suggests that the costs of developing performance standards are prohibitive.

Researchers are currently working on measurement tools that might with further refinement be used by labelers to create performance standards. These consist of monitoring systems, simulation models, and indexing systems (Riha et. al). Examples include the EIQ Index being developed at Cornell (Kovach et. al), the nutrient yardstick of the Netherlands, and others identified in Roberts and Swinton (1996). The nutrient yardstick is currently being used in the Agro-Milieukeur ecolabel of the Netherlands [Poppe]. In the case of the EIQ, the environmental impacts of particular pesticides on farm workers, consumers and farm ecology are ranked and weighted into one index.

The environmental impacts of various growing practices that might be measured by these tools and conveyed on an ecolabel include the concentration of nitrates and other chemicals in the soil and groundwater, the amount of beneficial soil organisms on a plot, the toxicity to animals from particular chemicals, the half-life of pesticides used, the amount of plant bio-diversity on a farm, the population of each animal species on a farm, and total usage of water.

A comprehensive standard would take into account as many of the impacts measured by these tools as possible. It would also take into account energy use, concentrations of air pollutants (e.g., carbon dioxide, methane), concentrations of surface water pollutants, amount of solid and toxic waste, and the environmental impacts from shipping products for retail. A less comprehensive standard would only focus on a few of these impacts.

A precise measure of environmental improvement would involve direct sampling of environmental media and ecosystem elements including water, soil, air, wildlife, and plants. A less precise measure would involve using a simulation technique such as a fate model to obtain an estimate of the effect on environmental indicators of different farming systems. The least precise measure would only dictate the practices to be used.

It appears that in some cases, the producer costs involved in complying with the least comprehensive and least precisely measured standards are affordable. A more comprehensive standard might prove to be comparable for some crops if the same techniques can be used to cover multiple impact criteria. This would vary by crop. Since none of the domestic agricultural labels use monitoring or simulation techniques, it is hard to say what the costs of using a more precise measure would be. However, there are several reasons why we should expect these costs to be quite high. These reasons include the complications involved in comparing alternative cropping systems including multiple performance criteria, differing technologies which may have differing time lags of effectiveness, dealing with multiple crops on a farm which are all interrelated, and how much weight to give undesirable side effects of production (Swinton and Roberts, p. 10). In addition, field monitoring and laboratory testing of environmental indicators is probably expensive.

Certifying growers requires managing huge data sets, coordinating tests with laboratories, monitoring applicants' products and practices, continually updating standards and records, and collecting individual producer data on crops, farm parameters, past and current growing practices, and all required grower-kept records. To comply with anti-deception statutes, data must be maintained in a secure manner.

Marketing costs can also prove substantial to both labelers and producers. They involve consumer research and general public education. The Core Values program is currently conducting a pilot study of two different consumer education strategies, differing in the time and effort required of growers and retailers. The first is less intensive and provides consumers at participating stores with brochures, grower profiles, and a large poster advertising the labeled good. Due to what Core feels is the saturation to consumers of such techniques, a second plan involves consumer interaction with actual Core growers through staffed tastings. At these are given out brochures, recipes, and samples. Those working on the research believe that a personal connection is critical to consumer education rather than just brochures so consumers can actually see how they are affecting things through their purchases. This second approach is more involved and more expensive.

Consumer research has also taken place in conjunction with Wegmans food stores. Their marketing costs for installing this program have included training videos for employees on what they are selling and how to promote the product, short in-store videos for consumers, brochures, signs, radio spots, ads, and even TV spots on cable. The brochure describes Wegmans's commitment to safer and more environmentally safe foods, and defines IPM. Bill Pool at Wegmans estimates that it takes about 3-4 years to get the message across to consumers about a new product. This suggests substantial start-up costs in terms of marketing.

Many of the costs of labeling (e.g., standard setting, marketing, data management) are fixed costs, which makes participation by a large number of growers necessary to keep fees down. Thus, the number of growers who participate under a given label will ultimately determine labeling fees.

Record-Keeping Costs

Grower costs of record keeping can be especially substantial even if environmental standards are based on process rather than performance standards. In one study (Grant et. al), average grower time requirements were estimated for adequate record keeping if one were to comply with New York IPM standards. Data administration was estimated at 5 hours per week, data entry at 6 fields per hour for pest activity and recording of pesticide application, 5 fields per hour to create spray summaries, and 2.5 fields per hour to create threshold graphs for pest control. A farm with 20 fields could expect to spend about 11 hours a week on data and record keeping. This is a lot of time and would likely keep many growers from participating or keeping honest records. It was estimated that inspectors from the labeling organization and government could visit about 2 farms per day on average. The salary of an average inspector in NY with an IPM background was $31,200 in 1990 (Grant et. al).

Input Costs and Yield Loss

The costs of alternative practices in terms of inputs and yield loss depend on the nature of the program. To get some idea of the magnitude of these costs, we summarize the results of studies of the costs of several practices that are associated with environmental improvements. Since these costs vary substantially by crop, we first summarize studies of costs of alternative practices for apples. It is followed by a more general discussion of costs for a variety of crops.

Pheromone Mating Disruption Cost Comparisons for Apples

David Granatstein with the Northwest Food Alliance has suggested that pheromone disruption could be the central component upon which to build an ecolabel. Reasons include its substantially lower impact on soil and water contamination than its conventional chemical counterpart, its success rate in Washington and other western states, and the increasing resistance of coddling moths to conventional pesticides.

Test farms under two separate projects in the northwestern states are focusing on this technique and supplemental measures such as compost use in apple orchards and cover crops for beneficial insects. One of these is an area wide USDA-ARS project with test sites in WA, OR, and CA while the second one is a SARE-funded effort. The SARE project is a no-broad spectrum project under the supervision of Larry Gut, a researcher at Washington State. These test farms have been set up in part to compare the actual costs between conventional and alternative farming methods.

Under the USDA-ARS project, growers are receiving a $50 per acre per year subsidy to practice the pheromone technique. It is being determined whether such a subsidy will allow those farmers to compete economically with conventional growers on the production side. So far, it has been found that some farmers have been able to cover their costs with the subsidy and some have not. When this subsidy ends, it may very well be the case that conventional techniques will be again used by most participants. Currently, no price premium is earned by those particular farmers on the market.

The SARE project in Washington state under the direction of Larry Gut is looking at many aspects of pheromone mating disruption and its ability to fight pests in apples as compared with conventional ways of doing so (e.g., using the organophosphate pesticide asymphos method). It was found that a farm using conventional techniques might use an average of two to four applications of pesticides at a cost of around $30-75 per acre plus a $20 cost on average for applying it (Gut and Brunner). With the pheromone treatment, such costs would be $90-120 per acre for materials plus $15-50 per acre for application depending on the level of pest pressure (Gut and Brunner). Additional costs under the pheromone method would also include greater information processing, time, and recording requirements. Overall, the costs of chemical treatments to secondary pests would come out about the same under either method. Clearly, the pheromone treatment costs on average are significantly higher than those with conventional methods (Gut and Brunner). In this study, the pheromone technique averages $55-120 more per acre, plus the additional time and effort involved.

A separate cost study was conducted with pheromone disruption on apples (Williamson et al.) Apple orchards in the Yakima Valley of Washington state were used to test the economic and pest control results of conventional versus pheromone pest control. The years studied were 1990-1992. It was found that there were additional costs with the mating disruption technique including high labor requirements, unpredictable pest control in cooler temperatures, and the high cost of pheromone emitters.

Those orchards which used the mating disruption did not need or only needed one cover spray per year as compared to the 3 to 4 needed by the control orchards and incurred lower insecticide and machinery costs. However, they required higher labor and miscellaneous costs which significantly outweighed that savings. The overall difference in costs between techniques averaged $188.14 higher per acre for pheromone disruption with values ranging from $95.91 to $241.22 for given farms in given years. This cost difference is much higher than that found by Gut and Brunner. In 1991, when pest pressure was low, the pheromone treatment was effective and economically feasible, whereas in 1992, a year of severe pressure, the control of the pheromone method was not good and farmers had less favorable outcomes. It was therefore suggested, that coddling moth be brought down as low as possible with other techniques before applying the pheromone method.

Williamson et. al concluded that to break even with pheromone disruption, apple growers would either have to receive higher apple prices or the price of pheromone emitters would have to decrease by 30-73%. According to Gut and Brunner, if this technique becomes widely used by growers, it is conceivable that such a price decrease could occur from economies of scale. He further commented that cost competitiveness largely depends upon the pest pressure on a particular farm. For farms with low to average pressure, the conventional moth control probably would be cheaper. However, for farms requiring many conventional sprays (more than four) due to worse pests or high resistance, the pheromone treatment might actually cost less if it is determined that it can be used in such a situation.

Costs of Growing Apples under IPM

Studies conducted in the early 1990's in New York compared the costs between conventional, IPM, and organic apples. According to Joe Kovach of the Cornell Agricultural Experimental Station in Geneva, the grower cost per acre of conventional, Red Delicious apples was $250/acre while that of IPM was $220/acre, and organic was $686/acre. Under IPM, the costs of chemicals applied went down by $45-50/acre from those of conventional techniques, while the costs of scouting increased by $20-25 leading to a $30 savings on average. Mite biological control was used as the main tool for IPM. No price premium was or is currently available for the IPM technique, so there was no economic incentive for growers outside of these slightly lower costs. He mentioned that these lower costs were not enough of an incentive to offset the additional effort required for practicing IPM for most apple growers.

Agnello et. al. (1994) found that although benefits might occur in the long run from using IPM practices in apple orchards, short-run material costs would be about the same with increased expenditures of time and effort. They concluded that in cases where costs are comparable under both methods, long-held practices prevent producers from changing to another technique.

Reducing Pesticide Use on Apples

Swinton and Scorsone studied the short-term impacts on Michigan apple production of using less pesticide in order to predict the likely financial impacts of losing several pesticides due to higher pest resistance. They found that the gross margins over pest control costs using the next best alternative are expected to fall by 16-21%. This is quite a significant drop-off and poses a significant financial difficulty to Michigan apple growers.

According to Don Ricks (Michigan State University), conventional production practices average over 90% clean fruit in Michigan (without diseases, pest damage, or major blemishes). However, Michigan growers using organic methods have seen their percentage of clean fruit drop down below 70%, a number that is economically unacceptable. Farmers can sell some of the damaged fruit in the juice market providing that the fruit does not have any worms or rot. However, the juice price is usually about one-forth the price for fresh apples, and production costs are not covered.

Additional costs that might be associated with apple growers using lower-impact growing techniques include those associated with soil protection measures. This involves soil testing and the use of cover crops as well as more complete record keeping. Others involve minimizing water usage which consists largely of scheduling irrigation. Often, the information needed for scheduling is provided by a service and thus requires a fee. Using compost also requires extra costs. Applications of compost might range from 1 to 5 tons per acre at about $80 per ton. These costs vary by region, farm, and even within farms.

Cost Comparisons for Other IPM-Grown Produce

IPM techniques are often economically competitive with conventional methods. For example, IPM techniques can sometimes lower the cost of pest management inputs by up to 50% depending on the crop and region. Since the extra time and scouting costs required under IPM offset savings such as these, total costs stay about the same as conventional costs. Other times, the total costs are higher under IPM. These costs will in large part depend on a growers definition and use of IPM, on their crop, and on their region.

For example, Wegmans's sells labeled sweet corn and peas without a price premium. The extra costs involved with scouting, labeling fees, alternative inputs, and time have been offset by current or expected future savings in chemical application. It is possible that costs will fall in the future as cover crops mature and growers become better at scouting. However, costs have only been comparable for a limited number of crops.

Many growers whose crops are not labeled already use IPM to varying degrees. Reasons include increasing pest resistance to chemicals, long-term concerns about soil quality, and tougher federal standards concerning grower practices. In addition, many farmers have their own definition of IPM. There are a continuum of levels to which growers can use IPM. In some cases, they may simply integrate one small technique such as planting cover crops, and in other cases they may integrate many aspects such as drastically lowering chemical usage and using rotations or resistant varieties as substitutes. Whether or not a farmer qualifies under an IPM-based labeling program is often times a matter of degree and specific practices rather than whether they are practicing it. This has resulted in the point systems that have become the guidelines for growers using an IPM-based environmental label. If they practice IPM to a sufficient degree to reach some minimum threshold, then they can typically be certified to use the label.

Alternative Agriculture Practices in California

Four types of farming systems are being studied and compared by the Sustainable Agriculture Farming Systems Project at UC Davis (Klonsky and Livingston). These include a conventional 4-year rotation, a conventional 2-year rotation, a low-input system, and an organic system. Each uses a representative crop rotation for the Sacramento Valley including tomatoes, safflower, corn, and a double crop of a winter legume or grain with dry beans.

For the first completed rotation of the project, 1989-1992, the short-run economic viability of each system was compared. The production costs, farm income, and profit for each of the systems were calculated. The program simulated the performance of a representative 2000 acre farm for each. A computer model was used to calculate the costs that would be incurred by a farmer using the actual farming operations carried out by the researchers. The producer-side emphasis in the first rotation was on fertility and weed management as these showed the greatest variation in costs between systems.

Total production costs for all four methods were quite similar overall when averaged over four years. The costs of low input and organic systems, however, greatly varied on a year-to-year basis, depending on the cover crop species selected, the number of operations used, and the amount of hand labor substituted for pesticides and fossil fuels. It was found that fertility management was the biggest challenge in low-input and organic systems. This component greatly varied from year-to-year for those two systems. Weed management was the other significant factor affecting performance for each system. Neither the organic nor low-input systems achieved equal profits to either of the conventional systems on a whole farm basis, even though they did in some cases on a crop-to-crop basis.

The conclusion was that in order for the organic and low-input farming plans to be economically competitive with conventional practices, a price premium was needed. This has also been found by other studies. For example, in a study of several types of organic vegetables, Sellen et al. (1994) found that premiums had to be 41 to 92% higher for organic to be as profitable as conventional methods.

Summary

We can conclude from this section that in a majority of cases, farmer costs (in terms of money, time, and effort) of growing agricultural products under ecolabel standards are higher than they would be under a conventional routine. How much higher depends upon the crop, the techniques required to lower its impact and the ecolabel standards being used. Ecolabel standards for certain crops that are less comprehensive and less precisely measured may not generate costs that are much higher than conventional practices. Indeed, some crops grown under IPM guidelines such as sweet corn resulted in comparable monetary expenditures. On the other hand, we saw that the cost for apples significantly rose when produced in an alternative way that involved changing just one aspect of production. Thus, some environmental technologies for some crops are not currently good candidates for ecolabeling. Further research is needed to determine whether costs could be brought down for promising growing techniques such as pheromone disruption that are economically infeasible at this time.

In the case of ecolabels that are more comprehensive and very precise in their measurement of environmental indicators, farmer and labeler costs would probably be significantly higher. Using simulation instruments such as the EIQ index and actually monitoring environmental indicators would most likely be very expensive for both producers and labelers. Research needs to be done on how expensive and feasible these might be to individual growers. This is important because it is the most comprehensive labels that would most likely convince consumers that they are receiving an true environmental reward from their purchase.

Existing programs (which use less comprehensive and precise ecolabel standards) would seem to require less of a price premium than the range given for organics. Indeed Wegmans's and Stemilt do not charge one. For some crops, however, such as apples it would seem that the price premium would have to be at least as high as the organic premium. If enough farmers adopted these techniques, economies of scale might eventually set in and lower their costs. If a performance standard and/or more comprehensive assessment was instituted for an existing program, farmer costs would most certainly rise. A significant increase could push all crops into and above the price range for organics. Such an increase would depend on how easy the standard was to use and the data and monitoring requirements. Thus, comparing costs between ecolabeled and organic food on the market would depend upon the crop being discussed, economies of scale, labeler standards, and the cost and effort required to use a performance indicator.

4. Consumer Demand for Ecolabeled Agricultural Products

Although much has been written on “green marketing” and “environmental marketing” (Kuhre 1997, 1995; Wasik; US EPA 1991, 1994; Peatti; Makower; Polonsky et al,; Lamprecht, Cairncross), there is little scholarly research about the potential market for ecolabeled agricultural products. However, there is a substantial amount of proprietary research on green consumers by marketing research and public opinion survey companies, a small portion of which is publicly available at this time.

The most relevant marketing study comes from the Food Marketing Institute (FMI, 1997). The data for this study were collected by the Hartman Group, a marketing research firm, under contract with the Northwest Food Alliance.[10] Survey data were collected in two stages. First, an eight page questionnaire was mailed in February 1996 to the principal grocery shopper in a nationally representative sample of 2,900 households. Sixty-five percent of the questionnaires were filled out and returned yielding a national household sample of 1,879 respondents. Statistical techniques were used to classify respondents into groups representing consumers who do or do not care about environment issues when it comes to food shopping. A twelve page questionnaire was then mailed to 903 respondents classified as caring about the environment. Seventy-nine percent of these questionnaires were filled out and returned yielding a “green” national household sample of 715 respondents.

The study found that there is a large group for whom environmental friendliness would be a “tie-breaker” in choosing among brands within a food product category, but they would not pay more (Table 1). It also found that while the majority of consumers are not likely to buy environmentally friendly products if they cost more, there is a small but still significant number of consumers who are likely to pay a premium (Table 1).

[10] The Northwest Food Alliance, mentioned above, is in the process of establishing an ecolabeling program in agriculture.

The amount of environmental concern and the degree to which this concern was likely to affect food shopping patterns was characterized by cluster analysis of 30 questionnaire items resulting in six consumer segments (FMI, Hartman Group). Table 2 shows the percentage of respondents in each consumer segment. The "True Naturals" were described as being very environmentally knowledgeable and concerned and the only respondents for which environmental considerations were a core food purchase criteria. The "New Green Mainstream" were described as very concerned about the environment, but not very knowledgeable about environmental issues related to food. These consumers occasionally expressed their environmental concern through food purchase decisions, but only if there was no sacrifice in product quality (e.g., taste, appearance, cleanliness, convenience). The "Young Recyclers" were described as environmentally concerned, but unwilling to pay more for environmentally friendly products. The "Affluent Healers" were only somewhat environmentally concerned, but very concerned about nutrition and health and willing to pay more for healthier foods. The "Overwhelmed" (30%) were too concerned with personal survival to worry about environmental issues. The "Unconcerned" (18%) did not believe the environment is in danger.

Some of the differences in purchase intentions among the consumer segments are shown in Table 3. The true naturals were much more likely than the other groups to express interest in purchasing environmentally enhanced products and to state that they have already purchased some kind of environmentally friendly and organic products within the past month.

Some idea of the reliability of the FMI study is suggested by results of another national poll. Roper Starch maintains a syndicated survey called Green Gauge which is based on annual national samples of 2,000 households since 1990.[11] The Green Gauge tracks consumer attitudes and behaviors

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[11]This description is based on the Green Gauge web site (http://www.roper.inter.net/research/syndicated/green.htm). Results for the each year are available from Starch Roper for about $15,000. Results presented here were obtained from

related to environmental issues. The results are sold to customers, so only a few of the results are publicly available.

The Green Gauge respondents are separated into five categories (Stisser, List). The percentage of respondents with in each consumer segment are shown in Table 4. “True-Blue Greens” are described as having made substantial changes in their shopping and personal habits to reduce environmental impacts. “Greenback Greens” are described as contributing to environmental organizations but not making substantial changes in shopping or housekeeping. “Sprouts” take only one or two actions to reduce their environmental impact, but are concerned about the environment. “Grousers” and “Basic Browns” are unconcerned about the environment.

The Green Gauge cluster results are somewhat similar to those of the FMI study. For example, 55% of respondents to the 1993 Green Gauge survey were in one of the three environmentally concerned categories (Table 4). Likewise, the FMI study found 52% of respondents were in one of their four environmentally concerned categories (Table 2). A larger number of respondents are classified into the most environmentally committed group by the Green Gauge survey. However, this difference may reflect the fact that the Green Gauge examines a broader range of environmentally related purchases, whereas the FMI survey is focused more narrowly on food.

Although the FMI study suggests that less than 10% would pay a premium for environmentally friendly food, there is evidence that this estimate is too low. For example, in a survey of Colorado households, Sparling et al. found that about half of consumers would pay a small premium of up to 8% for organic food. A quarter of consumers would buy organic at a 24% premium. Less than 3% would pay a premium of 64%. The average premium in the market where consumers were sampled was above

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marketing magazine articles (Stisser, List).

60%. Thus, they concluded that the organic premium was too high to reveal the true market potential for organic products.

Similarly, a review of studies of consumer willingness to pay for reduced pesticide residues suggests that at least 10% and perhaps as many as 40% of consumers are willing to pay a 10% premium (van Ravenswaay, 1995). Of course, this finding reflects consumers' food safety concerns as well as environmental concerns. The FMI study suggests that there is a significant group of consumers who focus only on the food safety aspect (i.e., the "Affluent Healers").

A drawback of the studies discussed so far is that they pertain to a situation where consumers are aware of the ecolabeled alternative. However, awareness takes time and resources to develop. A major advantage of the organic label is high consumer awareness. Over 90% of consumers are familiar with the organic label (Sparling et al.). In contrast, Green Seal, which is relatively new and has standards for products in 28 product categories is recognized by only 14% of U.S. consumers (Food Marketing Institute).

A comparison of ecolabeling programs in other countries indicates that consumer awareness of an ecolabeling program takes many years to develop. For example, the oldest ecolabeling program is Germany's Blue Angel seal which was established in 1977. As of 1993, the program certified 3,503 products in 75 categories. According to a 1988 survey, the Blue Angel is recognized by 79% of German households (U.S. EPA 1993b, p.44). Canada's Environmental Choice program was founded in 1988. During its first four years of operation it awarded its EcoLogo to over 750 products. A 1992 survey found that 42% of consumers recognized the logo (EPA 1993b, p. 50). Japan's EcoMark program was established in 1989. As of 1992, it had issued awards to 2,300 products in 49 categories. A survey in 1990 found 22% of the public was aware of the program (U.S. EPA 1993b, pp.56-57).

Of course, awareness of an ecolabel is not sufficient to generate a premium. Consumers must also understand and trust the label. There is evidence that there is consumer confusion about what the organic label implies about environmental attributes and other qualities (Park and Lohr, van Ravenswaay 1995). The FMI study suggests that the vast majority of consumers know little about the relationship between farming and environmental quality and how this differs for different crops. These results suggest it will be difficult to educate consumers about ecolabels based on process (e.g., IPM) rather than performance (e.g., the EIQ index) standards. Moreover, it is difficult to explain how agronomic practices such as IPM address food safety concerns, and thus it is unclear to what extent process standards would be viewed as meeting this concern.

5. Conclusions

Ecolabels are essentially a voluntary environmental seal of approval on products. They certify that a product meets higher environmental standards than other products in the same category. If consumers value this environmental claim enough to cover costs, ecolabels can give a product a competitive edge. Thus, ecolabels may be useful for encouraging the development and adoption of innovative agro-environmental technologies.

For consumers to value the ecolabel, negative externalities from production must affect consumers in the product market. In this case, consumers face an internality or tradeoff between the benefits of consumption (net of price) and the environmental costs of consumption.

The conditions needed for ecolabeling to create incentives for producers to adopt innovative environmental technologies is that consumers value ecolabeled products more than conventional products, and that the difference in value is equal to or greater than the difference in marginal costs of producing the two types of products.

These conditions may hold for some crops (e.g., sweet corn), but not others (e.g., apples). However, the available data is very limited, so this conclusion is by no means definitive. Rather, it suggests that further investigation is worthwhile.

The major categories of costs identified include labeling fees, record-keeping costs, potential yield losses, and added input costs. Labeling fees depend on the comprehensiveness of environmental standards, the precision of tests used to certify that producers meet the standards, and the number of producers participating in the program.

A comprehensive ecolabel standard would involve life cycle assessment of a broad range of environmental impacts including energy use, water use, waste generation, soil quality, biodiversity, and the like. Many of these impacts are not considered in current agro-eco labeling programs which tend to focus mainly on reducing pesticide use. Expanding the list of environmental impacts considered may create new opportunities for competing in domestic and foreign markets.

Present technology for measuring the environmental impacts of production does not permit much precision, so most standards are expressed in terms of best management practices rather than environmental impact. This increases the difficulty of explaining to consumers the value of the ecolabel. Research on improving environmental impact measurement could lower labeling fees and stimulate consumer demand for ecolabeled products.

Gains in market share or revenue from ecolabeling are very uncertain since little is known about the potential demand for specific ecolabeled products. Available marketing studies suggest there is a substantial market niche for ecolabeled products if the premium is less than that of organic food. Moreover, it looks like ecolabels are a potentially useful way to differentiate food products and gain market share within a product category. However, existing research is based on very general survey questions for which respondents may not be able to accurately forecast their behavior. More specific survey data is needed to learn how consumers would react to more or less comprehensive and precise environmental claims made on different types of food products.

Figure 1

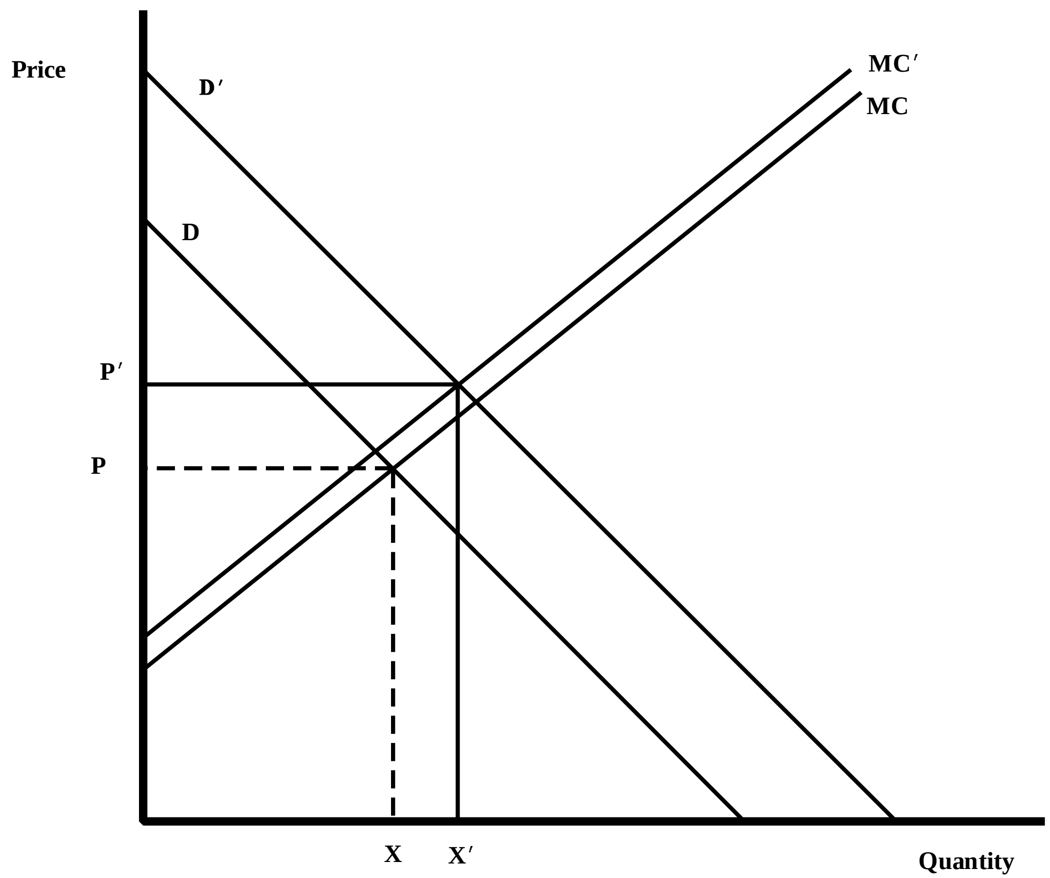

Table 1: Purchase Intentions for Environmentally Enhanced Products

	Very Interested	Somewhat Interested
	%	%
Purchasing environmentally enhanced products	25	46
Purchasing environmentally enhanced products if price 10% higher	8	38

Source: Food Marketing Institute (1997)

Table 2: FMI Consumer Segments

	Percent of Sample
	%
True Naturals	7
New Green Mainstream	23
Young Recyclers	10
Affluent Healers	12
Overwhelmed	30
Unconcerned	18

Source: Food Marketing Institute (1997)

Table 3: Purchase Intentions by Consumer Segment

	True Naturals	New Green Main-stream	Young Recyclers	Affluent Healers	Over-whelmed	Unconcerned
	%	%	%	%	%	%
Very interested in purchasing environmentally enhanced products	67	43	25	19	12	10
Very interested in purchasing environmentally enhanced products if price 10% higher	38	16	6	4	2	3
Purchased an environmentally friendly product in past month	72	49	40	30	26	29
Purchased an organic product in past month	42	15	8	5	4	6

Source: Food Marketing Institute, 1997.

Table 4: Green Gauge Consumer Segments

	1990 (%)	1993 (%)
True-Blue Greens	11	14
Greenback Greens	11	6
Sprouts	26	35
Grousers	24	13
Basic Browns	28	32

Sources: Stisser (1994) and List (1993)

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