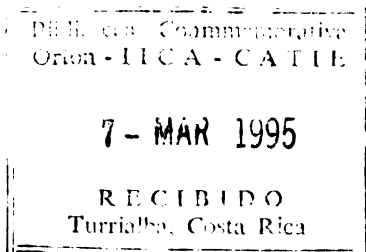


**THE PLANT PROTECTION POLICY SITUATION
IN CENTRAL AMERICA**



Report Prepared

by

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EVIDENCE TO THE FACT THAT PLANT PROTECTION POLICY IN COSTA RICA AND THE REST OF THE CENTRAL AMERICAN COUNTRIES IS PESTICIDE BASED

There is some evidence in favor of the hypothesis that plant protection policy in Costa Rica and the rest of Central America is biased towards the use of chemical pesticides¹. Such includes:

- 1.The pest management guidelines from the Ministries of Agriculture for the most important crops.
- 2.The line items (expenses) for which agricultural credit is available.

Furthermore, if the current plant protection policy were not pesticide biased, it can certainly be categorized as ineffective in avoiding a pesticide based agricultural production². On the other hand, there is also testimony of increased understanding of this problem, and a willingness to do something about it, from many policy makers. Such encompasses:

- 1.The recent constitution of formal IPM research programs have in several public institutions.
- 2.The proclamation of IPM as the official plant protection policy by some Ministries of Agriculture.

General knowledge about IPM among policy makers, and willingness to promote this strategy exists; but formal, effective mechanisms to produce and provide them with the information they need to do so are scarce.

EVIDENCE TO JUDGE WHETHER THE AMOUNT SPENT FOR PESTICIDES IS OPTIMAL FROM THE FARMER'S OR THE SOCIAL POINT OF VIEW

In this case, explicit evidence is lacking and needs to be developed but, departing from related data, logic yields us to conclude that the socially desirable level of chemical pesticide usage must be substantially different from, and well below of the farmer's optimal. Several externalities of pesticide use are now widely accepted by scientist, policy makers and the general public³:

- 1.The public cost of dealing with the results of agricultural workers being intoxicated with pesticides.
- 2.The public cost of dealing with the results of consumers of agricultural food products being intoxicated with pesticides.
- 3.The environmental and natural resource costs associated with pesticide usage.

4. The effect of pesticide use on the biological and economic sustainability of agricultural production systems.

No attempts have been made in Central America to determine the socially optimal amount of pesticides to be used in any specific crop; but taxes, in the few instances where such are imposed on pesticide imports⁴, are not based upon considerations like the former, but assigned as part of a general revenue raising strategy.

On the other hand, on farm studies for certain crops indicate that pesticide usage is substantially above the economic optima, even from the producer's perspective⁵. Given that there are only negative externalities arising from such, it can be safely inferred that chemical pesticides are being used at levels significantly above the socially desirable.

IS IPM A REAL POLICY GOAL IN CENTRAL AMERICA

Most policy efforts in Central America are directed towards a more effective and safer chemical pesticide use and to promote the efficient control of economically important pests. This is mainly due to prioritization in the use of scarce governmental resources; but it is also driven by the lack of specialized technical advice that could enable the design and implementation of policies that reach beyond the former objectives, and are successful in promoting IPM field implementation³.

Furthermore, the idea of IPM implementation attracts the policy makers attention because it yields definite advantages, specially in terms of sustainability of agricultural production and environmental protection but, are they willing to take the chance of pushing for the gradual ousting of chemical pesticides? Most likely they first need to be convinced that viable, comparable alternatives exist, and that such can be readily made available to farmers¹.

EVEN THOUGH THE LEGISLATIVE PROCESS IN PESTICIDE REGULATION IN COSTA RICA IS BETTER THAN IN OTHER CENTRAL AMERICAN COUNTRIES SUCH AS HONDURAS, THERE IS PLENTY OF ROOM FOR IMPROVEMENT

In Costa Rica, there is limited infrastructure for the analysis of pesticide residues. Even though an adequate legal framework is in place, there is still a great need for better enforcement and follow up activities. In Honduras, which can be considered the other extreme, the current pesticide legislation was passed in 1962 and it is clearly outdated⁶:

1. A new and more specific pesticide law has been prepared and is awaiting to be passed by the congress.

2. The procedure to register a pesticide is very simple and based on information provided by the interested party.

3. The Honduran Department of Plant Health counts with very limited human resources and lacks of technical independence in decision making.

4. The Honduran Department of Plant Health does not have efficient technical support to assure adequate monitoring of pesticide quality and residue levels.

5. The national supervisory capability is deficient and performed by unspecialized paratechnical personnel.

ECONOMIC STUDIES ON PEST CONTROL IN CENTRAL AMERICA

Plant protection economic studies in Central America have mostly applied methodologies based in partial budgeting and production function analysis'. Duality theory and simulation models have not been utilized.

1. Production function analysis has been improperly utilized in several occasions'.

2. Regression analysis has been employed as a basis for different methodologies to determine Economic Action Thresholds for pesticide spraying'.

3. There is a growing discussion about the appropriateness of the currently available methodologies to determine Economic Action Thresholds for pesticide spraying, and incipient efforts to develop, validate and disseminate more proper analysis techniques¹⁰.

4. Most economic studies on pest control that have been conducted are at the farm level. Macroeconomic studies on several key issues are a critical need.

CHEMICAL PESTICIDE PRICING POLICY

The restrictions on government spending imposed by the international banks during the first half of this decade have discouraged the using of production subsidies, in general. During the former decade, however, the Government of Nicaragua heavily subsidized most agricultural inputs, including pesticides. This situation also affected agricultural input markets in Honduras and, to a lesser extent Costa Rica.

The Government of Costa Rica has sporadically subsidized the price of specific pesticides in what were considered emergency situations. More subtle subsidies still remain in some countries through some sort of preferential credit for certain agricultural activities, which includes a specific line item for pesticide purchases.

NON-PRICE FACTORS AFFECTING PESTICIDE USAGE

The main non-price factor that affects the current level of pesticide use is the farmers' lack of access to comparable alternatives. Comparable in the sense of being as effective under a wide variety of pest conditions, and of being easy to understand and implement

Many of such IPM options have been developed by research centers and validated on farmer fields, but the mechanisms that are necessary to transfer these technologies to massive numbers of farmers do not exist or are non-functional¹.

¹ Please refer to the corresponding "Leyes de Sanidad Vegetal" of the different Central American Countries.

² GARCIA, JAIME E., "Los Plaguicidas y el Combate de Plagas Agrícolas en Costa Rica". Oficina de Extensión Comunitaria y Conservación del Medio Ambiente, Universidad Estatal a Distancia.

³ RAMIREZ, OCTAVIO A., "The Role and Importance of Policy Action in Support of a More Extensive Implementation of IPM in Agricultural Production". Proceedings of the 1st Meeting of the Central American and the Caribbean Integrated Pest Management Working Group. San José, Costa Rica, March of 1994.

⁴ "Algunas Consideraciones sobre los Precios de los Agroquímicos en Costa Rica". Informe de la Dirección General de Mercadeo Agropecuario, Departamento de Economía de Mercados, Ministerio de Agricultura y Ganadería de Costa Rica. San José, December of 1987.

⁵ Please refer to several studies available at CATIE's Plant Protection Area's Regional Information and Documentation Center. Such include:

CALVO, GUSTAVO A., L. BARRANTES, L. HILJE, L. SEGURA, O. RAMIREZ, N. COPPER, A. RAMIREZ and J. CAMPOS, "Informe de Avance sobre la Validación de Tecnologías de Manejo Integrado de Plagas del Tomate en el Valle Central Occidental, 1991-1992". Costa Rica, October 1992.

⁶ CONTRERAS, MARIO, "Situation, Perspective and Strategies for the Use of Pesticides in Central America". Regional Office for Central American Programs (ROCAP). Guatemala, Central America.

⁷ Please refer to several studies that have been published in CATIE's "Integrated Pest Management Journal" available at CATIE's Plant Protection Area's Regional Information and Documentation Center. Such include:

FRENCH, JAMES B., "Métodos de Análisis Económico para su Aplicación en el Manejo Integrado de Plagas. Manejo Integrado de Plagas (Costa Rica) No.12:48-66, 1990.

⁸ RAMIREZ, OCTAVIO A., "La Especificación de Funciones de Producción y su Importancia para Proyectos de Investigación Aplicada. Manejo Integrado de Plagas (Costa Rica), Forthcoming.

⁹ HRUSKA, ALAN J. AND P. ROSSET, "Estimación de los Niveles de Daño Económico para Plagas Insectiles", Manejo Integrado de Plagas (Costa Rica) No.5:30-44, 1987.

¹⁰ RAMIREZ, OCTAVIO A., "Methodologies for Determining Economic Action Thresholds: Errors of the Past and Perspectives for the Future". Paper presented to the fourth Regional Integrated Pest Management Congress in El Zamorano, Honduras, April of 1992.

¹¹ RAMIREZ, OCTAVIO A., "Generación de Tecnologías MIP para su Implementación en America Central y el Caribe" Proceedings of the 1st Meeting of the Central American and the Caribbean Integrated Pest Management Working Group. San José, Costa Rica, March of 1994.

**THE ROLE AND IMPORTANCE OF POLICY ACTION IN SUPPORT OF
A MORE EXTENSIVE IMPLEMENTATION OF IPM IN AGRICULTURAL PRODUCTION**

**Information Gap Between Integrated Pest Management Specialists and
Policy Makers**

The information gap that exists between extensionists and researchers in Central American countries has been a matter of concern and discussion in recent years. Much less attention has been yielded to the importance of the probably even more acute communication breach that endures among researchers and policy makers, specially regarding technological advances and specific possibilities in the field of Integrated Pest Management (IPM) implementation.

This is, at least in part, due to the lack of understanding from many IPM researchers of the importance of policy actions to promote IPM implementation to its fullest and socially optimal extent, and of the types of such actions that could be undertaken to do so. The goal of this paper is to superficially discuss both of the former matters, as well as some other related issues.

**The Importance of Policy Actions to Promote IPM Implementation to
its Fullest and Socially Optimal Extent**

When IPM is compared to the unilateral use of chemical pesticides, several advantages can be usually identified:

1. A substantially reduced risk of pesticide intoxication for the agricultural workers exposed to such dangerous chemicals.

2. A decrease in long-term cancer rates and other ailments usually associated with the prolonged consumption of sub-lethal dosages of pesticides in the general population that ingests agricultural food products.

3. And increased long-term probability of being able to obtain reasonable yields and economic returns on a larger number of crops in traditional agricultural areas. This can be achieved by avoiding the development of pest strains that are resistant to chemical control agents, by refraining the outbreak of secondary pests into primary plant protection problems, and by fostering the conservation of non-renewable natural resources such as the farming soil. In other words IPM is a key element for the biological and economic sustainability of agricultural production.

4. As a by-product of the former, the protection of non-traditional (usually forest) agricultural areas from the invasion of farmers or field workers forced to abandon the historic crop production zones; or by new agricultural activity born as a response to the increased demand for food products that can not be fulfilled by the conventional growing areas any more.

5.The protection of biodiversity and other productive activities such as fisheries, that can be affected by chemical pesticide run of fall outs.

6.Preventing the contamination of water sources for human and animal consumption and its effects on their health, when agricultural production is established in watersheds or in areas where such drinking water is obtained from welling into the water table.

7.Improving the balance of payment, since most chemical pesticides are imported (at least the raw materials needed for formulation), and most IPM alternatives are intensive in the use of locally produced inputs, such as labor.

Of the seven advantages listed above, however, and assuming that the agricultural producers know about and understand the magnitude each and every one of them, it is only reasonable to hypothesize that farmers may give some value to the first and third considerations when deciding whether to control a pest by spraying a chemical pesticide or implementing and IPM alternative.

In small farms the head of the household or one of the family members usually takes care of the pesticide spraying. Although in countries like Costa Rica the government (i.e. society at large) takes care of the medical expenses in the case of an intoxication, the main negative value of that event rests on the pain, suffering and possible dead of the affected individual. Therefore, it should be hoped that small farmers consider the full worth of the potential risk of poisoning when deciding about the implementation of alternative pest control measures.

Nevertheless, it is often commented by social scientist that work directly with small farmers, that they frequently behave as if such danger did not exist. This may be so because they don't understand it very well, or just don't believe that they will become intoxicated, although anybody else could. Another reason may be that they are so concerned about assuring the production of food for themselves and their families that, when faced with this critical need, the risk of crop loss that the perceive from the event of adopting a new pest management technology outweighs their estimation of the possibility and danger of being poisoned when spraying chemical pesticides.

In the case of medium-size or large farms, where hired labor usually takes care of the pesticide spraying, the owner can not be expected to assign a full value to the good health of his workers, even more so when society at large is in charge of covering the medical expenses in the case of an intoxication.

Regarding the third advantage, it should be mentioned that most farmers are probably not informed about the long-term implications of the persistent and unilateral use of chemical pesticides, in terms of the biological, economic and environmental

sustainability of their agricultural production systems. Therefore, they can not take into consideration when deciding about the implementation of alternative pest control measures.

If they were fully informed about this matter, however, the question remains about how much value would they place on their future well being, and that of their descendants, when this is weighted against present and quite tangible economic returns. The former is affected by factors such as land tenure and political and economic stability. If individuals, for any reason, do not expect to be able to benefit from their farming in the long-run, why should they worry about cropping systems becoming more sustainable in their area.

The other five advantages that arise when IPM is compared to the unilateral use of chemical pesticides, mostly accrue to society as a whole, and not to individual farmers. Furthermore, even if a single individual agricultural producer had the necessary information and well meaning to behave taking into consideration the full social benefits of using IPM technologies in his farm, he will probably be intelligent enough for not doing so. This because such benefits are only achieved if most farmers within a specific area adopt the available IPM alternatives, significantly reducing their use of chemical pesticides. The individual actions of a single farmer will have no effect, except on accomplishing the first advantage. Therefore, he would not be likely to act upon his good intentions unless it can be warranted that all other producers will do the same.

The former discussion can be summarized as follows:

1. Most advantages that arise from IPM implementation will benefit society as a whole, and the farmer population only represents a relatively small fraction of it.

2. Some of those advantages are either achieved in the long-term or are substantially intangible in their nature. That is, they are of great importance, and can be achieved; but once they are being accomplished the beneficiaries may not realize it. An example will be the drinking of pollution-free water.

3. In many instances the beneficiaries of such advantages do not have enough information and technical expertise to appropriately gauge their full value. An example would be the decrease in long-term cancer rates and other ailments usually associated with the prolonged consumption of sub-lethal dosages of pesticides in the general population that ingests agricultural food products.

4. Although some of those advantages accrue to the same individuals that must act in order to achieve them (i.e. the farmers), some times society must promote certain types of self-benefiting behavior. An example outside of agriculture would be the fines to individuals that do not wear seat belts.

Considering the former, the need for social action through policies tending to promote the implementation of IPM in Central America becomes very clear. If the choices are left to the individual farmers, without establishing regulations and mechanisms to internalize and spread out the social costs caused by the externalities of a pesticide based agricultural production, the level of IPM implementation will remain well below its social optimum.

Actions that can be Undertaken to Promote IPM Implementation to its Fullest and Socially Optimal Extent

Educational Campaigns to Make the Consumers Aware of the Presence and Danger of Pesticide Residues on Food Products, and the Establishment of Mechanisms to let them Express their Desires for such to be Free of Dangerous Chemicals

If the consumers are not fully aware of the presence and danger of pesticide residues on food products, and of the fact that there are viable alternatives to the unilateral use of chemical pesticides in agricultural production, they won't be likely to support initiatives promoting IPM implementation.

When informed, however, many consumers in countries like Costa Rica, for example, could decide to purchase food products that are certified to be free of pesticide residues, even if in certain cases they have to pay a slightly higher price and/or accept a somehow lower cosmetic quality.

Mechanisms should be installed to positively certify this type of agricultural products, and to make them widely available to consumers through the proper marketing strategies and channels. Although this approach is important, it must be complemented by minimum mandatory standards for all edibles.

It is critical to emphasize that for certain crops an IPM based production system may be actually lower in cost, and economically more efficient at the farm level, than the status quo. This because in many cases, current pest management strategies are extremely wasteful in the use of costly chemical pesticides.

Although this issue needs to be researched further, evidence exist to support the hypothesis that an IPM based agricultural production, in balance, can be shaped nearly as efficient in the short-term as it is at this point. It can be safely stated that the main social costs of promoting the implementation of an IPM based agricultural production will be that of financing the necessary technical assistance, adaptive research and technology transfer programs at massive levels.

Policies to Alleviate the Perceived Incremental Production Risk of Substituting Chemical Pesticides with IPM Options at the Farm Level

This action is much related to the preceding comments. The current pest management strategies that in many crops are extremely wasteful in the use of costly chemical pesticides; are propelled at least partially by the farmers using of the later as crop insurance. In several cases chemical pesticide use can be substantially reduced and even totally substituted by the implementation of IPM practices, without experiencing a significant yield decrease.

In such crops, it is only under certain unusual circumstances that, if implementing available IPM options, pest pressure becomes dangerously high and either extreme plant protection measures are required or a substantial yield loss has to be tolerated. Even though such events, that may occur either at the level of an individual farm or in an entire producing area, can be forecasted through the use of pest monitoring techniques, most farmers are reluctant to take any chances.

This is understandable since a failure in the forecasting and associated technologies could obliterate the one and only source of family income for many small and medium-size farmers. Therefore, mechanisms that guarantee them protection against such eventualities could have a very positive effect towards their willingness to implement IPM alternatives and reduce their using of chemical pesticides.

Educational Campaigns about the Social Benefits of an IPM based Agricultural Production vs. one Dependent on the Unilateral use of Chemical Pesticides

It is imperative that producers, consumers and policy makers understand the immediate and long-term drawbacks of an agricultural production that is dependent on the unilateral use of chemical pesticides. They must also be aware of the fact that there exist IPM alternatives that, to a greater extent in some cases and lesser in others, can be utilized as adequate substitutes to such; and that the potential exist to substantially progress towards the development of agricultural production systems that are less damaging to the human beings and our natural resources and environment.

For this, a comprehensive educational campaign about the social benefits of an IPM based agricultural production vs. one dependent on the unilateral use of chemical pesticides would be the appropriate avenue.

More Public Resources to be Dedicated to IPM Research and Technology Transfer

The persistent and substantial underfunding of public research and technology transfer institutions, mostly due to the political and economic crisis that characterized the past decade in Central America, has been a major obstacle to a more extensive implementation of IPM in key agricultural production systems.

This situation is slowly being improved through the semi-privatization of some of those institutions coupled with strong financial support of international banks and donors. Such process has usually involved some sort of restructuring and, in all cases, IPM research and extension has been stressed as a priority within the new organization. Distinct "units" in charge of IPM research/validation, that are well funded and have far-reaching operational links with extension services that are also properly financed, have been consolidated.

The permanent IPM research and extension capabilities that could be developed in national public institutions with the support of the corresponding programs in Regional Centers such as CATIE, through short-term and graduate-level training, information and documentation products and services, specialized technical assistance, etc.; would be a significant advantage for achieving a more extensive implementation of IPM in key agricultural production systems.

A compromise from policy makers to complement and provide for the sustainability of the efforts of international banks and donors that have granted the necessary funding to jump start some public research and technology transfer institutions back into a functional state, however, is essential.

Tariffs or Bans on the Import or Usage of Certain Pesticides

This can be one of the more important mechanisms to internalize (i.e. make sure that the farmers take into account) the previously discussed social costs (i.e. externalities) caused by a pesticide based agricultural production.

Scientists can support policy makers in deciding about:

1. Within the most commonly utilized, what pesticides are so dangerous that the social costs of their use in specific crops and under certain conditions completely out weight its benefits; taking into account the possible existence of appropriate and readily available alternatives for the management of the corresponding pest problem(s). Such pesticides, therefore, should be gradually banned and parallely, IPM options to its use would need to be channeled through the extension systems.

2. Within the most commonly utilized, what pesticides are being used at levels significantly above the farm level economic and social optimum; for key crops in terms of production areas and chemical pesticide usage. IPM research teams have already established temporary guidelines for the farm level economic optimum use of chemical pesticides in several important crops; utilizing such in conjunction with IPM alternatives.

Although the rigorous determination of the socially optimum level of pesticide(s) use in a specific crop(s) is a complicated and somehow subjective task, it can be accomplished by a properly trained economist if the necessary information is available. This may be important when it is expected that the social optimum differs substantially from the farm level economic optimum, or as a scientific exercise with exemplary purposes.

In most situations, the farm level optimum can be used as an upper level (maximum) limit for chemical pesticide utilization, that can be adjusted downward in consultation with an experienced, multidisciplinary team of scientists. Then, it is the task of the economist to estimate the necessary tariff (i.e. tax) or quota (i.e. import restriction) that will raise the unit price of the pesticide(s) to such an amount that the farm level utilization will be reduced closer to the desired limit.

This process could be implemented gradually and, at the same time, IPM alternatives to the unilateral use of such chemical pesticide(s) could be channeled through the extension systems. Furthermore, the revenues from the previously mentioned tax(es) could be used to fund IPM research and extension efforts.

The Allotment of Credit for Chemical vs. Non-Chemical Control

In many crops, credit is essential for being able to start and complete the productive cycle. In addition, line items are often established within a credit package, that limit the amounts of money that can be spent in different activities. Although there is always a substantial quantity assigned and approved for the purchase and application of chemical pesticides, allotments for non-chemical pest control measures are most likely out of the question.

This is definitely a chief impediment to the widespread implementation of many sound alternative IPM measures that are already available. The balance within credit for chemical vs. non-chemical pest control has to be gradually changed, in close coordination with a strong technical assistance program to teach farmers about the latest.

IPM as a Strategy to Confront Pest Problem Crisis

In the not infrequent event of the arrival of a new pest, or the outbreak of a secondary one into a primary plant protection problem, to a specific country or productive area, chemical control has been the an indispensable line of defense in Central America. Although it is an important tactic, its improper, unilateral and exaggerated use may have prolonged and aggravated the crisis by hindering the potential for the development of a natural, biological control scheme that, if allowed to progress, can in many cases maintain pest populations near non-damaging levels in the long term.

In this regard, it is necessary that policy decision makers have immediate access to a multidisciplinary team of highly trained IPM experts that can advise them about the possible strategies to confront pest problem crisis. Advise could include the recommendation of IPM alternatives that can be validated/ demonstrated on the field within a short period of time, as well as the necessary technical support to do so. It should also consist of specialized backing to the national research and extension programs, in the design and implementation of applied research/ validation efforts to generate improved technologies for the proper management of the new pest problem.

Short Term vs. Long Term, and Focused vs. Disperse Benefits of Policies to Foster IPM Implementation

This can be a very important issue for policy decision makers. It can be stated that aggressively promoting the field implementation of IPM to its fullest, socially optimum extent, will deliver substantial benefits. However, some of them can be characterized in general, as being achieved in the long term, disperse among the vast majority of the population, and hard to perceive and quantify.

The biological, environmental and economic sustainability of agricultural production, for example, is a long-term advantage. The contribution of a more widespread implementation of IPM practices to the sustainability of agriculture, to the protection of non-traditional (usually forest) agricultural areas and of the biodiversity and other productive activities such as fisheries, that can be affected by chemical pesticide run of fall outs, would also be hard to perceive and quantify.

The decrease in long-term cancer rates and other ailments usually associated with the prolonged consumption of sub-lethal dosages of pesticides in the general population that ingests agricultural food products is also a long-term advantage, it is disperse among the vast majority of the population. It is also hard to perceive since, although the decrease in the cancer rate could be scientifically quantified, the individuals that were not affected (but other wise would have been) will never know about it.

On the other hand, and although this may not necessarily be the case, some of the measures that will have to be undertaken to promote a more extensive implementation of IPM practices are generally judged as costly in the short-term, focusing negatively on a limited number of individuals, and quite easy to perceive and quantify.

Costly in the sense that a considerable investment in research and extension is required before beginning to receive the benefits of IPM implementation, although, as mentioned earlier, such could be funded with the revenues from pesticide import/formulation tax.

Also costly in the sense that farmers will be faced with increased prices for chemical pesticides, although, as mentioned earlier, in many cases those are being utilized at much higher rates than economic optimum at the farm level. Therefore, in several instances, higher prices are likely reduce usage to more rational levels without any significant increase in the overall pest control costs or yield losses. Furthermore, as the natural control begins to recuperate and IPM practices become widespread, short-term agricultural productivity should recover any ground that might have been lost.

Finally, costly in the sense that individual farmers may have to face the prospect of increased short-term yield risk in some instances (although less long-term yield risk). Most cases would involve an exaggerated perception of risk increase, that could be lessen by making available some sort of self-financed crop insurance system.

Focusing negatively on a limited number of individuals, in the sense that the farmers may seem to be the ones that would have to assimilate the possible short-term loss in agricultural productivity triggered by higher prices and a more restricted availability of chemical pesticides. Economic theory, however, solidly demonstrates that if such productivity loss indeed occurs, the negative consequences would be spread widely between producers and consumers of agricultural goods (i.e. the whole of society).

Lastly, the cost of the investment in research and extension, the higher prices and a more restricted availability of chemical pesticides, and the potential increase in the cost of certain foods would be perceived and quantified easily and quickly by the policy makers, farmers and consumers, respectively.

Concluding Remarks

To close this analysis, it is important to emphasize that many of the former comments are meant to be advanced as working hypothesis, and must not be considered general, proven facts. They are based on experience, observation, and in many cases logical extrapolation from site/crop specific findings to a more extensive range of circumstances.

The author, however, considers them to be reasonably accurate, especially if they are interpreted as being the average result of many diverse situations. Nevertheless, the main point of this essay is to provoke thought and debate on this issue and related facts; and to hopefully motivate research that would eventually prove or dismiss the hypothesis here submitted.