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Economic Analysis of Crop Protection Policy in Costa Rica

Stefan Agne

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Economic Analysis of Crop Protection Policy in Costa Rica

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Acknowledgements

This paper includes recent information on pesticide policies in Costa Rica. Numerous institutions and individuals have contributed through their expertise and through reports on the subject. I would like to thank all of them.

The entire research was executed while based at CATIE[1] in Turrialba, Costa Rica. I would like to thank all my collegues at CATIE's IPM Project and above all Octavio Ramirez who made my stay at CATIE possible.

In December 1995 a seminar-workshop on crop protection policies in Costa Rica took place at IICA[2]'s headquarters in Coronado, Costa Rica. This workshop brought together crop protection experts from public and private entities that play a major role in pesticide policy formulation in Costa Rica. The collaboration of IICA's Area III (Agricultural Health) and of the IICA-GTZ[3] Project in organizing this workshop as well as the valuable suggestions and discussions provided by the participants have been greatly appreciated.

I am grateful to Prof. Hermann Waibel, Gerd Fleischer, Octavio Ramirez and David Kaimowitz for their valued comments on previous drafts of this paper.

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1 CATIE = Centro Agronómico Tropical de Investigación y Enseñanza

2 IICA = Instituto Interamericano de Cooperación para la Agricultura

3 GTZ = Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

Preface

Since early 1995, when the "Guidelines for Pesticide Policy Studies" were published by the Pesticide Policy Project as the first issue of its publication series, this booklet has been widely requested by individuals, multi- and bi-lateral development organizations. More than 400 copies have been distributed. Some of these organizations have been applying the basic concept proposed in the guidelines in their crop protection studies. It was understood from the start that the approach proposed in these guidelines will be subject to modifications as empirical testing takes place. The present publication on Crop Protection Policy in Costa Rica is the first real world test that strictly follows the conceptual framework which is underlying the guidelines.

In taking up such a task one is always dealing with ”two hearts”: the things that have to be done and the things that would be nice to do. Stefan Agne, who spent some exciting months in Costa Rica needs to be highly commended for taking up the difficult task of being the first one to bridge the gap between theory and practice. He showed that the framework is useful as a "vademecum” in asking the right questions which in many instances pave the way for a desirable solution. It has been proven that the framework provides a clear structure based on welfare theory.

The analysis impressively demonstrates the existing linkage between the structural changes of the agricultural sector and trends in pesticide use. It also became clear in which way agricultural and environmental policies affect pesticide use patterns. Furthermore, the inefficiency that can be caused by the existing regulatory framework and other institutional settings, the important role that information and information gaps play in strengthening certain technological pathways in crop protection can be shown clearly. It was also made apparent that the best way to assess the relative importance of the determinants of pesticide use is in a workshop environment with representatives of various interest groups. Overall, the analysis necessarily is remains descriptive which, nevertheless, is appropriate for many of the variables involved.

What this case study also showed is that the things that would be nice to do, depend on a considerable amount of preparatory research results from the natural sciences. This is particularly the case for the quantification and economic assessment of the external effects that are caused by pesticides. How much does the society have to pay for those ”non-internalized” environmental and health effects caused by pesticides ? How far is pesticide use above its optimal level if we take social welfare as the objective function?

Using a participatory assessment approach this study revealed the relative strength of the forces that determine and sometimes pre-determine pesticide use. Therefore this information is useful in moderating "better arrangements" among the stakeholders in crop protection. It is expected that the Costa Rican example will be followed by other Central American countries. A workshop on crop protection policy analysis in Central America is planned for 1997. This should get the ball rolling for a higher regard given to economic instruments in crop protection policy in the region.

Hermann Waibel August 1996

Executive Summary

This report has been motivated by the hypothesis that, in many cases, the level of pesticide use is above the optimum, both from the private and the social point of view. Besides purely technical determinants of pesticide use, there are various institutional and macro-economic issues that have been neglected for a long time. Those issues act as constraints to the dissemination of IPM and non-chemical methods of crop protection. The leading question of this report has been whether Costa Rica's economic and institutional policy framework is conducive to unilateral use or chemical pesticides or to the adoption of non-chemical pest management methods.

Chapters 2 and 3 summarize the main characteristics of the agricultural sector and of pesticide trade and use in Costa Rica. Costa Rica is a growing market for pesticides, in spite of many initiatives to reduce pesticide use. Between 1990 and 1994 the CIF-value of pesticide imports increased from 56.2 million USD to 84.2 million USD, which is equivalent to a shift of almost 50 %. This is mainly due to the extension of the banana growing area and of other pesticide intensive horticultural crops, but also because of increasing pesticide resistance.

This research has been following a participatory approach. In numerous interviews major institutional and economic determinants of pesticide use have been identified, which then have been evaluated with the aid of a survey among crop protection experts.

Institutional and **information constraints** hamper the dissemination of IPM in Costa Rica. Pesticide legislation is advanced as compared to other Central American countries. However, there are serious deficiencies in the implementation of the laws. First, the large number of institutions involved in pesticide legislation and enforcement of the laws makes effective control difficult. Second, the costs of exercising control requested by law are very high because of the large number of individuals working with pesticides. Third, violators of the law are often not punished at all or not seriously enough. Furthermore, education in crop protection and the agricultural banks' technical recommendations have been identified as institutional constraints to a reduction of pesticide use.

The official extension service is promoting IPM which aims to reduce dependence on pesticides. On the other hand information transmitted by the chemical industry and by pesticide retailers stimulate pesticide use. The lack of information on non-chemical methods in institutions and at the farm level and

insufficient use of economic arguments in IPM extension also favor unilateral pesticide use.

In Costa Rica, agricultural inputs for a long time have been exempted from all duties and taxes. Tax exemptions for pesticides and tax exemptions for complementary inputs such as spraying equipment and fertilizers stimulate the demand for pesticides. At present tax exemptions for pesticides imply a 6 % or 5 million USD **price subsidy**. However, in the context of trade liberalization tax exemptions may become less important.

Pesticide use provokes **external costs**. Some of those such as environmental pollution are tolerated by society, others, e.g. medical treatments of intoxicated persons are paid for with public resources. A discussion about the internalization of the external costs caused by pesticide use should take place. Administratively, this would be possible through a *selective sales tax* either for a specific group of highly hazardous pesticides or for all pesticides.

Crop protection experts evaluated institutional factors and information as the most important stimulants of pesticide use. In addition, price factors such as tax exemptions for pesticides, tax exemptions for complementary inputs, and the toleration of external effects provoked by pesticide use were considered relevant for pesticide use stimulation. In a second step the experts assessed four groups of policy instruments[4] according to the following criteria:

- administrative costs of the implementation,
- effectiveness in reaching the environmental objective,
- impact on farmers' income,
- degree of acceptance by farmers,
- degree of acceptance by society,
- political feasibility.

Regulatory measures (prohibition and restriction) were evaluated most favorably in spite of the well known deficiencies in the implementation of the laws and administrative provisions. A combination of taxes and subsidies was supposed to be more effective in reaching the environmental goal than taxes without subsidies, and to be more acceptable for farmers. However, environmental taxes were expected to be difficult to realize.

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4 The four categories of policy instruments include taxes, subsidies, a combination of taxes and subsidies and regulatory policy instruments.

Resumen Ejecutivo

Este informe fue motivado por la hipótesis que en muchos casos, el nivel de uso de los plaguicidas sobrepasa el óptimo económico, en ambos casos a nivel de finca y desde el punto de vista social. Además de los determinantes puramente técnicos del uso de plaguicidas existen varios factores institucionales y macro-económicos que por mucho tiempo han sido desatendidos. Estos factores actuan como restricciones en la diseminación de MIP y de tecnologías no químicas. La pregunta orientadora del presente informe era saber si el marco político económico y institucional de Costa Rica favorece más el uso unilateral de plaguicidas o la adopción de estrategias no-químicas de fitoprotección.

Los capítulos 2 y 3 resumen las características del sector agrícola y del intercambio y uso de plaguicidas en Costa Rica. Costa Rica es un mercado creciente para estos, a pesar de muchos esfuerzos para reducir el uso de plaguicidas. Entre 1990 y 1994 el valor cif de las importaciones de plaguicidas incrementó de 56.2 a 84.2 milliones de USD, lo que es equivalente a un aumento de un 50%. Esto se debe sobre todo a la extensión del área de banano y de otros cultivos con alta intensidad de plaguicidas, pero también al incremento en la resistencia contra plaguicidas.

La investigación utilizó una metodología participativa. En numerosas entrevistas se identificaron determinantes institucionales y económicos del uso de plaguicidas, los cuales fueron evaluados por una encuesta entre expertos en fitoprotección.

Las **limitaciones institucionales** y la escasa **disponibilidad de información** obstaculizan la difusión del MIP en Costa Rica. La legislación en el campo de los plaguicidas es amplia y cubre los aspectos más importantes del manejo de éstos. Sin embargo, se encuentran serias dificultades en la implementación de estas leyes. Primero, el gran y diverso número de instituciones involucradas en este campo dificulta la coordinación entre las mismas, haciendo muy difícil un control eficaz. Segundo, los costos de ejercer el control previsto por las leyes son muy elevados, debido al alto número de individuos que trabajan con plaguicidas. Tercero, los que no cumplen la ley muchas veces no son castigados con suficiente severidad o ni son castigados. Además, la educación en fitoprotección y las recomendaciones técnicas de los bancos agrícolas se han identificado como obstaculos institucionales a la reducción del uso de plaguicidas.

El servicio oficial de extensión promueve MIP, lo que ayuda en reducir el uso de plaguicidas. Por el otro lado, la información transmitida por la industria química y por vendedores de plaguicidas estimula el uso de plaguicidas. La falta de información sobre métodos no químicos en las instituciones y a nivel de finca y además el uso insuficiente de argumentos económicos en la transferencia del MIP también favorece el uso unilateral de plaguicidas.

En Costa Rica, los insumos agrícolas por mucho tiempo se han exonerado de cualquier arancel o impuesto. La exoneración de impuestos para plaguicidas y para insumos complementarios como equipo de aplicación y fertilizantes estimulan la demanda para plaguicidas. Actualmente la exoneración de impuestos para plaguicidas implican un **subsidio de precio** de un 6 % o de unos 5 milliones de dólares estadounidenses. Sin embargo, en el contexto de la liberalización del intercambio la exoneración de aranceles probablemente resultará de menor importancia.

El uso de plaguicidas provoca **costos externos**. Algunos de estos como la contaminación ambiental están tolerados por la sociedad, otros, por ejemplo tratamientos médicos de personas intoxicadas están pagados con recursos públicos. Una discusión sobre la internalización de los costos externos causados por plaguicidas se debería llevar a cabo. Administrativamente, la internalización de estos costos se podría realizar por un *impuesto selectivo de consumo* sea por un grupo específico de plaguicidas altamente peligrosos o sea por todos los plaguicidas.

Expertos en fitoprotección determinaron que los factores institucionales y el factor información son los que más estimulan el uso de plaguicidas. Además, los factores que influyen en el precio tales como la exoneración de impuestos para plaguicidas y para insumos complementarios, así como la aceptación de efectos negativos provocados por plaguicidas, se consideraron relevantes para estimular el uso de plaguicidas. En un segundo paso los expertos determinaron cuatro grupos de instrumentos políticos[5] según los criterios siguientes:

5 Las cuatro categorías de instrumentos políticos incluyen impuestos, subsidios, una combinación de impuestos y subsidios así como instrumentos regulatorios.

- costos administrativos de implementación,
- efectividad en lograr el objetivo ambiental,
- impacto al ingreso de los agricultores,
- grado de aceptación por parte de los agricultores,
- grado de aceptación por la sociedad,
- factibilidad política.

Los instrumentos regulatorios (prohibición y restricción) fueron evaluados como los más favorables a pesar de las ampliamente conocidas deficiencias en la implementación de las leyes y de las medidas administrativas. Se suponía que la combinación de impuestos y subsidios eran más efectivos en lograr el objetivo ambiental que impuestos sin subsidios y de ser más aceptables por los agricultores. Sin embargo, se esperaba que impuestos ambientales se podrían difícilmente realizar.

List of Abbreviations

CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
cif	cargo, insurance, freight
CNAA	Cámara Nacional de Agricultura y Agroindustria
CNP	Consejo Nacional de Producción (National Council of Production)
CRC	Costa Rica Colones
DGPA	Direccíón General de Proteccíón Agropecuaria (MAG's Crop Protection and Animal Health Service)
DGSV	Dirección General de Sanidad Vegetal (MAG's former Crop Protection Service)
FAO	Food and Agriculture Organization of the United Nations
FEDECOOP	Federación de Coopera-tivas de Caficultores R.L.
fob	free on board
GATT	General Agreement on Tariffs and Trade
GNP	Gross National Product
GTZ	Deutsche Gesellschaft für Technische Zusammen-arbeit (GTZ) GmbH
ha	hectare
HS	Harmonized Commodity Description and Coding System
ICAA	Instituto Costarricense de Acueductos y Alcantarillados
ICAFE	Instituto Costarricense de Café
IICA	Instituto Interamericano de Cooperación para la Agricultura
INCIENSA	Instituto Costarricense de Investigación y Enseñanza en Nutrición y Salud
IPM	Integrated Pest ManagementMAG
	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
MEIC	Ministerio de Economía, Industria y Comercio (Ministry of Economy, Industry and Trade)
MH	Ministerio de Hacienda (Ministry of Finance)
MINAE	Ministerio del Ambiente y de Energía (Ministry of the Environment and Energy)
MS	Ministerio de Salud (Ministry of Health)
n.a.	not available
n.c.	not classified
PIC	Prior Informed Consent
PPUNA	Programa de Plaguicidas de la UNA
SEPSA	Secretaría Ejecutiva de Planificación del Sector Agropecuario
t	tons
TSS	Ministerio de Trabajo y Seguridad Social (Ministry of Labor and Social Security)
UCR	Universidad de Costa Rica
UNED	Universidad Nacional Estatal a Distancia
UNA	Universidad Nacional de Costa Rica
USAID	United States Agency for International Development
USD	United States Dollar
WHO	World Health Organization
WTO	World Trade Organization

1 Introduction

For many years pesticides have been considered an indispensable ingredient of the modern agricultural technology package. In many cases they helped to sustain intensive monocultural production systems, however, in other cases the emergence of pesticide resistance made it impossible to continue growing a crop. In the recent past pesticide use has become one of the most controversially discussed issues in agriculture mainly due to proven and assumed side effects.

The hypothesis of this study is that in many cases the level of pesticide use is above the optimum, both from the private[6] and from the social[7] point of view. How could this happen? One reason may be the fact that pesticide use for a long time has only been seen as a purely technical matter. The level of pesticide use seemed to be determined by pest incidence, i.e. the need to protect agricultural production. In fact, the political and economic framework of a country may have a strong impact on pesticide use.

Registration of pesticides, pesticide management, safe use training and other related activities are classic fields of pesticide policies. This paper suggests the consideration of all policies that have an impact on pesticide use as pesticide policies, including pesticide trade and sales policies. It focuses on the impact of the economic and institutional policy framework on pesticide use. The key question is whether this framework stimulates unilateral pesticide use or the adoption of non-chemical pest management methods.

According to the "Guidelines for Pesticide Policy Studies" (AGNE, S., G. FLEISCHER, F. JUNGBLUTH, H. WAIBEL, 1995) the driving forces of (excessive) pesticide use have been classified into four groups:

- institutional factors (e.g. legislation),
- information (information provided by extensionists, pesticide retailers, the chemical industry, etc.),
- price factors (e.g. reduced sales tax or tariffs),
- the lack of consideration of external costs of pesticide use.

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6 The private optimum, i.e. the maximum net benefit for farmers, is calculated on the base of short run costs and benefits of production on the farm level. External costs of production are not considered.

7 The social optimum, i.e. the maximum net benefit for the society as a whole, does include costs, that may be external for individuals, but not for society.

The research has been carried out in cooperation with a broad spectrum of organizations and individuals concerned with political and economic conditions of pesticide use. Numerous interviews and discussions have been conducted with experts from government agencies, technical service organizations, the chemical industry and farmers' and consumers' organizations. In December 1995, a seminar-workshop on pesticide policies in Costa Rica took place at IICA's headquarters in San José, Costa Rica, where specialists from different ministries, universities, research centers, the industry and the Federation of Coffee Cooperatives (FEDECOOP) met to discuss Costa Rica's actual crop protection policy.

The data used in this paper has been collected in Costa Rica between fall 1994 and spring 1996. It includes a compilation and analysis of information in the fields of pesticide markets, pesticide productivity, externalities of pesticide use and pesticide policy. Chapter 2 of this report gives a short overview of Costa Rica's agricultural sector. Chapter 3 discusses pesticide markets and pesticide use in Costa Rica. Recent developments in Costa Rican agricultural and environmental policies related to pesticide use are summarized in Chapter 4. In Chapters 5 and 6 pesticide policies were analyzed from four different perspectives : the institutional setting, availability of information, price distortions and negligence of external effects provoked by pesticides. Chapter 6.2 summarizes a selection of case studies that illustrates the existence of external effects, but it is far from showing the whole range of externalities incurred by pesticide use in Costa Rica. Finally, the determinants of pesticide use as evaluated by crop protection experts of various organizations in Costa Rica is presented in Chapter 7.

The five appendices of this paper contain a map on agroecological zones in Costa Rica, an overview of agricultural production, background data on pesticide use, on pesticide taxation in Costa Rica and background information on the expert survey described in Chapter 7.

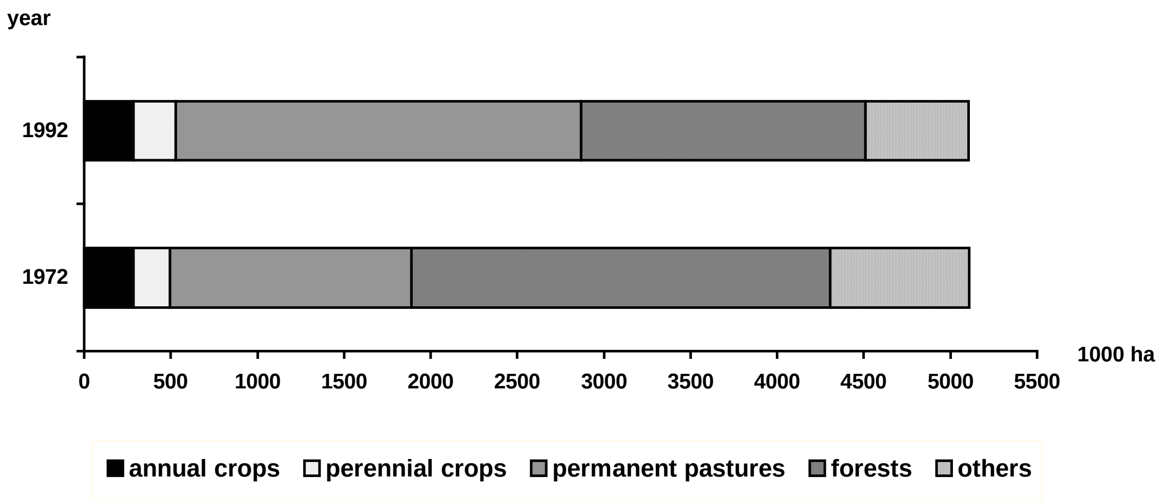
2 Characteristics of Costa Rica's Agricultural Sector

Agriculture is a major economic activity in Costa Rica. In 1994, 21.5 % of the total working force were employed in agriculture and the agricultural sector contributed 18.4 % to the GNP (SEPSA, 1995). The share of agricultural exports from total exports varied between 66.8 % in 1989, 72.8 % in 1992 and 66.6 % in 1994 (SEPSA, 1995).

2.1 Land Use

Land use in Costa Rica changed significantly between 1972 and 1992. Permanent pastures increased by almost 68 % mainly at the expense of forest land. The areas cultivated with annual crops remained constant at a level of 285,000 ha while cultivation of perennial crops increased by 15.6 % from 212,000 ha to 245,000 ha.

Figure 1: Changes in land use in Costa Rica from 1972 to 1992[8]



Source: FAO (1994)

Areas cultivated with annual and perennial crops are of special interest for this paper[9]. From 1990 to 1994 the agricultural area dedicated to export crops increased significantly. Banana production almost doubled from 28,300 ha to 52,700 ha.

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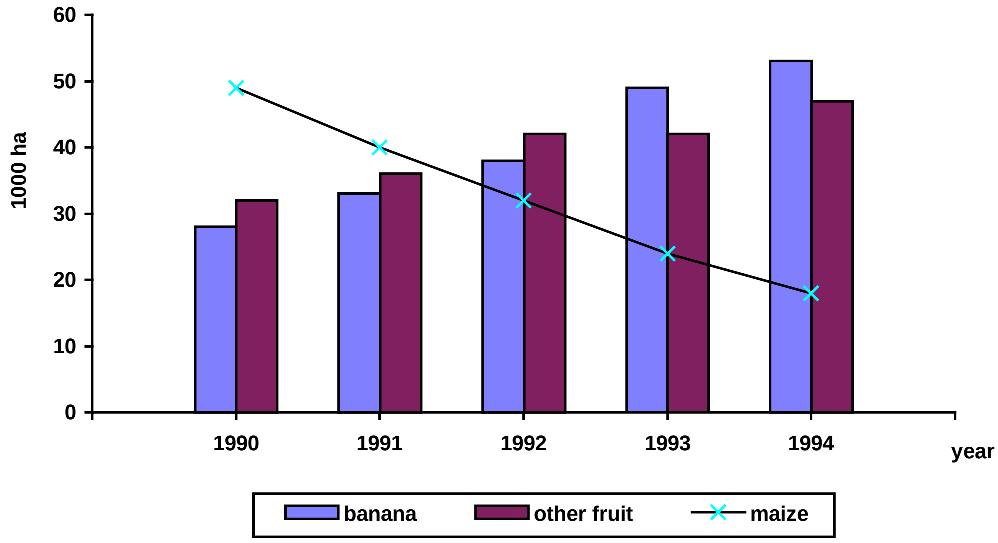
[8] FAO estimates

[9] Table 2.1 in appendix 2 gives an overview of areas cultivated with the most important crops in Costa Rica from 1990 to 1994.

The area cultivated with ornamentals expanded from 3,400 ha to 4,280 ha and fruit growing, excluding banana crops, increased by approximately 85 %, from 20,526 ha to 31,363 ha. Tobacco growing expanded slightly, while the coffee and sugar cane areas remained almost constant and cocoa and cotton growing diminished. The rice area virtually did not change, bean and maize areas decreased, the latter by more than 50 % from 49,381 ha to 17,561 ha. (SEPSA, 1996).

Figure 2: Changes of banana and other fruit[10] areas in Costa Rica compared to maize cultivation from 1990 to 1994



Source: SEPSA, 1996

This development is related to agricultural trade liberalization and the promotion of horticultural export crops. Protection for basic grain production in Costa Rica was reduced significantly which had a strong impact on maize production. The shift towards cultivation of pesticide intensive horticultural crops supposedly has a stimulating effect on the demand for chemical pesticides in Costa Rica.

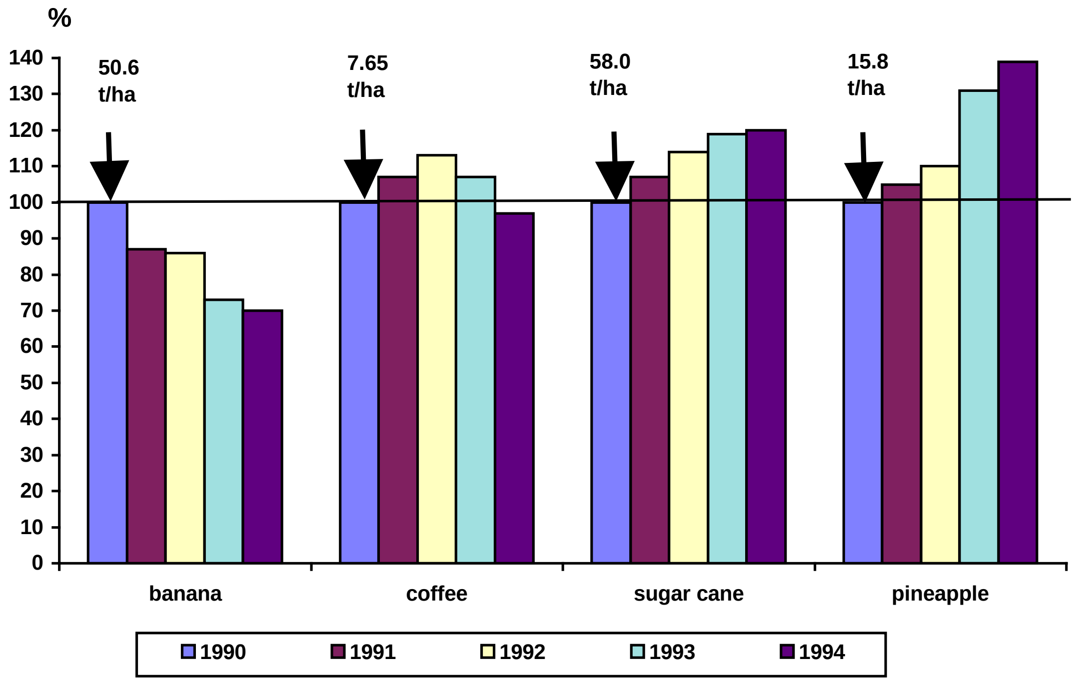
2.2 Productivity in Crop Production

Table 1.3 in Appendix 1 gives an overview of the average productivity in Costa Rican crop production between 1990 and 1994. The yield variation of four key crops is displayed in Figure 3. Coffee berry yields varied between 7.65 and

10 "Other fruit" comprise macadamia nut, melon, mango, orange, pineapple

8.63 t/ha which means they remained at a level more than twice as high as the North and Central American average (FAO, 1994). At the same time productivity in banana production declined by 29 % from average yields of 50.6 t/ha to 35.8 t/ha. Pineapple yields increased by over 31 % from 15.8 t/ha to 20.7 t/ha and sugar cane yields increased by 19,7 %. Yield variations suggest that there is a potential for growth in pineapple and sugar cane productivity while coffee productivity is at its peak and banana productivity is continuously declining. Decreasing average yields in banana production are related to fungicide resistance of *Mycosphaerella fijiensis* (see also section 6.2.3) and to the extension of the banana growing area into less favorable areas.

Figure 3: Variation in average yields from 1990 to 1994 in banana, coffee, sugar cane and pineapple production (1990 = 100%)



Source: author's calculations based on SEPSA (1996) and ICAFE (1995)

3 Pesticide Trade and Pesticide Use in Selected Crops

This chapter demonstrates first the evolution of *pesticide markets* in Costa Rica from 1990 to 1994 and then introduces *pesticide use* in selected crops. *Pesticide formulation* has become increasingly important in Costa Rica, where 21 companies formulate, pack and bottle pesticides. FORMUQUISA, one of the most important Costa Rican agrochemical companies also produces two active ingredients: Glyphosate and Propanyl (CÁMARA DE INSUMOS AGROPECUARIOS, personal communication). Some firms formulate PIC list or potential PIC list pesticides such as Paraquat, Aldicarb, Methomyl, Methyl Parathion, Monocrotophos, Methamidophos, Ethoprop, Phenamiphos, Phorate, Mirex, Terbufos (DINHAM, 1993).

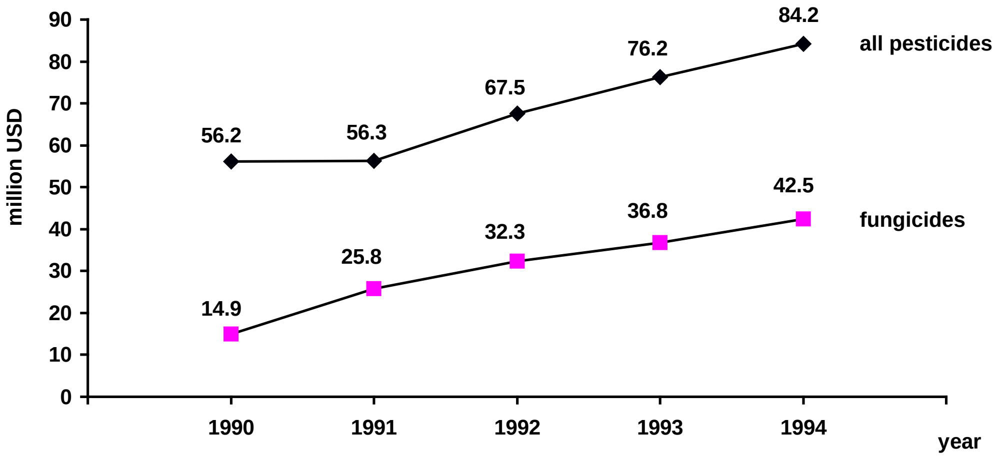
3.1 Pesticide Imports

The value of Costa Rica's chemical pesticide imports in nominal terms increased from 56.2 million USD in 1990 to 84.2 million USD in 1994, which is equivalent to a shift of 28 million USD or almost 50 %. Costa Rica is a growing market for chemical pesticides, above all for fungicides whose imports almost tripled from 14.9 million USD in 1990 to 42.5 million USD in 1994.

Imported quantities of fungicides increased from 2.5 million units (kg+l) to 4.3 million units. Most of this variation can be explained by the extension of the banana growing area in Costa Rica and the need to increase fungicide applications per hectare in banana plantations because *Mycosphaerella fijiensis* (Sigatoka negra), the most prevalent fungal disease in banana production, has become less susceptible to fungicides.

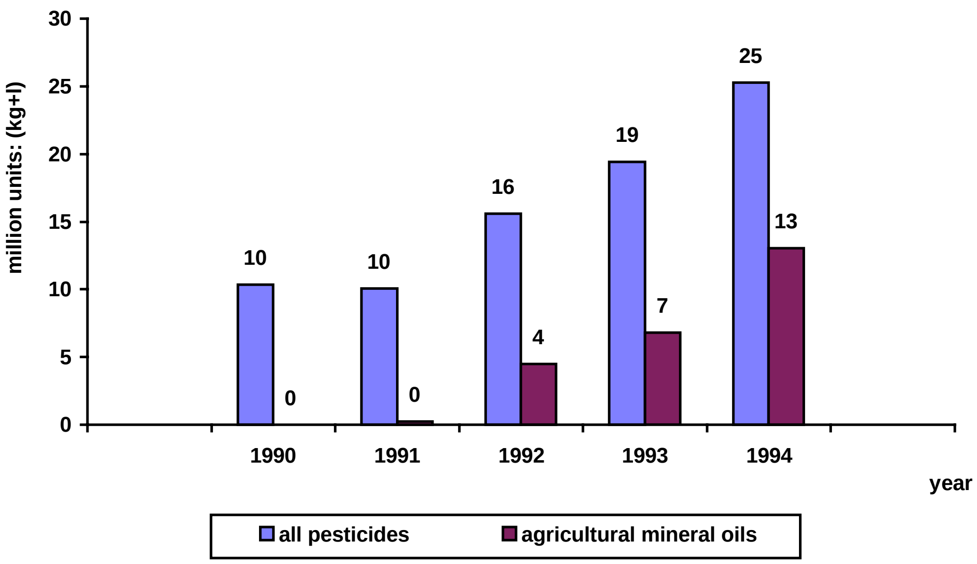
Nematicides, some fumigants and some insecticides are highly toxic substances and therefore belong to classes Ia, Ib or II of WHO's pesticide classification. In the period from 1990 to 1994 the *value* of nematicide imports decreased from 2.47 million USD to 1.81 million USD while the value of insecticide and fumigant imports increased from 0.89 million USD to 1.3 million USD and from 0.28 million USD to 0.64 million USD, respectively.

Figure 4: CIF-value of chemical pesticide imports to Costa Rica from 1990 to 1994 (in current USD) [11]



Source: Cámara de Insumos Agropecuarios, revised by Dr. Bernal Valverde, CATIE, and by the author

Figure 5: Quantities of pesticides imported to Costa Rica from 1990 to 1994 (technical material and formulated products in million units [kg+l])



Source: Cámara de Insumos Agropecuarios, revised by Dr. Bernal Valverde, CATIE, and by the author

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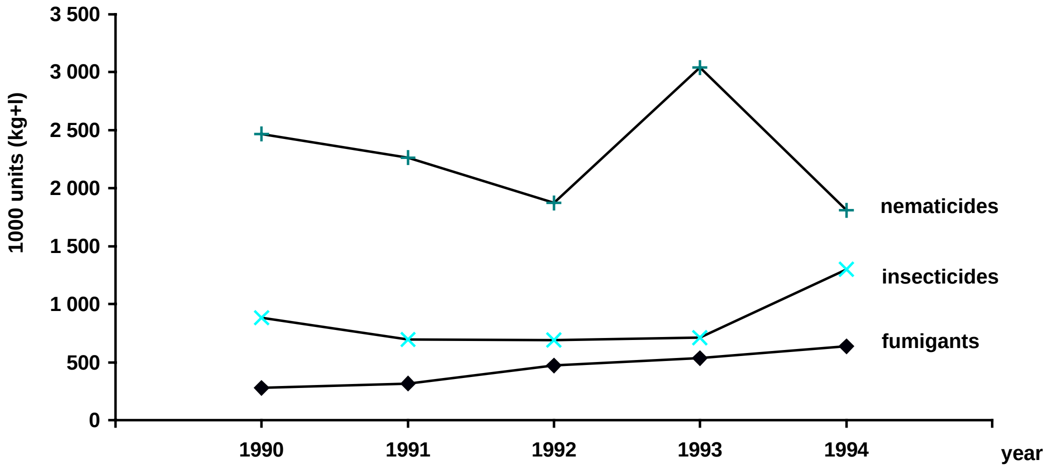
11 Chemical pesticides include fumigants, fungicides, herbicides, insecticides, mollusquicides, nematicides, etc. as well as coadjuvants.

From 1990 to 1994, the total volume of pesticide imports grew from 10.3 million units (kg+l) to 25.3 million units. This increase of 146 % was mainly caused by expanding imports of agricultural mineral oils which were classified as adjuvants.

The variation of imported *quantities* of fumigants, nematicides and insecticides is shown in Figure 6; imported volumes of fumigants and insecticides increased, while volumes of nematicide imports were variable in the observation period.

Figure 6: Volumes of fumigants, nematicides and insecticides imported to Costa Rica from 1990 - 1994 (in 1000 units)



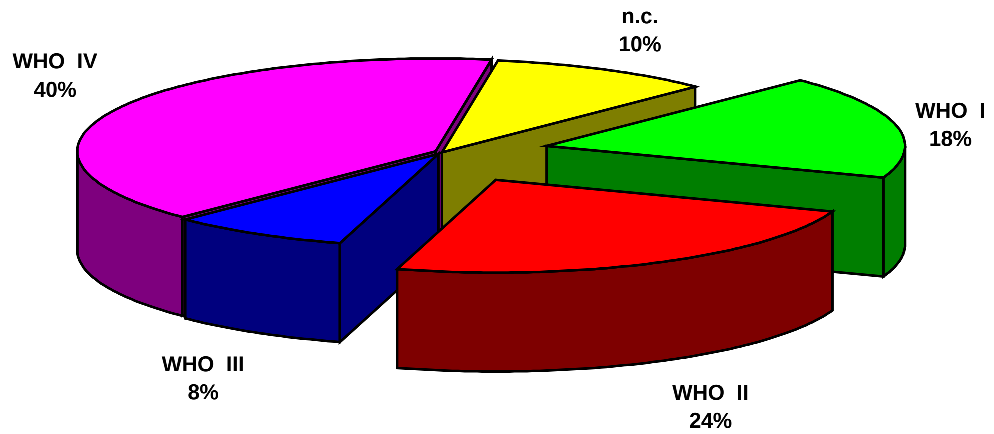
Source: Cámara de Insumos Agropecuarios, revised by Dr. Bernal Valverde, CATIE, and by the author

The value of *Bacillus thuringiensis* imports, a biological pesticide, has increased from about 170,000 USD in 1990 to about 262,000 USD in 1994, while imported quantities of *B. thuringiensis* increased from 14,509 kg to 44,537 kg. This implies a decrease of the cif-price for this product from 11.72 USD/kg to 5.88 USD/kg. More widespread use of *B. thuringiensis* may be an indicator of the growing acceptance of biological pest control among farmers.

All data presented in this chapter include technical material and formulated products. Variation in imported volumes of pesticides as documented in official import statistics may be different from the variation at the active ingredient level. In other words, importing a given quantity of an active ingredient as concentrated technical material will lead to lower numbers in import statistics than importing the same quantity of an active ingredient as a formulated product. Therefore, import data can only be interpreted as an estimate for actual pesticide imports.

The National University's Pesticide Program *(PPUNA)* in Heredia, Costa Rica, analyzed Costa Rican pesticide imports according to WHO's toxicity classification. In 1993 about 18 % of all pesticide imports (in volume terms) belonged to WHO categories Ia, extremely hazardous, and Ib, highly hazardous as indicated by Figure 7. WHO until now has only classified solid or liquid pesticides, not those that are applied as fumigants such as Methyl Bromide[12]. The large fraction of unclassified pesticides often contains these harmful substances (CHAVERRI, F. and J. BLANCO, 1995 and Dr. INEKE WESSELING, PPUNA, personal communication).

Figure 7: Volumes of pesticide imports to Costa Rica in 1993 according to WHO's toxicity classification[13]



Source: Chaverri, F. and J. Blanco (1995)

In 1994, the United States of America was the biggest supplier of pesticides to Costa Rica, covering 37 % of its pesticide imports. Seventeen percent of the pesticide imports were imported from Switzerland, 14 % from Germany, and 11 % from Colombia.

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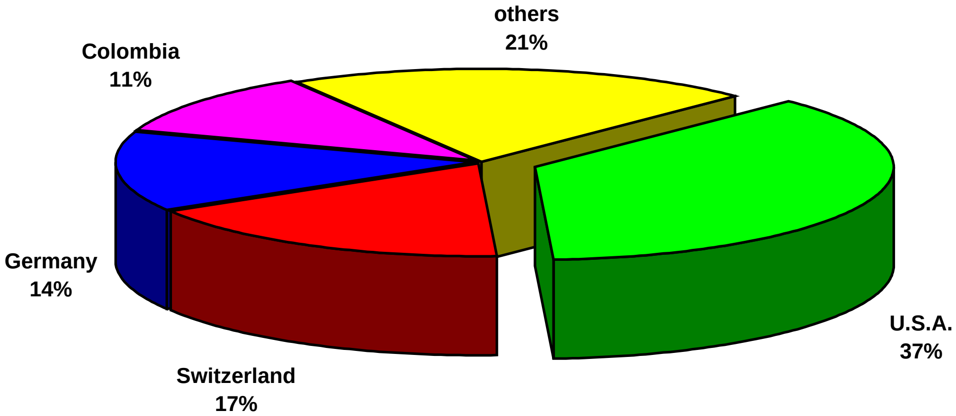
12 Methyl Bromide is highly in debate, not only as regards toxicity but also as a potential ozone depleting substance.

13 The WHO-classification presupposes judicious and safe use of pesticides: WHO Ia = extremely hazardous, WHO Ib = highly hazardous, WHO II = moderately hazardous, WHO III = slightly hazardous, WHO IV = not hazardous (when used appropriately), n.c. = not classified.

Figure 8: Origin of pesticide imports in 1994 by country (in % of cif-value)



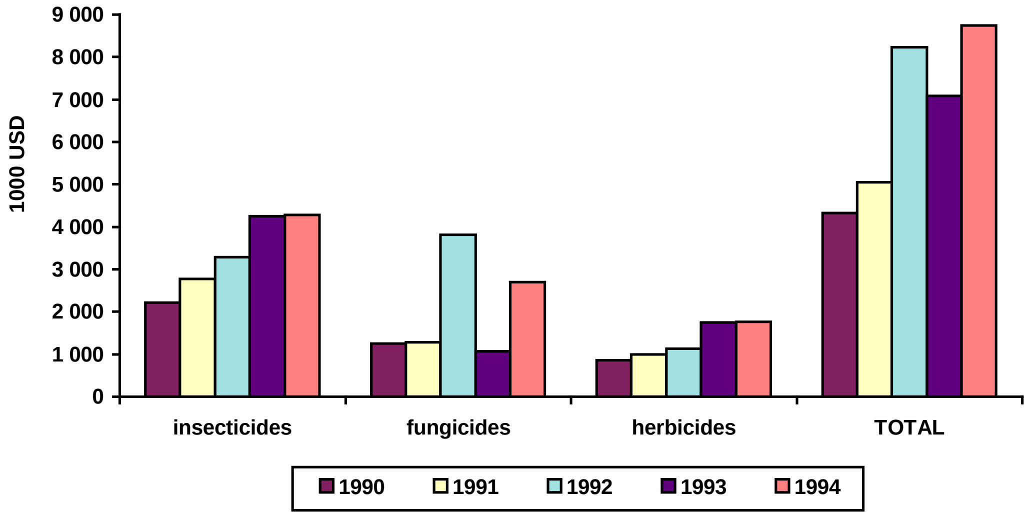
Source: Cámara de Insumos Agropecuarios, revised by the author

3.2 Pesticide Exports

Costa Rica's Ministry of Economy, Industry and Trade (MEIC) provides aggregate data on pesticide exports from Costa Rica, defining three groups of pesticides: insecticides, fungicides and herbicides. More detailed information on formulated products or active ingredients exported from Costa Rica is not available. The value of pesticide exports equals less than 1 % of the value of all Costa Rican exports (MEIC, SEPSA, 1993, own calculations) and therefore can be considered of relatively low importance for the Costa Rican economy.

Between 1990 and 1994, the value of pesticide exports in nominal terms more than doubled. Exports of all classes of pesticides, namely insecticides, herbicides and fungicides, expanded in the above named 5-year period by almost 100 %. Insecticides are the most important group of export pesticides, making up approximately half of the total value of pesticide exports (see figure 9). The increase of the value of herbicide exports is partly related to a modification in the export registration scheme for growth regulators that have been classified as "herbicides" since November 15, 1993 (MEIC, DIRECCIÓN GENERAL DE ESTADÍSTICAS Y CENSOS).

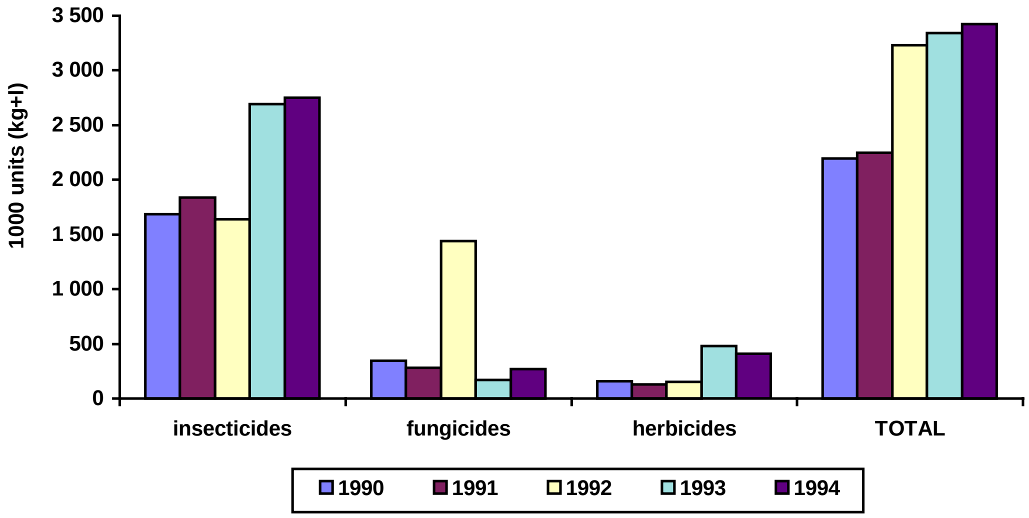
Figure 9: Fob-value of pesticide exports from Costa Rica from 1990 to 1994 (in 1000 current USD)



Source: MEIC, Dirección General de Estadística y Censos

Figure 10 shows the evolution of quantities of pesticides exported from Costa Rica in the period from 1990 to 1994. Export quantities also increased significantly with insecticides being the dominating class.

Figure 10: Volumes of pesticide exports from Costa Rica from 1990 to 1994 (in 1000 units [kg+l])

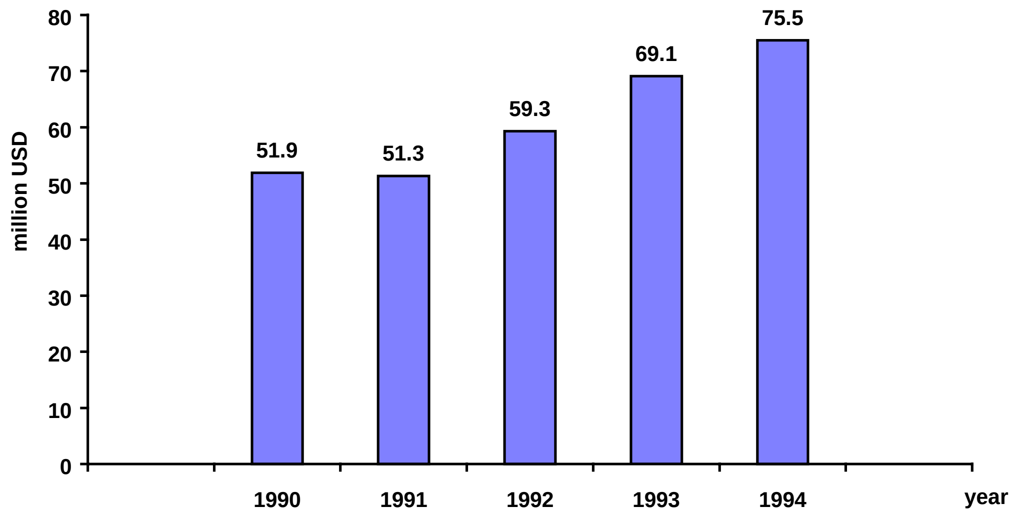


Source: MEIC, Dirección General de Estadística y Censos

3.3 Pesticide Use in Selected Crops

At this stage neither data on the value added in Costa Rican pesticide production nor on the value of pesticides purchased in Costa Rica is available. Therefore only pesticide trade may be used as an indicator for pesticide use in this country. Actual expenses for pesticides in Costa Rica are well above this figure because Costa Rica has a significant pesticide formulating industry. In figure 11 the values of net pesticide imports from 1990 to 1994 are shown (value of pesticide imports - value of pesticide exports). With those numbers an approximation for pesticide expenses per hectare agricultural land can be calculated. In 1994 more than 170 USD were spent per ha agricultural land.

Figure 11: Net imports of chemical pesticides to Costa Rica from 1990 to 1994 - value in current USD

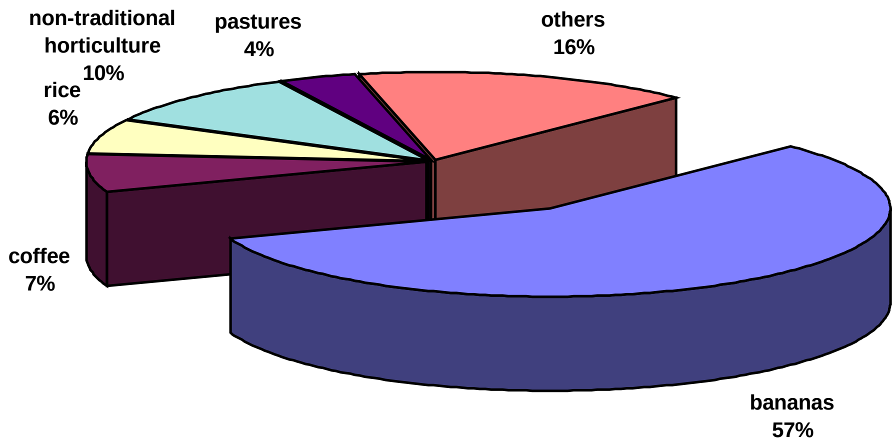


Source: author's calculations based on figures 4 and 9

Figure 12 illustrates the 1993 pesticide market in Costa Rica. Fifty-seven percent of all pesticides were purchased for use in banana plantations although bananas occupied less than 10 % of Costa Rica's agricultural area. Pesticide expenses for non-traditional horticultural crops cover 10 % of the national pesticide market. Both, banana production and horticultural production are very pesticide intensive. In some horticultural production systems excessive pesticide use has been noted (ARAUZ, L.F. ET AL., 1983, cited in HILJE, L. ET AL., 1987).

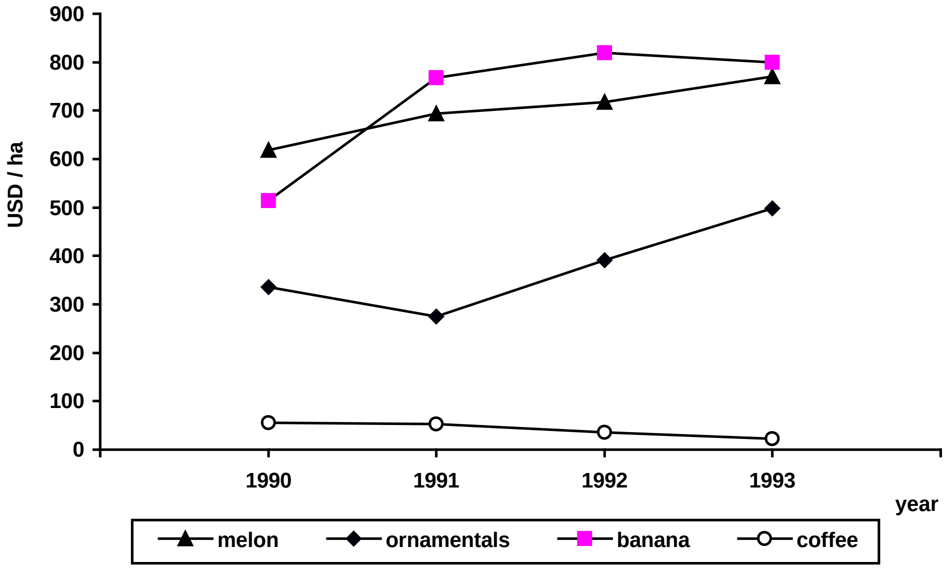
Compared to horticultural crops, coffee and rice are less pesticide intensive. In 1993, 6 % of all pesticides purchases were used in rice production which covers 13.6 % of Costa Rica's total agricultural area, while 7 % of all purchases were used for coffee production on 20 % of the agricultural land.

Figure 12: Pesticide use in selected crops in Costa Rica 1993 (in % of cif-value)



Source: CNAA (Cámara Nacional de Agricultura y Agroindustria), 1994

Figure 13: Expenses for pesticides per ha from 1990 to 1993 (in current USD)

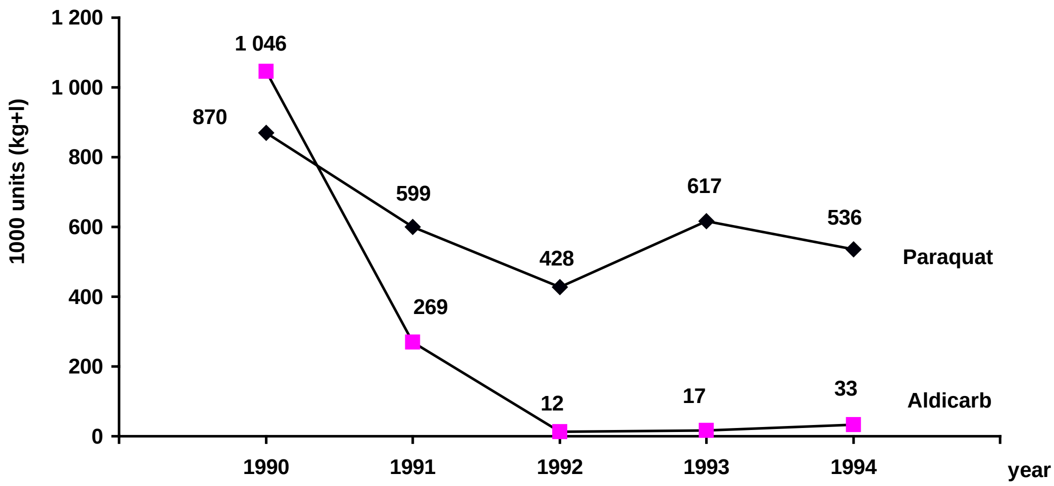


Source: BAYER DE COSTA RICA, personal communication

Low world market prices for coffee in the early nineties led to a decrease in pesticide use in coffee production. Contrary to this trend, pesticide use in some horticultural crops increased in the same period as shown in Figure 13.

Between 1987 and 1991 some of the most hazardous active ingredients were prohibited in Costa Rica[14]. However, sales of Aldicarb and Paraquat, both figuring among PAN's list of the "dirty dozen" have not been restricted yet. Only their use has been limited: In June 1991 Aldicarb was prohibited in banana plantations because illegal residues had been found in bananas exported to the U.S.A. (PPUNA, cited in DINHAM, 1993, p. 98). This led to a significant import reduction as shown in Figure 14. Paraquat cannot be used in annual crops after sowing, which is difficult to control. Paraquat imports are still significant.

Figure 14: Volumes of Paraquat and of Aldicarb imported to Costa Rica from 1990 - 1994



Source: Cámara de Insumos Agropecuarios, revised by Dr. Bernal Valverde, CATIE, and by the author

[14] See also appendix 3 with background information on pesticides.

4 Agricultural and Environmental Policies Affecting Pesticide Use

Many different areas of agricultural policy have an impact on crop protection decisions at the farm level. Promotion of "modern" agricultural production technologies, for example, has led to an increase in the use of agrochemicals. Furthermore, government interference in product markets by pricing and marketing policies affect decisions on input use. Based on economic theory high product prices lead to a relatively high pesticide intensity, while low product prices tend to lower external inputs such as pesticides.

4.1 General Outline of Costa Rica's Agricultural and Environmental Policies

Agricultural policy in Costa Rica has changed substantially since the beginning of the 1980's. As a consequence of two structural adjustment programs, a general withdrawal of state institutions from agricultural markets has taken place. The present administration which has been in office since May 8, 1994, has negotiated for a third structural adjustment program which implies a further reduction of the public sector.

Trade with agricultural commodities

In agricultural trade and production policy a further liberalization can be expected due to commitments made by the Costa Rican Government in a bilateral trade agreement between Costa Rica and Mexico, vis a vis GATT/WTO and in negotiations for a Central American Market. In the context of Costa Rica's integration into the world market, production systems in which Costa Rica is supposed to have comparative advantages have been promoted. Those include traditional export products like coffee, bananas, and beef and non-traditional export products like fruits, flowers and other ornamentals.

On the Central American Market no import duty is applied to non-sensitive agricultural products. For sensitive goods like milk and milk products, a licensing system is still in place but will supposedly be abandoned soon. Agricultural imports from third countries[15] are taxed with two types of ad valorem duties and a licensing system is applied to sensitive products[16]. These

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[15] All countries outside the Central American Market are considered as third countries.

[16] According to MAG's agricultural trade division the following agricultural products are considered to be sensitive: milk products, porcine meat, poultry, sausages, sugar, rice, white maize, beans, potatoes, tomatos, onions, flours, oils, alcohols, tobacco, jute tissues and textile fibers.

measures allow prices to be maintained above the world market prices for the respective products.

Costa Rica used to have market regulations for basic grains. CNP *(Consejo Nacional de Producción*), the National Council of Production, administered markets and fixed minimum prices. Beginning in 1995, guaranteed minimum prices for basic grains have been reduced and are expected to be abolished in the near future. This will allow the elimination of direct consumer subsidies to basic grains (MAG, 1994, p. 9).

A taxation system is applied to most agricultural export products. The commercialization of coffee is a special case because it is supervised by ICAFE[17], the Costa Rican Coffee Institute. Coffee can be taxed with ad valorem duties that vary depending on the fob-export price for coffee. Government earnings by taxing coffee production and trade almost diminished from 6.6 % of the government budget in 1989 to less than 0.1 % in 1993 (ICAFE, 1994: 103-105). However, in 1994, high coffee prices increased government revenues from coffee production.

Liberalization, efficient resource allocation and the environment

As mentioned in the previous section, liberalization of production and trade has had a negative impact on basic grain production while production of pesticide-intensive horticultural export crops increased. According to neoclassical trade theory, liberalization of markets leads to a more efficient resource allocation and an increase in welfare. Hereby, however, it is assumed that commodity prices reflect all production costs which in many cases is not true. Agricultural production that heavily relies on pesticide use, for example, causes substantial external costs that are not accounted for at the farm level and, thus, are not reflected by market prices. In this case, the market mechanism fails and specific policy measures are required to adjust factor allocation after true production costs which include external costs of production. If those costs are not taken into account, a burden will be accumulated that will have to be faced in the future.

Here the question arises: to what extent do environmental and health concerns play a role in the formulation of Costa Rican agricultural policy. Sustainable agricultural production is asserted to be the overall goal of the new agricultural

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[17] ICAFE = Instituto Costarricense de Café

policy[18], which implies that the intensity of pesticide use in different production systems must be an important issue for present policy orientation. Banana production is a well known example of unsustainable cropping system with high agrochemical inputs (RAMIREZ, A.L., C.M. RAMIREZ, 1980, THRUPP, L.A., 1988, 1991). Similarly, pesticide use in non-traditional export crops is discussed controversially. Putting more emphasis on the production of agricultural goods, where Costa Rica is supposed to have comparative advantages, without taking account of environmental and other social costs of production, will lead to a level of pesticide use above the social optimum.

Environmental Policy

In Costa Rica, environmental policy is based on laws and regulations that address specific problems. Competencies are distributed among different ministries, each of those being responsible for relatively small, well defined areas. These circumstances make it difficult to plan and coordinate activities.

The Organic Law of the Environment *(Ley Orgánica del Ambiente)*, published in the official journal "La Gaceta Oficial" on November 13, 1995, may serve as a basis for the elaboration of comprehensive environmental policy concepts for the future. It gives MINAE *(Ministerio del Ambiente y de Energía)*, the new Ministry for Environment and Energy, a coordinating role for environmental policies in Costa Rica.

MINAE replaced MIRENEM *(Ministerio de Recursos Naturales, Energía y Minas)*, the former Ministry of Natural Resources, Energy and Mining, which had been founded in 1986. In the nineties, MIRENEM had become the most important government agency dealing with environmental issues, executing activities in the fields of forestry, administration of the national park system, wildlife conservation, energy and mining, which were all based on respective laws (MIRENEM, 1994). One important area of activity was the supervision of environmental impact assessment for investment projects.

MIRENEM and now MINAE do not have substantial competencies in pesticide legislation. However, there has been an effort to include this ministry into the process of pesticide policy formation by giving it a seat in the "Comisión Asesora de Plaguicidas" (see section 5.1).

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[18] In 1995 MAG published a paper on agricultural policies facing the 21st century *(Políticas Agrícolas de Cara al Siglo XXI)*, which provides a general idea of the actual orientation of Costa Rica's agricultural policy.

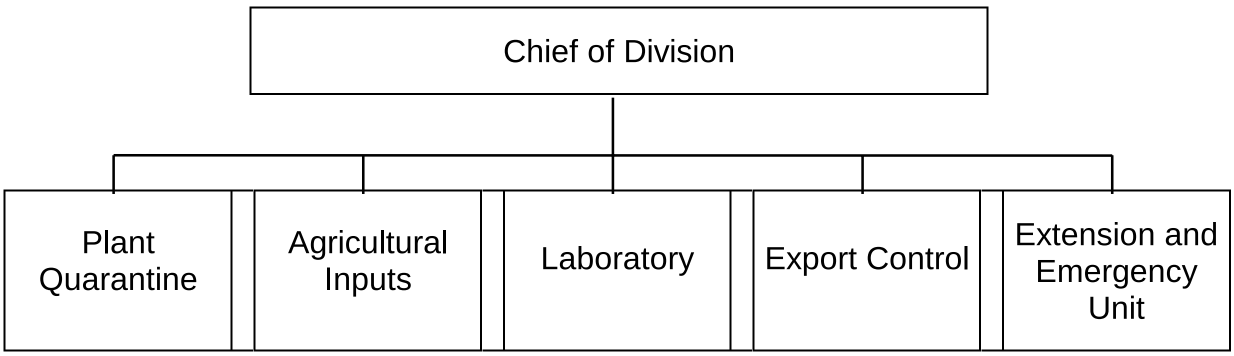
4.2 MAG's Crop Protection Service

Costa Rica's Crop Protection Service *(Dirección General de Sanidad Vegetal)* formerly was an independent unit within the Ministry of Agriculture *(MAG)*. In early 1995, it was merged with the Animal Health Service *(Dirección General de Salud Animal)* to form the General Directorate of Agricultural Protection *(Dirección General de Protección Agropecuaria = DGPA)*. This new department has undergone a process of restructuring which has not yet been finalized.

Present organization

Currently, both of the formerly independent units operate in two separate divisions. Each division has five sub-sections. The Crop Protection Service is organized as shown in the following diagram (Figure 15).

Figure 15: Organization of Costa Rica's Crop Protection Service within DGPA



Source: DGPA

The sub-section for agricultural inputs is responsible for all technical pesticide issues, i.e. registration of pesticides; control of pesticide quality and imports; and residue analysis. In this section, about 400 vegetable samples from local producers are analyzed per year.

Funding of the Agricultural Protection Service

The DGPA has three sources of income:

- the government budget,
- funds obtained for services,
- a 0.5 % fee on the cif-price of all agrochemical imports.

Funds obtained for services such as residue control and the fee on agrochemical imports are revenues that are exclusively managed by DGPA (own resources). According to the Crop Protection Law, the funds obtained by the import fee have to be used to finance official laboratories for pesticide residue analyses in foodstuffs and for pesticide quality control.

Recent data on the budget of the Crop Protection Service is not available. However, in 1993, the former Crop Protection Service *(Dirección General de Sanidad Vegetal)* spent about 150 million CRC, or approximately 1.05 million USD[19].

At present, the DGPA employs 318 civil servants; 258 of which are paid through the government budget, and 60 through the other two sources of funding. The government budget covers only about 10 % of the operational budget as against 90 % provided by DGPA’s own resources. This makes DGPA relatively independent from the government's budgetary situation.

The Crop Protection Service’s pest outbreak budget

The Crop Protection Service has a special budget for emergency spraying operations which can vary considerably between years, depending on the occurrence of pests. This contingent budget, as most of DGPA's operational funds, is administered independently by DGPA, and is not linked to the government budget. Funds that are not spent in one fiscal year can be used in the following year.

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[19] average exchange rate in 1993: 1 USD = 142.44 CRC (Banco Central de Costa Rica)

5 The Institutional Framework of Pesticide Use and the Role of Information in Crop Protection

5.1 Pesticide Policy Formulation

As in many other countries pesticide policy has two components : command and control and economic incentives. However, pesticide regulatory policy and taxation of agricultural inputs have always been considered to be two separate fields of work. On the one hand, MAG, the Ministry of Health (MS) and the Ministry of Labor (MTSS) have been responsible for technical aspects of pesticide use, such as pesticide registration and residue analysis. On the other hand tax exemptions have been handled by the Ministry of Finance (MH) and the Ministry of Economy, Industry and Trade (MEIC).

Public and private institutions are involved in the process of pesticide policy formulation. Two advisory committees play an important role in this field (Table 1), namely the Pesticide Assessory Commission (Comision Nacional de Plaguicidas) and, the Commission deciding on tax exemptions (Comisión técnica de exoneración de insumos agropecuarios).

MAG and the National Chamber of Producers, Importers and Distributors of Agricultural Inputs (Cámara de Insumos Agropecuarios) are the only entities represented in both commissions where MAG has the leadership. All other institutions only take part in one commission. Pesticide and pest management experts from universities and research institutions at present are not part of either commission[20]. Farmers, farm laborers, consumers and environmental groups are rather excluded in the process of policy formation, although these groups are affected by the consequences of pesticide policy decisions.

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20 This was not true, though, at the beginning of the 1980's, when a representative of the University of Costa Rica *(Universidad de Costa Rica)* was a commission member (HILJE, L. ET AL., 1987).

Table 1: Composition of Costa Rica's Pesticide Assessory Commission and of the Commission deciding on tax exemptions

Institution	**Number of representatives**	
	Pesticide Assessory Commission[21]	Commission deciding on tax exemptions[22]
Ministry of Agriculture and Livestock (MAG)	◐ + ■	◐ + ■
Ministry of Health (MH)	■	
Ministry of Labor (MTSS)	■	
Ministry of the Environment and Energy (MINAE)	■	
Ministry of Economy, Industry and Trade (MEIC)		■
Ministry of Finance (MF)		■
National Center for Poisoning Monitoring	■	
Cámara de Insumos Agropecuarios[23]	■ + ■	■
Cooperatives (FEDECOOP)		■
Agronomists' Association[24]	■	
TOTAL	**9**	**6**

◐ = president of the commission, ■ = commission member

[21] Comisión Asesora Nacional de Plaguicidas
[22] Comisión Técnica de Exoneracón de Insumos Agropecuarios
[23] National Chamber of Producers, Importers and Distributors of Agricultural Inputs *(Cámara de Fabricantes, Importadores y Distribuidores de Insumos Agropecuarios)*, from now on referred to as the *"Cámara de Insumos Agropecuarios"*.
[24] The "Association of Agronomists" is the professional association of all agronomists in Costa Rica.

Pesticide Assessory Commission

The Pesticide Assessory Commission *(Comisión Asesora Nacional de Plaguicidas)*[25], a technical advisory committee to the Ministers of Agriculture, Health and Labor, has the responsibility of revising all valid legislation related to pesticides with the aim of proposing reforms, if necessary, and of reaching an effective cooperation between institutions that further develop pesticide policy. Its recommendations must follow national and international norms. In addition, the commission has responsibilities in the following fields:

- permanent promotion of educational and extension programs about negative effects of inadequate use of pesticides;
- monitoring of pesticide quality, adequate pesticide dosage for agricultural and domestic use and promotion of legislation on residues and tolerances of pesticides;
- study and evaluation of applications for registration of products that are not authorized in the country of origin, upon request of MAG's Crop Protection Service;
- examination or revision of approved pesticide registration records with the intention of relaying observations to MAG' s Crop Protection Service.

The commission is composed of professionals that occupy decision making positions in the institutions mentioned. Because of the responsibilities the commission members have in their respective fields of work, problems of attendance to the commission meetings are frequent, while activities besides the scheduled meetings can hardly be carried out (BARQUERO ARCE, 1993). After not having met for almost one year, the commission renewed activities in mid 1995 (CÁMARA DE INSUMOS AGROPECUARIOS, personal communication).

Commission on tax exemptions

An extensive list of agricultural inputs, including agrochemicals and equipment for its application are exempted from all taxes[26]. Tax exemptions can be decided by the Minister of Finance on the recommendation of the Commission on Tax Exemption. The commission has a technical secretary, who is based at MAG's Crop Protection Service. The representative of the Ministry of Agriculture and Livestock presides over the commission. The commission can meet and make decisions if at least three members are present, among those

[25] This commission was established by Ministerial Decree No. 2580 on 11 October 1972.

[26] All legal tax exemptions are specified by Regulation No. 21281-MAG-H-MEIC, valid since April 3, 1992, which is based on Law No. 7293.

the president of the commission and a representative of another state institution. Agreements of the commission are taken by a simple majority, in the case of a tie the president executes the deciding vote.

5.2 Pesticide Legislation: Laws and their Implementation

International legislation

Costa Rica agreed to the FAO Code of Conduct including the Prior Informed Consent and therefore has the obligation of making efforts to implement these international agreements. Besides, US- and EU-legislation on residues in imported foodstuffs are of vital interest to Costa Rica, because agricultural exports are almost exclusively oriented towards the United States of America and to the European Union (LA NACIÓN, 12 January 1995). The rejection of Costa Rican exports may cause significant setbacks.

Costa Rica's national legislation

Costa Rica's legislation in crop protection in Central America is advanced. Different institutions are involved in pesticide legislation, among which the Ministry of Health and MAG are the leaders. The Ministry of Health has the overall responsibility for legislation and supervision related to toxic substances, of which chemical pesticides are an important fraction[27]. Occupational safety has to be determined and regulated by the Ministry of Health in cooperation with the Ministry of Labor[28]. Recommendations developed by the Ministry of Health are to be implemented by the Ministry of Agriculture.

The 1968 Crop Protection Law *(Ley de Sanidad Vegetal[29])* and its revised version of 1978[30] form the basis for numerous regulations and decrees on pesticide registration and use. A recent study about pesticide legislation in Costa Rica gives a good overview of developments until the end of 1994 (CASTRO, 1995). It suggests the development of one legal instrument that regulates all aspects of pesticide use in order to achieve a more coherent and understandable pesticide legislation. The author emphasizes that public entities involved in pesticide issues as well as private agents often do not manage the laws they should apply and that sometimes they do not know the legislation.

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27 Health Law 5395 of 1974, Title III, Chapter 7, Article 345, Item 8, cited in USAID/RENARM, 1992
28 Health Law 5395 of 1974, Title III, Chapter 7, Article 452, Item 10, cited in USAID/RENARM, 1992
29 Law No. 4295
30 Law No. 6248

Execution of the laws and monitoring

In Costa Rica, MAG is the dominating government agency in implementation and monitoring of pesticide legislation and is responsible for all technical aspects of pesticide use. At MAG, the Agricultural Inputs Department *(Deparamento de Insumos)* is in charge of the registration of pesticides and of controlling their appropriate use. It analyzes technical information provided by the industry and administers import statistics for agrochemicals. At the same time, it is responsible for pesticide residue analyses in foodstuffs carried out by two national residue analysis laboratories.

The Ministry of Health has to evaluate whether or not toxicity levels of pesticides are tolerable for human beings and the Ministry of Labor is responsible for the supervision of occupational risks related to pesticide use. In Costa Rica, two government agencies are in charge of food and surface and ground water quality control. ICAA *(Instituto Costarricense de Acueductos y Alcantarillados)* and INCIENSA *(Instituto Costarricense de Investigación y Enseñanza en Nutrición y Salud)* monitor bacterial contamination of food and water, but they do not check for pesticide residues. For pesticide residue monitoring in agricultural products MAG has two pesticide residue laboratories, where about 400 vegetable samples from the Costa Rican market are analyzed each year.

Although Costa Rica has made considerable progress in pesticide legislation during the last 10 years, implementation of the laws has proven to be difficult. There are three major reasons for this:

- prohibitively high control costs due to the huge number of individuals dealing with pesticides,
- the few resources that are available for monitoring are distributed among different government agencies which generally operate independently from each other, and
- violators of the law are often not punished (or not seriously enough) because the administration feels that farmers and retailers need time to adjust to the relatively new legislation.

CASTRO (1995) states that the legislation involves too many institutions in the monitoring of pesticide use which leads to interinstitutional friction and neglectance of duties, because it assumed that other institutions handle the issue. Four entities, for example, are involved in controlling the adequacy of pesticide retailers' storage facilities etc., namely MAG, the Ministry of Health, the Ministry of Labor and the Association of Agronomists[31]. To fulfill this task, each institution has inspectors that visit agrochemical shops examining aspects related to the interests of his institution. Resources are scarce and therefore the total number of inspectors is not sufficient to control a sufficiently high number of pesticide distributors. It would be advantageous to group the efforts by either giving the controlling authority to only one public entity or to ask inspectors to look at all aspects related to agrochemicals distributors and to report to all Ministries involved.

5.3 Agricultural Credit[32]

Banks, in general, have a strong influence on the dominant agricultural production technology. They give recommendations to farmers who seek loans and, if considered necessary, give technical assistance to farmers during the production process.

In Costa Rica, requirements for a bank loan contain financial and legal information about the farmer to make sure that he will be able to cover the loan. Every farmer who seeks credit must submit details on the crops he intends to grow and also on his production technology. Credits may be given in shares, obliging the farmer to document his expenses of the previous period to make sure that the money provided was used for production purposes.

The banks interviewed in Costa Rica[33] do not impose specific credit requirements concerning crop protection. However, for every crop a technology package is proposed to the farmer which has been evaluated by an inter-bank-commission, the "Comisión Interbancaria". The bank guidelines on production technology, "avío bancario", determine the maximum amount of money eligible for a credit. If the proposed technology package is not used, it has to be proven that the farmer's production technology is also viable. In the case that a bank is afraid that the farmer could lose the crop, a bank agronomist may assist him. At this stage, the agronomist's recommendations are rather binding.

Even though the technology package provided by the banks is generally not obligatory, it is assumed to have a strong impact on production technology because, in many cases, no other information is available to the farmers.

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[31] Organic Law of the Ministry of Agriculture and Livestock, Title III, Chapter 5, Article 56 (taken from USAID/RENARM, 1992)

[32] I thank Theresa Jimenez, Proyecto MIP, CATIE, for her help in interviewing bank officials.

[33] Banco Nacional de Costa Rica (BNCR), Banco de Costa Rica (BCR), Banco de Crédito Agrícola de Cartago (BCAC), Banco de Fomento Agrícola, Banco del Comercio

5.4 Public Research and Education in Crop Protection

Research

Public agricultural research is executed by MAG, two public universities and in cooperation between the ministry and the universities. Furthermore, ICAFE, the Costa Rican Coffee Institute which is a semi-state run organization, has the mandate to conduct research on coffee production. The funds invested in research on crop protection are partly used for research on pesticide use and partly for research on integrated measures.

Education

The Costa Rican academic system consists of primary schools, colleges, and universities. After 6 years of primary school, studies may be continued at general colleges with a duration of 5 years or at professional colleges with a duration of 6 years. Professional colleges, aside from general education, offer a specialization in a profession and lead to a first professional degree at an intermediate level *(Técnico medio)*. At both general and professional colleges a diploma can be obtained that qualifies for university admission *(bachillerato)*.

Forty-four professional colleges offer a specialization in agriculture. At many, it is possible to choose a specific career within the field of agriculture, e.g. agricultural production or agro-ecology. Curricula may contain basic courses on economic and production aspects of major crops of the country and the region in which the college is situated *(e.g. Colegio Técnico Profesional Los Chiles, Alajuela)* or on farm management, occupational health, ecology, management of natural resources *(Colegio Técnico Profesional de Paquera)*. A survey among agricultural colleges in Costa Rica revealed that there are no specific courses on crop protection. Phytosanitary measures may be treated in the courses for crop production. Only universities offer special courses on crop protection.

Safe use training

Educational programs on safe use of pesticides have been developed for farmers, farm workers, housewives and children by MAG in cooperation with the representation of the chemical industry *(Cámara de Insumos Agropecuarios)*. Participating farmers are taught basic techniques on how to apply pesticides, are recommended to wash clothes after spraying, etc. Protection gear used in northern countries is not recommended because it is not considered suitable for the tropical climate. Therefore, safe use recommendations have been confined to judicious application, and basic protective clothing like rubber boots and gloves (*Cámara de Insumos Agropecuarios*, personal communication). Appropriate protective clothing for the tropics has not been developed yet.

Safe use has been taught on a relatively small scale. Since the beginning of the program in 1986 through 1993 merely 10 % of the rural agricultural working force and less than 5 % of the rural population have been reached[34]. In most cases, information about safe use of pesticides has been presented in full-day or half-day meetings without follow up activities. The impact of those seminars, therefore, can only be considered as limited.

5.5 Extension in Crop Protection: Availability of Information and Methodology

Extension in crop protection in Costa Rica has changed in the last few years. It used to be pesticide-based but now promotes IPM. MAG's extension service and the Crop Protection Service are responsible for extension in crop protection.

Availability of information on non-chemical methods in agricultural institutions and on the farm level

Throughout the world non-chemical crop protection methods have been developed in agricultural research institutions and in the field[35]. Non-chemical measures include the targeted use of beneficial organisms, cultural measures such as crop rotation to avoid infestation, and the tolerance of pests up to a determined level, the "economic threshold".

In Costa Rica there are links between research and extension for some specific IPM projects but they are far from covering the whole range of options. This causes a lack of information in agricultural institutions which is partly responsible for the fact that few integrated methods have found their way into the agricultural practice in Costa Rica.

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34 Data on persons trained were provided by the Cámara de Insumos Agropecuarios, data on rural population, on rural and total agricultural working force were taken from the 1994 Encuesta de Hogares, Dirección General de Estadísticas y Censos, San José, Costa Rica.

35 In Costa Rica, for example, a cultural strategy to delay the transmission of the gemini virus to tomatoes has been successfully tested. The gemini virus is transmitted by the white fly *(Bemisia tabaci)* and causes major losses in tomato production.

Extension methodology

In Costa Rica IPM extension is relatively new and therefore little experience has been obtained with extension methodology. There are two major problems in extension. First, only a small number of farmers are reached by public extension. Second, methodologies for farmer education are not very efficient.

The most popular methodology used in Costa Rica is to invite farmers to field days where results of research are displayed. Integrated pest management is generally understood as a threshold based chemical control which may be supplemented with some cultural measures. In view of the dynamic nature of pests and the strong influence of farm-specific location factors the effectiveness of this methodology in convincing farmers about the advantages of IPM is questionable.

IPM training deviates significantly from the concept used in Asia, particularly in Indonesia, where the concept of Farmer Field Schools was shown to be the best way to transfer IPM technologies (KENMORE, 1991). The overall goal of Farmer Field Schools is to empower farmers by generating an understanding of the ecological principles of production, and thus enable them to make decisions on crop protection that are suitable for their conditions.

5.6 Information transmitted by the Industry and by Pesticide Retailers

Most farmers in Costa Rica do not receive technical assistance by official extension services. In their decision on crop protection measures they rely on their own experience, on their neighbors' experience and on information obtained when buying pesticides. Pesticide shops cover all regions of Costa Rica. Many farmers prefer to contact a pesticide retailer instead of an official extensionist when problems arise because pesticide shops can be reached easily, quickly and practically at any time.

The chemical industry's advertisements for pesticides can be found throughout the country. It is obvious that information transmitted by the industry and by retailers aims at increasing pesticide sales. Both, the industry and pesticide retailers, try to maximize their profits which in a market economy is acceptable, but is not necessarily conducive to the dissemination of integrated pest management strategies, especially if there is a lack of information on non-chemical alternatives.

6 Economic Pesticide Policies - Tax Exemptions and Hidden Costs of Pesticide Use

6.1 Tax Exemptions for Pesticides and other Agricultural Inputs[36]

Until now, pesticide policies in Costa Rica have consisted of legislative measures and education without taking into account possibilities offered by economic policy instruments. Effectiveness of the classic policy could be increased by complementing it with economic provisions. Low taxes or tax exemptions for pesticides are frequently justified with the need to stimulate agricultural production. Keeping in mind that the knowledge about pesticide productivity in the different regions is limited and that there is a severe lack of scientific studies on negative externalities provoked by pesticides, tax exemptions or low tax rates for chemical pesticides are difficult to justify.

In Costa Rica, sales taxes are value added taxes, which means that sales taxes paid for inputs are being refunded by the government. Therefore, as a start, it seems appropriate to apply the same duties to pesticides that are applied for industrial inputs, which vary at present between 6 % and 16 %, according to the degree of manufacturing. Raw materials are charged with a 5 % import duty and a 1 % duty in the context of a safeguard clause.

To better explain the effects of a pesticide tax on pesticide demand and on government revenues, a hypothetical example shall be calculated with the Costa Rica's 1994 pesticide import data and a 6 % import duty that originally had been fixed for most pesticides. Applying this duty would imply a 6 % price increase.

The extent of demand reduction as a consequence of pesticide price changes is determined by the own price elasticity[37]. Several authors have estimated own price elasticities for different groups of pesticides and for various crops. The results vary between -0.25 (OSKAM et al., 1992) and -0.81 (DUBGAARD, 1991). For Costa Rica or other Latin American countries, no quantitative

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36 This paragraph is based on updates of decrees No. 22593-MEIC-H, 22594-H-MEIC published in Appendix No. 39 of "La Gaceta Diario Oficial" No. 217 del 12.11.1993, Tomo II and on an interview with Mrs. Lina Morera, Ministerio de Economía, Indústria y Comercio (MEIC), San José

37 Own price elasticity ε is the ratio between relative changes in quantities (dx/x) and respective own prices (dp/p) of the considered commodities [the percentage change in quantity demanded divided by the percentage change in the price of the commodity]

$$\varepsilon = \frac{\partial x / x}{\partial p / p}$$

analysis of pesticide demand is available. In this hypothetical example an own price elasticity of -0.2 shall be assumed for Costa Rica's agricultural sector.

In 1994, the CIF-value of imported pesticides equaled approximately 84 million USD. Assuming an own price elasticity of -0.2, the application of a 6 % ad-valorem tariff would lead to a 1.2 % decrease in pesticide demand. If, in this case, pesticide imports decreased by 1.2 % as well, the CIF-value of pesticide imports would be lowered to about 83 million USD. If those were charged with a 6 % import duty, the government would yield approximately 5 million USD which could actually be used for other purposes in crop protection such as research for non-chemical methods. Thus, tax exemptions for pesticides can be interpreted as a 5 million USD subsidy to stimulate pesticide use.

Pesticide taxation would lead to a reduction in pesticide use and at the same time generate funds to strengthen measures such as research and extension in IPM or organic farming, special credit schemes for farmers who produce in an environmentally safe way, etc. (see also Chapter 8).

At some point, a discussion concerning a supplementary tax should take place, concerning the necessity to internalize the external costs provoked by pesticide use. Administratively, this would be possible through a *selective sales tax*.

6.2 Hidden Costs of Pesticide Use

This chapter summarizes reports and official statistics on external effects of pesticide use in Costa Rica. It gives an overview of the literature to illustrate the dimension of negative side effects of pesticide use in Costa Rica. In any case, it may be assumed that only a small fraction of actual injuries have been documented, making it difficult to assess the real external costs incurred by pesticide use[38].

6.2.1 Health Impacts on Farmers and on Farm Workers

Occupational pesticide poisonings have been considered a serious problem in Costa Rica for many years. The sterilization of more than 1,000 workers in banana plantations as a side-effect of applying DBCP is well documented and illustrates the hazards related to pesticide use (THRUPP, L.A., 1989, and RAMIREZ, A.L., C.M. RAMIREZ, 1980; cited in HILJE, 1991).

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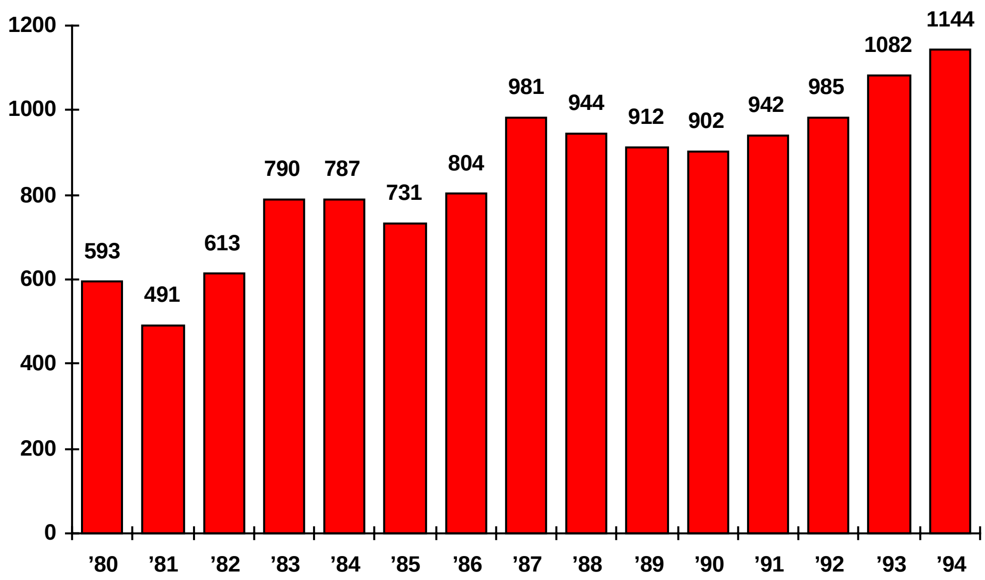
[38] Dr. Jaime García, professor at the Universidad Nacional Estatal a Distancia (UNED), is in the process of publishing a comprehensive review of literature related to external effects of pesticide use in Costa Rica (GARCÍA, J., forthcoming).

Poisoning monitoring

Costa Rica's National Center for Poisoning Control is located in the Childrens' Hospital in San José. Medical staff of this center give advice to physicians dealing with pesticide poisonings and to poisoning victims. A special service provides information on adequate treatment of intoxications 24 hours a day.

Figure 16: Poisonings with agrochemicals in Costa Rica registered at the National Center for Poisoning Control from 1980 to 1994



Source: Centro Nacional de Control de Intoxicaciones, San José, Costa Rica

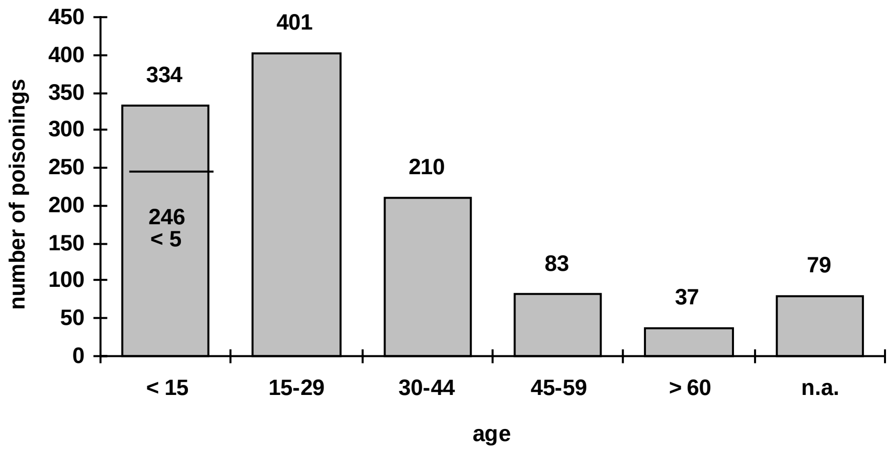
Physicians who treat pesticide poisonings are asked to report any incidence of pesticide poisonings to the center. The center registers and processes this information and makes it available to the public. The voluntary information provided by poison victims and physicians are the only source of information the center has. Therefore, it can be supposed that the number of registered cases is lower than that of actual poisonings.

In 1994, the Center for Poisoning Control presented an analysis and summary of the data collected from 1986 to 1992 (QUIRÓS, V. et al., 1994). The most relevant results of this study are presented in this section and updated with data from 1993 and 1994. Figure 16 shows the distribution of poisonings with agrochemicals reported to the Center from 1980 to 1994. An almost constant increase of reported cases from 593 in 1980 to 1144 in 1994 can be observed. In 1994, more than 99% of all agrochemical poisonings were caused by pesticides, with insecticides, nematicides and herbicides covering almost 74 %

of all intoxications. Organophosphates (233 cases), Carbamates (151 cases) and Paraquat (128 cases) were the most frequently registered chemicals associated with pesticide poisonings. Most of the agrochemicals (48 %) were ingested, 11.4 % were absorbed by the skin, 29 % were inhaled and another 10 % were concurrently inhaled and absorbed by the skin. Of all pesticide intoxications registered in 1994, 34 % were classified as occupational intoxications, 43 % as accidental and 19 % as suicide attempts. In 1994, about 70 % of all the persons poisoned were male and about 30 % were female.

Data on lethal intoxications for 1994 is not available. In 1993, 42 lethal intoxications occurred (MEDICATURA FORENSE), 18 of those caused by Paraquat, 11 by Carbamates and 10 by Organophosphates.

Figure 17: Distribution of pesticide poisonings in 1994 according to age



Source: Centro Nacional de Control de Intoxicaciones, San José, Costa Rica

Figure 17 shows the distribution of affected persons according to their age. Children under 5 years are highly affected, possibly due to the lack of adequate storage facilities for pesticides on the farmers' property. The major risk group is men between 15 and 44, who represent the largest part of the agricultural working force.

The data shows that in spite of the previously discussed concerns about the health risks related to pesticide use, the number of pesticide poisonings have increased over time. In this context, it would be interesting and worthwhile to examine the impact of the prohibition of the most toxic substances from 1988 to 1991 or of safe use training on the number of intoxications.

Assessment of health costs associated with pesticide use

It is difficult, if not impossible to record all cases of intoxications and illness caused by pesticides. Estimates on health costs associated with pesticide use have to start with the cases available and may then be improved by in-depth surveys in specific parts of the country with the objective to assess the percentage of intoxications that are reported to the National Poisoning Control Center, and then calculate the real intoxication numbers. Costs provoked by intoxications, as a start, could be estimated with the help of expenses for medical treatments and with income loss through lost labor days. The value of fatalities would also need to be discussed.

6.2.2 Pesticide Residues and Metabolites in Foodstuffs and in the Environment

Pesticide residues detected in foodstuffs

Costa Rica's Plant Protection Service analyzes pesticide residues in about 400 vegetable samples each year to monitor and improve food quality on the national markets. The results of these analyses are not available to the public. VON DÜSZELN (1995) published data from Costa Rica's Crop Protection Service on residue analysis in 1992 in which 37% of all samples contained pesticide residues, while about 6 % of the samples violated Costa Rican maximum residue limits. In 1993, when the range of compounds analyzed was extended, residues were found in 55 % of the samples, and 11 % of the samples exceeded maximum residue limits (DGSV, personal communication).

HAN (1992, cited in GARCÍA, 1992) states that between 1985 and 1991 more than 500 tons of agricultural crops were detained in US ports because they surpassed FDA's (Food and Drug Administration of the U.S.A.) maximum residue limits.

Pesticide residues and metabolites in the environment

The Pesticide Program at Costa Rica's National University monitored the effects of pesticide use on banana plantations in north eastern Costa Rica. Residues of various pesticides have been found in the surface water of drainage channels. The most frequently detected compounds were the fungicides Thiabendazole, Propiconazole and the insecticides Chlorpyrifos and Terbufos.

CORDERO AND RAMIREZ (1979) and THRUPP (1991) documented the existence of copper toxicity in soils that were used by the United Fruit Company for banana production.

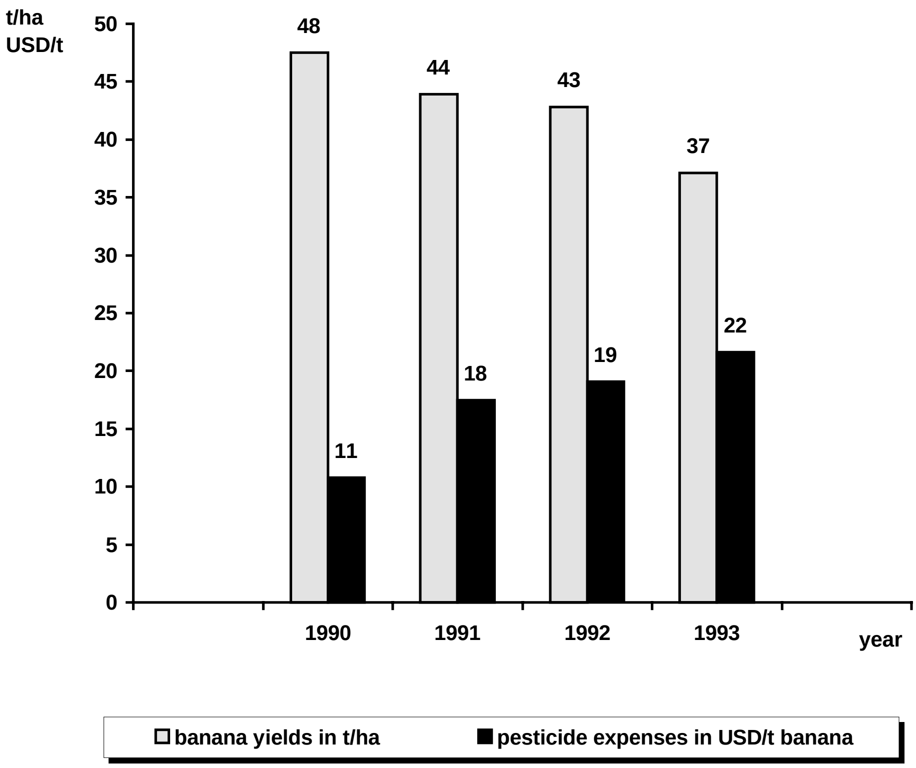
6.2.3 Evidence of Pesticide Resistance

Pesticide resistance is an consequence of pesticide use that has been found in numerous countries all over the world (see GEORGHIOU, 1986 and 1990, FAO, 1991, for insecticide resistance; CASELEY, 1991 for herbicide resistance, DEKKER, 1982 for fungicide resistance, etc.). In Costa Rica, as in other Central American countries, there is considerable evidence for pesticide resistance, however, few cases have been scientifically investigated and documented. The following paragraph summarizes some of those findings.

Antichloris viridis' resistance to the insecticide Dieldrine (STEPHENS, 1984 THRUPP, 1990, both cited in HILJE, 1991), the diamond backmoth *Plutella xylostella*'s resistance to the pyrethroid Deltametrine (BLANCO ET AL., 1990, cited in HILJE, 1991), and the whitefly *Bemisia tabaci's* resistance to many different insecticides are well known examples of insecticide resistance in Costa Rica. Herbicide resistance has been detected in *Echinocloa colona*, an important weed in rice production (GARRO, ET AL., 1991) and in *Ixophorus unisetus* and *Eleusine indica* (VALVERDE, ET AL, 1993).

In laboratory experiments, B. WILLIAMS (1989) found resistance of *Mycosphaerella fijiensis* (Sigatoka negra) to the fungicides Propiconazole and Flusilazole. Meanwhile, fungicide resistance has become a fact in most banana plantations. Statistics on expenses for pesticides in banana production and on the evolution of average yields reinforce the relevance of these findings. The average total pesticide expenses per ha in banana production were estimated at 514 USD/ha in 1990 and at 800 USD/ha in 1993 (BAYER DE COSTA RICA, personal communication), while average yields declined from 47.5 t/ha to 37.1 t/ha, respectively (author's calculations based on SEPSA, 1993). Consequently, in 1990, one ton of bananas could be produced with approximate pesticide expenses of 10.8 USD while in 1993, 21.6 USD was spent for pesticides to produce the same amount of bananas.

Figure 18: Average banana yields in t per ha versus expenses for pesticides in banana production in USD per t of produced bananas



Source: SEPSA (1993), Bayer de Costa Rica, author's calculations

After the decline of cotton production in Central America, which must be seen in close relation to pesticide resistance (MURRAY, 1994), banana production is becoming a second example for unsustainable pesticide use. Heavy dependence on pesticide use may lead to a dilemma for banana producers where production without pesticides is not profitable and further pesticide application provokes more resistance, consequently leading to lower yields and to rising expenses for pesticides.

7 The Determinants of Pesticide Use in Costa Rica and Policy Measures to Improve the Current Situation - a Tentative Impact Assessment

Among crop protection experts there is a consensus that pesticide use in many cases exceeds the optimum and therefore needs to be reduced to an economically reasonable level, for the benefit of both, farmers and society. Consequently the following questions arise:

- Which political and institutional factors determine pesticide use in Costa Rica?
- Which policy measures would be appropriate to improve the actual situation?

More than twenty pesticide experts from ministries, national and international government organizations, research institutions and from the private sector expressed their opinion on these issues in a questionnaire that was distributed at a seminar-workshop at IICA's headquarters in San José in December 1995. All institutions that directly participate in the formulation and execution of pesticide policies were represented and, in addition, scientists and experts from international organizations.

7.1 The Determinants of Pesticide Use in Costa Rica

The institutional and economic determinants of pesticide use in Costa Rica have been thoroughly discussed in this paper. At the IICA seminar, their impact has been evaluated in a participatory manner on a scale from -5 to +5. A negative value implies a discouraging effect, a positive value indicates a stimulating effect on pesticide use. Thus, -5 is equivalent to the strongest reduction, and +5 to an extreme stimulation of pesticide use. Factors that do not have an impact at all are given a zero. Figure 19 summarizes the average values assigned to the different determinants of pesticide use[39].

Institutional factors and information were estimated to be the most important determinants of pesticide use. Tax exemptions for pesticides as well as for complementary inputs, and external effects of pesticide use were considered

[39] In addition to the evaluation of given determinants of pesticide use, experts were asked to add factors they considered important. Some of them mentioned the need to combat pests and diseases as a major reason of pesticide use, which is true. However, this study focused on institutional and economic determinants of pesticides use. Pest occurrence can only indirectly be influenced by institutional and political changes and therefore has been neglected in this research.

relevant, too, even though figure 19 does not reflect the importance attributed to external effects.

Calculating the average for the whole sample, the values given to external costs of pesticide use were "flattened", because the range of evaluations went from -5 to +5. This was not the case for other factors and probably due to an ambiguous interpretation of the role of external effects.

On the one hand, the occurrence of external costs has been seen as a deficiency of the market system which leads to an overuse of pesticides. Following this interpretation, actual market prices for pesticides are too low, because they do not reflect external costs. Tolerating external costs of pesticide use by not applying environmental taxes therefore has been interpreted as an indirect subsidy for pesticides. External effects thus have been assigned a positive value, i.e. they are stimulating pesticide use.

On the other hand, it has been assumed that the mere threat of external effects leads to a reduction of pesticide use. This implies that farmers are minimizing pesticide use because they are aware of the risk related to it. In this case external effects have been assigned a negative, i.e. pesticide reducing, value.

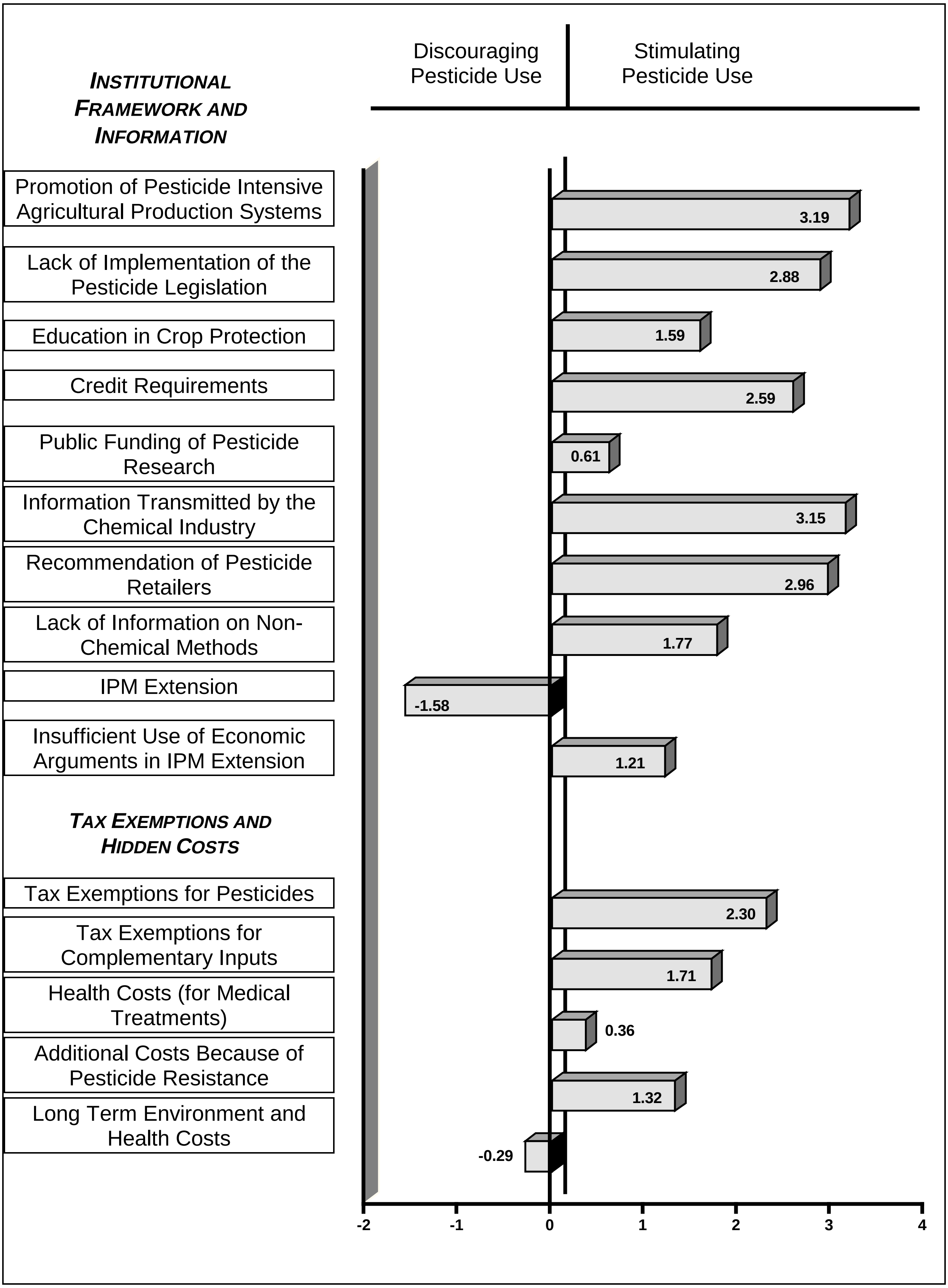
Finally, some of the workshop participants evaluated the externalities of pesticide use with a zero, which means they do not influence pesticide use at all.

The importance attributed to external costs of pesticide use by the workshop participants becomes more explicit in Figure 21, when negative and positive evaluations are discussed separately and according to the experts' professional background.

In addition to the factors specified in this report, the workshop participants emphasized that *quality requirements of international consumer markets* stimulate pesticide use in Costa Rica. Furthermore it was mentioned that in some cases the competition with neighboring countries makes a stricter pesticide legislation in Costa Rica difficult.

The wanting participation of researchers in pesticide policy formulation was identified to be a constraint to an improvement of the actual situation. Furthermore it was agreed upon that the research activities on non-chemical crop protection as well as research on the environmental effects of pesticide use were insufficient.

Figure 19: Determinants of pesticide use and their impact according to an expert survey in Costa Rica



For the analysis of the evaluations according to the experts' professional background, the sample has been subdivided into the following four groups:

- representatives from ministries (Ministry of Agriculture, Ministry of Health, Ministry of Finance, Ministry of Economy),
- representatives from other government institutions including international organizations (Center for Poisoning Control, OPS, OIT, GTZ, ...)
- researchers (Universidad Nacional, Universidad de Costa Rica, CATIE)
- private sector experts (Federation of Coffee Cooperatives, Chamber of Producers, Importers and Distributors of Agrochemicals, Farmers' Union and Representation of Costa Rican Citizens[40]).

A comparative analysis of the evaluations of the four groups, plus the sample average, is presented in figures 20 and 21. The scores of the various groups are compared for five different categories, namely the impact of institutional factors, the lack of information in pest management, tax exemptions, and external costs of pesticide use.

There was a consensus among the workshop participants on the relative importance of each group of determinants of pesticide use. However, absolute values assigned differed considerably. On the average, scientists gave the highest scores. They considered institutional factors, information and tax exemptions as highly relevant and the acceptance of external costs of pesticide use as relevant. Experts from ministries and government organizations assigned a similar relative importance to the proposed groups of determinants for pesticide use. However, the absolute scores, i.e. the impact of those determinants on pesticide use, were lower. The range of values assigned to the determinants of pesticide use was biggest among the representatives of ministries (0 to 5), which may be an indicator for differing points of view among the government authorities.

Private sector representatives evaluated tax exemptions as of minor importance while the availability of information was given high scores.

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[40] The farmers' organization (UPANACIONAL) and the Representation of Costa Rican Citizens (Defensoría de los Habitantes) did not participate at the seminar but were interviewed individually.

Figure 20: Evaluation of the impact of institutional factors and information by all experts and by experts group

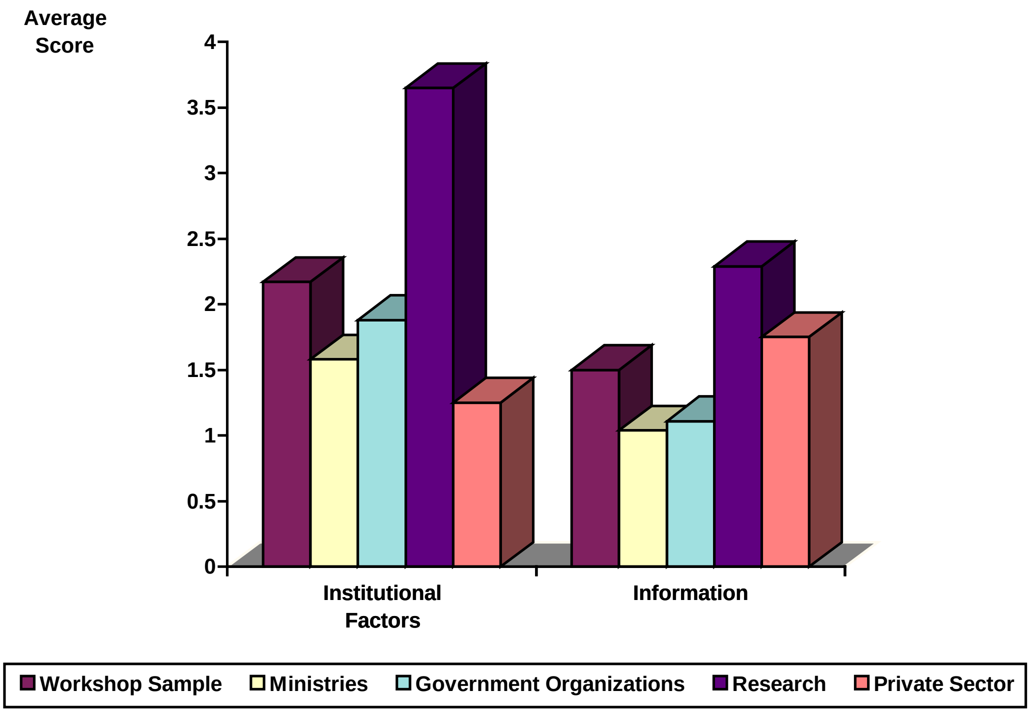
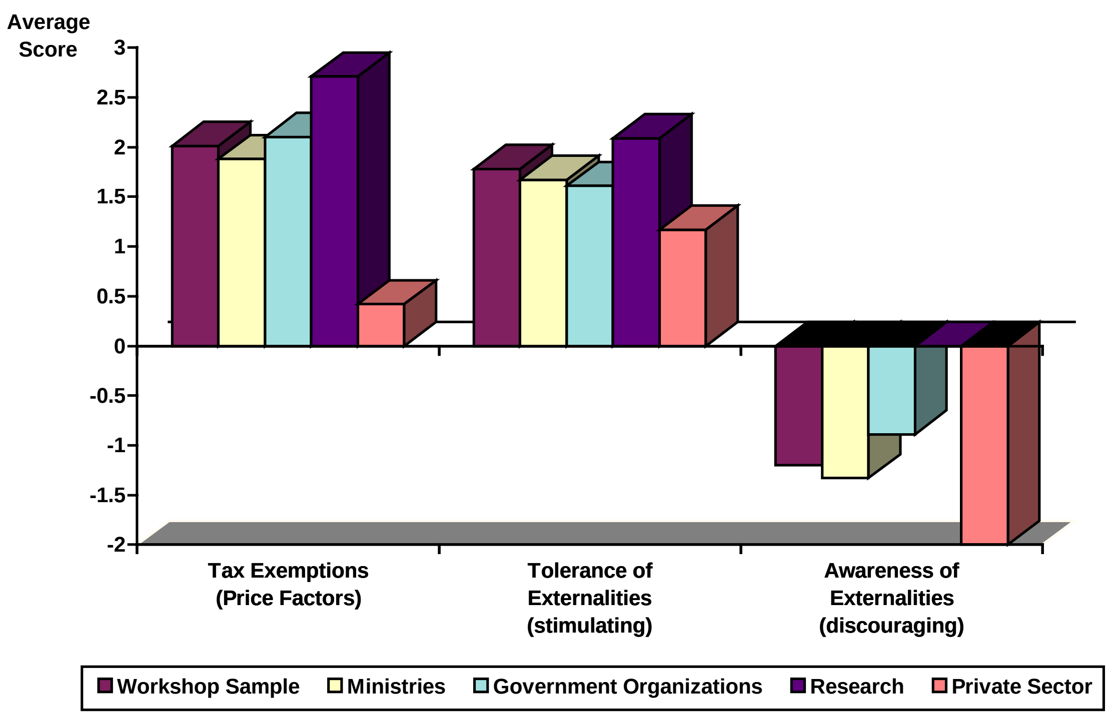


Figure 21: Evaluation of the impact of tax exemptions and external effects by all experts and by expert group



7.2 Policy Measures to Improve the Actual Situation

In a second session, the seminar participants have been asked to evaluate policy options to reduce the current level of pesticide use according to a list of criteria. A matrix for policy evaluation has been handed out with four sets of policy measures and six criteria for evaluation.

The proposed policy measures were summarized in four groups:

- taxes on pesticides,
- subsidies in favor of farmers who apply integrated pest management or organic farming,
- taxes on pesticides and a simultaneous reinvestment of the funds obtained to support farmers who apply integrated pest management or organic farming, and
- legislative measures (prohibition and restriction of pesticides).

Each measure was evaluated according to

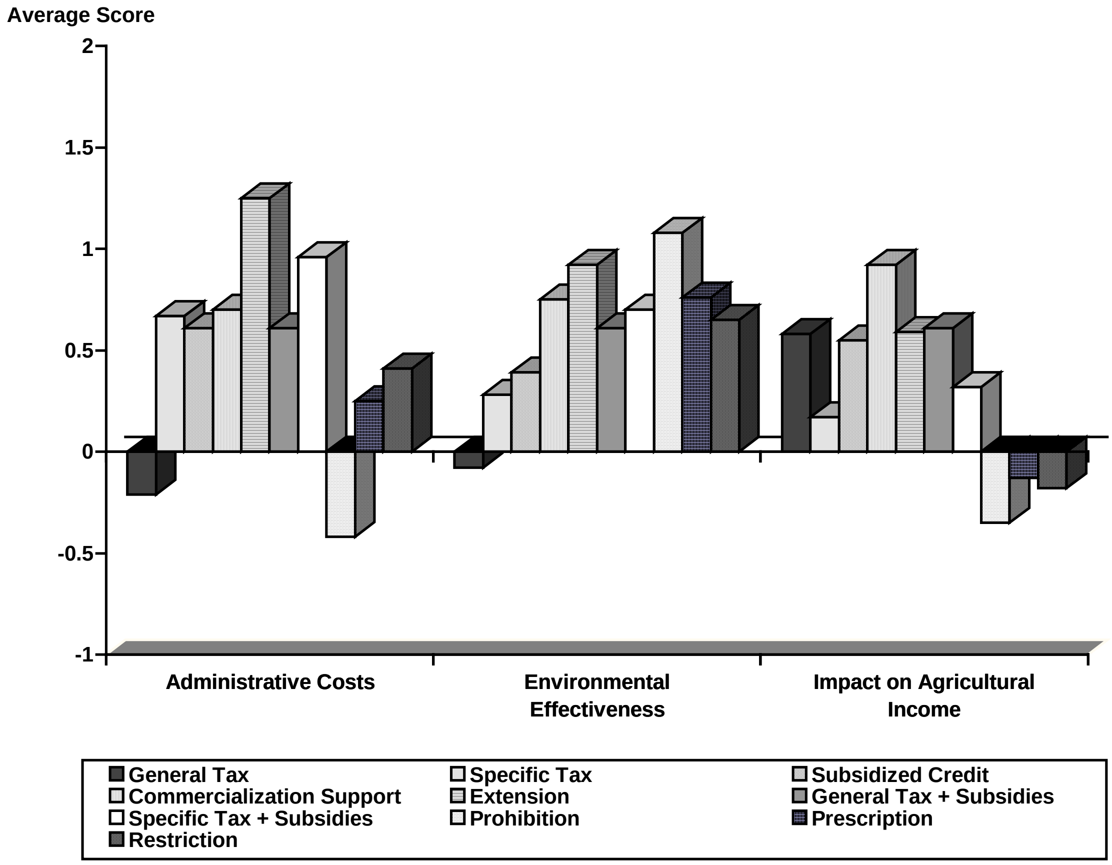
- administrative costs,
- effectiveness in reaching the environmental objective,
- impact on the farmers' income,
- degree of acceptance by farmers,
- degree of acceptance by society, and
- political feasibility

on a scale from -2 to +2, where

-2 = very low, -1 = low, 0 = neutral, +1 = high, +2 = very high.

Classic instruments in pesticide policies such as the prohibition, prescription and restriction of the most dangerous pesticides were evaluated most favorably. They were assigned low or moderately high administrative costs, high effectiveness in reaching the environmental objective and low impact on farmers' income. Figure 23 shows that these instruments were nevertheless supposed to be unpopular among farmers, but to have a high acceptance in the society and to be enforced with little political resistance.

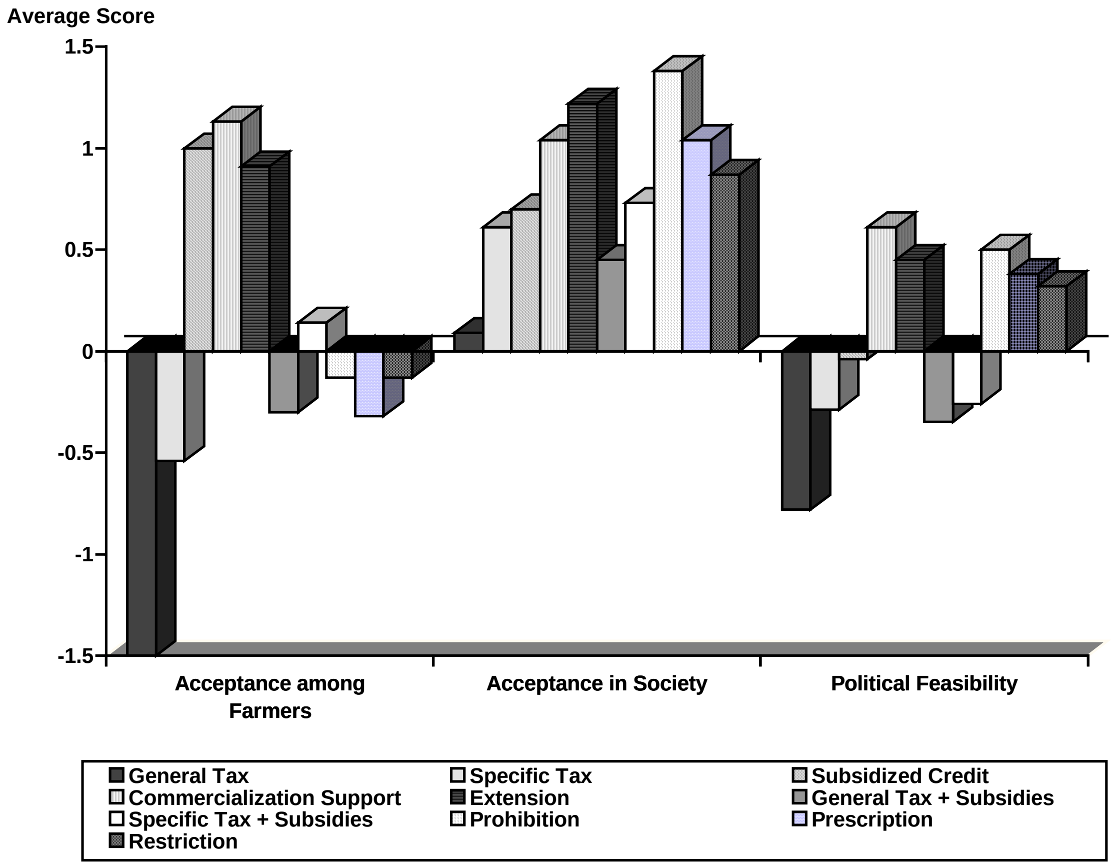
Figure 22: Effect of various policy measures as assessed by all experts



Subsidies for environmentally friendly production have been evaluated positively, as well. Acceptance among farmers and by society were assessed to be high, probably because of their assumed impact on the agricultural income and the positive environmental effects. However, administrative costs were judged to be high, especially for extension measures. Political feasibility therefore remains indifferent, and, in the case of extension, rather low.

A general tax on pesticides, in spite of their low administrative costs, received a negative evaluation. Its environmental effectiveness was evaluated modest while its (negative) impact on agricultural income, extremely low acceptance among farmers, moderate acceptance in society and low political feasibility seem to contradict this measure. A selective tax on the most hazardous substances is more likely to be realized, most of all for its acceptance in society and because of less resistance among farmers. Its impact on the farmers' income and its environmental effectiveness were evaluated as neutral in spite of the rather high administrative costs.

Figure 23: Expected acceptance of policy measures by farmers, society and political feasibility of selected policy measures as assessed by all experts



A combination of taxes and subsidies is supposed to be more effective in reaching the environmental goal and to be more acceptable for farmers than taxes without subsidies. However, environmental taxes were expected to be difficult to realize. The following policy measures which had not been considered in the survey were proposed by some of the participants:

- support for IPM research,
- education of farmers,
- education of consumers,
- prohibition of advertisements for pesticides, and
- creation of awareness on occupational health issues in rural worker organizations.

The evaluation of policy measures shows the strong belief in the regulatory concept. However, it is astonishing that the administrative costs of regulatory measures have been evaluated as neutral. This confirms the frequently made observation that technical experts generally neglect the costs of implementing legislative measures despite of the fact that monitoring as required by the law is costly.

8 Conclusions and Recommendations

Pesticide use is a controversial issue because of its well-known negative side effects. Many studies have indicated that Costa Rica has continuously been confronted with such undesired effects which represent costs for producers and for society that are generally not taken into account. Considering these serious problems, it is not surprising that many institutions are working on ways out of this dilemma. Costa Rica's Crop Protection Service, now a section of DGPA, has undertaken efforts to promote IPM in order to reduce pesticide use and related negative external effects. However, increasing expenditures for pesticide imports during the last five years indicate an opposite trend.

For a long time, pesticide use has exclusively been discussed in a technical context, i.e. as a function of pest incidence and the need to avoid crop loss[41]. This paper has identified the impact of key institutional and economic determinants of pesticide use in Costa Rica.

Governments often are reluctant to policy changes when accurate information on the actual situation and on the outcome of new policies does not exist. This report and the evaluation by experts can be considered as a first step towards an impact assessment for institutional and economic determinants of pesticide use.

However, **further research** is necessary to analyze the present situation and the effect of policy change. Further studies on pesticide productivity and on external effects of pesticide use are expected to provide a better information base in order to approach the optimal level of pesticide use. Based on this information, the effect of policy changes on farmers' income, pesticide use and environmental pollution could be estimated more accurately. Furthermore, it would be interesting to analyze different options for investment in crop protection to find out the most efficient one. In detail, the following research is recommended:

Pesticide productivity

Pesticide productivity is usually determined through trials in experimental stations by comparing treated and untreated plots without taking into account the possibility of non-chemical options to substitute agrochemicals (cultural

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[41] The impact of social and economic circumstances on the use of pesticides in Costa Rica have been documented for the first time in a case study on the use of the nematicide DBCP in Costa Rica's banana production (THRUPP, 1988).

practices, targeted use of natural predators, ...). These simplifications lead to a systematic overestimation of pesticide productivity (WAIBEL, 1996). Therefore research on crop protection and pesticide should be conducted in a farming systems perspective. In order to obtain a more realistic view of pesticide productivity in the different regions, on farm surveys and surveys among extensionists about infestation pressure, microclimate, the technology employed, and yields should be conducted.

External effects - diagnosis and economic evaluation

Information on the various external effects of pesticide use is scarce and therefore in many cases, it is difficult to estimate their costs. Health costs may be assessed by evaluating costs for treatment, medication and the opportunity costs of labor. The cost of pesticide residues in export products could be estimated with the aid of statistics on rejected loads by EU- and US-ports. Further economic evaluation of environmental effects of pesticide use requires sound data from natural sciences. Therefore, research on the environmental impact of pesticide use is proposed to universities and other research centers.

Cost-benefit analysis of investments in integrated and non-chemical crop protection

In view of the likely overestimation of pesticide productivity and the many external costs provoked by pesticide use, tax exemptions for pesticides seem to be difficult to justify. In addition, environmental taxes for pesticides should be considered. The options of redirecting pesticides subsidies to other approaches to improve agricultural productivity in environmentally safer ways, should be studied. Such options are :

- subsidies for non chemical pest control products,
- expansion of extension programs in integrated pest management (IPM) and organic agriculture,
- credit facilities for farmers that use IPM or organic technologies,
- support for advertising food produced with IPM or organic technologies,
- support of research programs for development and for farmers' adoption of IPM and organic technologies.

These options must be subjected to cost-benefit analysis of investments taking into account environmental valuation and sustainability criteria.

Analysis of the effect of alternative policy scenarios on pesticide use, productivity and farmers' income.

The effect of policy change can be estimated by applying various methodologies. Considering the data available for the analysis, appropriate economic models can be chosen for the analysis of the impact of pesticide taxation on pesticide use, land productivity and on the income of the farming community. Available tools range from partial budgeting to input demand systems and partial equilibrium models.

Further research will require additional time and resources, however, problems in crop protection may urge immediate action. Thus, some **recommendations for policy makers** can be given on the basis of this report.

In Costa Rica, the present government has recently mandated that sustainability should be the overall agricultural policy goal, aiming at a reduction of pesticide use to, however, unspecified minimum levels. In fact, current policies do not sufficiently address this issue as there are a number of national policies that stimulate pesticide use. Economic incentives for farmers to adopt IPM technologies are low which is partly caused by tax exemptions for chemical pesticides.

The analysis has shown that informational and institutional factors are most decisive in influencing pesticide use. A change of the institutional setting may require in many instances a considerable period. More rapid changes could be achieved in two areas:

The first step should be to apply *market-based instruments* in crop protection and pesticide policies. Tax exemptions for pesticides are direct subsidies that have stimulated pesticide use for many years. They may lose importance since import duties will be lowered considerably in Central American trade negotiations. Until that date, tax exemptions should be abolished to raise funds for research, extension and the promotion of non-chemical crop protection. If import duties are lowered funds for measures to promote non-chemical crop protection may be obtained by a selective sales tax for pesticides.

Secondly, improvements can be made by adjusting the *formulation* and the *implementation of the laws*. Researchers, farmers, and consumers can contribute to the process of legislative adjustment with scientific information, practical experience and information about preferences. Therefore, their inclusion in the process of pesticide legislation would lead to policy decisions which better reflect the objectives of the society at large. Crop protection legislation should be summarized in one legal instrument that regulates all aspects of pesticide use in order to achieve a more coherent and understandable pesticide legislation and a better cooperation between institutions involved.

9 References

AGNE, S., G. FLEISCHER, F. JUNGBLUTH & H WAIBEL (1995): Guidelines for Pesticide Policy Studies - a Framework for Analyzing Economic and Political Factors of Pesticide Use in Developing Countries. Pesticide Policy Project, Hannover, Germany.

AGUILAR, J. ET AL. (1983): Generación y transferencia de tecnológica privada en el sector agrícola de Costa Rica: el caso de los agroquímicos. MIDEPLAN, Proyecto COS 81/TO1.s.p., San José, Costa Rica.

ANTLE, J.M. (1988): Pesticide Policy, Production Risk, and Producer Welfare. An Econometric Appraoch to Applied Welfare Economics. Resources for the Future, Washington, D.C., U.S.A.

ARAUZ, L.F. ET AL. (1983): Diagnóstico sobre el uso y manejo de plaguicidas en las fincas hortícolas del Valle Central de Costa Rica. Informe preliminar. Agronomía y Ciencia 1 (3):37-49.

BARQUERO ARCE (1993): Análisis de la Comisión Asesora para el Uso de Plaguicidas. Documento Interno. San José, Costa Rica.

BLANCO, H., P.J. SHANNON & J.L. SAUNDERS (1990): Resistencia de Plutella xylostella (Lep.: Plutellidae) a tres piretroides sintéticos en Costa Rica. in: Turrialba 40 (2): 159-164, Costa Rica.

BRADER, L. (1979): Integrated Pest Control in the Developing World. Annual Review of Entomology 24: 225-254.

CAPALBO, S.M. & J.M. ANTLE (EDS.) (1988): Agricultural Productivity. Measurement and Explanation. Resources for the Future, Washington, D.C.

CARLSON, G.A. (1977): Long-Run Productivity of Insecticides. American Journal of Agricultural Economics 59: 543 - 548.

CARLSON, G.A., D. ZILBERMAN & J.A. MIRANOWSKI (1993): Agricultural and Environmental Resource Economics. Oxford.

CARRASCO-TAUBER, C. & L.J. MOFFITT (1992): Damage Control Econometrics: Functional Specification and Pesticide Productivity. American Journal of Agricultural Economics 74: 158 - 162.

CARRIERE, J. (1991): The Crisis in Costa Rica: An Ecological Perspective. In: Goodman, D. and M. Redclift (eds.): Environment and development in Latin America - The politics of sustainability. Manchester University Press.

CASELEY, J.C., G.W. CUSSANS & R.K. ATKIN (1991): Herbicide Resistance in Weeds and Crops. Oxford, United Kingdom.

CASTRO CÓRDOBA, R. (1995): Estudio diagnóstico sobre la legislación de plaguicidas en Costa Rica. Ministerio de Salud/OPS, San José, Costa Rica.

CHAVERRI, F. & J. BLANCO (1995): Importación, formulación y uso de plaguicidas en Costa Rica. Período 1992 - 1993. Informe final al proyecto MASICA / OPS, Programa de Plaguicidas, UNA, Heredia, Costa Rica.

CNAA (1994): Hacia la Agricultura del Siglo XXI. San José, Costa Rica.

COMPART, W. (1990): Nutzung von Bodenbedeckerpflanzen im Kaffeeanbau Costa Ricas im Zusammenhang mit Erosionsproblematik und Nematodenbefall. Dissertation, Stuttgart, Germany.

CORDERO, A. & G. RAMIREZ (1979): Acumulamiento de cobre en los suelos del Pacífico Sur de Costa Rica y sus efectos detrimentales en la agricultura. in: Agronomía Costarricense 3: 63-78.

CORELLA, J.E. (1992) : Diagnóstico de los agroquímicos en Costa Rica. Ministerio de Economía, Industria y Comercio (MEIC), Dirección General de Comercio. San José, Costa Rica.

DEKKER, J. & S.G. GEORGOPOULOS (EDS.) (1982): Fungicide Resistance in Crop Protection. Wageningen, Netherlands.

DINHAM, B. (1993): The Pesticide Hazard. A Global Health and Environmental Audit. The Pesticide Trust, London.

DUBGAARD, A. (1991): Pesticide Regulation in Denmark. In: Hanley, N., (ed.): Farming and the Countryside: An Economic Analysis of External Costs and Benefits, pp 48-58

FAO (1990): International Code of Conduct on the Distribution and Use of Pesticides (Amended version). Rome.

FAO (1991): The Occurance of Resistance to Pesticides in Arthropods. Rome.

FAO (1993): Analysis of Government Responses to the First Questionnaire on the International Code of Conduct on the Distribution and Use of Pesticides. Rome.

FAO (1994): FAO Production Yearbook 1993, Vol. 47. Rome.

GARCÍA, J. (1992): Límites máximos de residuos de plaguicidas en productos alimentarios de origen vegetal: situación en Costa Rica. In: Agronomía Costarricense (19) 1, San José, Costa Rica

GARCÍA, J. (1995): Industria, Importación y Comercialización de Plaguicidas en Costa Rica. In: Agronomía Costarricense (19) 1, San José, Costa Rica

GARCÍA, J. (forthcoming): Introducción a los plaguicidas. EUNED: San José, Costa Rica.

GARRO, J.E. ET AL. (1991): Propanil Resistance in Echinochloa colona populations with different herbicide use histories. In: Brighton Crop Protection Conference - Weeds - 1991, Vol. 3, British Crop Protection Council, United Kingdom.

GEORGHIOU, G.P. (1986): The Magnitude of the Resistance Problem. In: GEORGHIOU, G.P. (ED.): Pesticide Resistance: Strategies and Tactics for Management. National Academy Press, Washington, D.C., U.S.A.

GEORGHIOU, G.P. (1990): Overview of Insecticide Resistance. In: Managing Resistance to Agrochemicals. Green, M.B. et al. (Hrsg.), American Chemical Society, Washington, D.C., p. 18-41

GTZ (1989): Internal Report of the Convenio Costarricense-Aleman de Sanidad Vegetal, GTZ-MAG.San José, Costa Rica.

HILJE, L. (1984): Estado actual del combate de plagas agrícolas en Costa Rica. Ciencias Ambientales 5-6: 115-124, Costa Rica.

HILJE, L. ET AL. (1987): El uso de los plaguicidas en Costa Rica. San José, Costa Rica.

HILJE, L. ET AL. (1991): Los plaguicidas y el combate de plagas. Conference presented at a course on IPM in Grecia, Alajuela, Costa Rica.

ICAFE (1994): Informe sobre la actividad cafetalera de Costa Rica. San José, Costa Rica.

ICAFE (1995): Informe sobre la actividad cafetalera de Costa Rica. San José, Costa Rica.

JOHNSON, S. & S. WISE (1991): A Comparative Analysis of State Regulations for Use of Agricultural Chemicals. In: Just, R.E. und N. Bockstael (Hrsg.): Commodity and Resource Policies in Agricultural Systems. New York, Berlin, Heidelberg.

KENMORE, P.E. (1991): Indonesia's Integrated Pest Management - A Model for Asia. Manila, Philippines.

MAG (1994): Políticas Agrícolas de cara al siglo XXI. Versión preliminar, octubre 1994. San José, Costa Rica.

MIRENEM (1994): Opus Magna 1990 - 1994. San José, Costa Rica,

MURRAY, D.L. (1994): Cultivating Crisis. The Human Cost of Pesticides in Latin America. University of Texas Press, U.S.A.

QUIROS V., D., A.E. SALAS H. & Y. LEVRIDGE E. (1994): Intoxicaciones con Plaguicidas en Costa Rica. Centro Nacional de Control de Intoxicaciones, San José, Costa Rica.

RAMIREZ, A.L. & C.M. RAMIREZ (1980): Esterilidad masculina causada por la exposición laboral al nematicida 1,2-dibromo-3-cloropropano. Acta Med. Cost. 23 (3): 219-222, Costa Rica.

RAMIREZ, O. (1994): The Plant Protection Policy Situation in Central America. In: Agne, S., G. Fleischer and H. Waibel: Proceedings of the Göttingen Workshop on Pesticide Policies. Göttingen, Germany.

RAVENSWAY, E. VAN & P. SKELDING (1985): The Political Economics of Risk/Benefit Assessment: The Case of Pesticides. American Journal of Agricultural Economics 67: 971 - 976.

REPETTO, R. (1985): Paying the Price: Pesticide Subsidies in Developing Countries. World Resources Institute Research Report No.2, Washington, D.C.

ROLA, A.C. & P.L. PINGALI (1993): Pesticides and Rice Productivity: An Economic Assessment for the Philippines. International Rice Research Institute, Los Baños, Philippines.

ROJAS, O.E. (1987) : Zonificación agroecológica para el cultivo del café (Coffea arabica) en Costa Rica. IICA, San José, Costa Rica.

SEPSA (1993): Información Básica del Sector Agropecuario. Vol. 7. Ministerio de Agricultura y Ganadería, San José, Costa Rica.

SEPSA (1995): Boletín Estadístico, Vol. 6. Ministerio de Agricultura y Ganadería, San José, Costa Rica.

SEPSA (1996): Boletín Estadístico, Vol. 7. Ministerio de Agricultura y Ganadería, San José, Costa Rica.

STEPHENS, C.S. (1984): Ecological Upset and Recuperation of Natural Control of Insect Pests in some Costa Rican Banana Plantations. In: Turrialba 34 (1): 101-105, Costa Rica.

THRUPP, L.A. (1988): The Political Ecology of Pesticide Use in Developing Countries: Dilemmas in the Banana Sector of Costa Rica. Ph.D. thesis, University of Sussex, England.

THRUPP, L.A. (1989): Direct Damage: DBCP Poisoning in Costa Rica. Dirty Dozen Campaigner May 1989.

THRUPP, L.A. (1990): Inappropriate Incentives for Pesticide Use: Agricultural Credit Requirements in Developing Countries. In: Agriculture and Human Values, Summer-Fall 1990.

THRUPP, L.A. (1991): Long-term Losses from Accumulation of Pesticide Residues: A Case of Persistent Copper Toxicity in Soils of Costa Rica. In: Geoforum 22: 1-15.

USAID/RENARM (1992): The Green Book. Costa Rica Country Analysis. Draft, May 1992. Internal document. Washington, D.C., U.S.A.

VALVERDE, B. ET AL, (1993): Field-evolved Imazapyr Resistance in Ixophorus Unisetus and Eleusine Indica in Costa Rica. In: Brighton Crop Protection Conference - Weeds - 1993, British Crop Protection Council, United Kingdom.

VON DÜSZELN, J., I. VERENO & T. WIELAND (1995): Qualitätskontrolle von Pflanzenschutzmitteln aus GTZ-Pflanzenschutzprojekten. In: Entwicklung + Ländlicher Raum 29 (1):16-19, Frankfurt am Main, Germany.

WAIBEL, H. (1983): Die Ökonomik des chemischen Pflanzenschutzes im bewässerten Reisanbau der Philippinen. Dissertation, Stuttgart-Hohenheim, Germany.

WAIBEL, H. (1990): Pesticide Subsidies and the Diffusion of IPM in Rice in Southeast Asia: the Case of Thailand. FAO Plant Protection Bulletin 38: 105 - 111.

WAIBEL, H. (1994): Towards an Economic Framework of Pesticide Policy Studies. In: Agne, S., G. Fleischer and H. Waibel: Proceedings of the Göttingen Workshop on Pesticide Policies. Göttingen, Germany.

WAIBEL, H. (1996): The Economics of Crop Health Management. Giessener Beiträge zur Entwicklungsforschung, Vol. 23, 31-44, 1996, University of Giessen, Germany.

WILLIAMS B., C.W. (1989): Determinación de la sensibilidad de Mycosphaerella fijiensis a fungicidas inhibidores de la síntesis del ergosterol (ISE) utilizando ascosporas y conidios. Master Thesis, CATIE, Turrialba, Costa Rica.

WHO/UNEP (1990): Public Health Impact of Pesticides Used in Agriculture. Geneva, Switzerland.

WORLD BANK (1993): Pesticide Policies In Developing Countries. Do They Encourage Excessive Pesticide Use? World Bank Technical Report No. 238 written by J. Farah. Washington, D.C.

WORLD BANK (1994): World Development Report 1993. Washington, D.C.

WORLD RESOURCES INSTITUTE (1991): Accounts Overdue: Natural Resource Depreciation in Costa Rica. Washington, D.C.

Appendix 1: Agroecological Zones in Costa Rica

Appendix 2: Characteristics of Costa Rica's Agricultural Sector

Table 2.1: Area cultivated with key crops in Costa Rica from 1990 to 1994

Crop	1990	1991	1992	1993	1994*
Traditional Export Crops (ha)					
Banana	28 296	33 400	38 119	49 394	52 707
Cocoa	17 420	15 000	13 500	12 000	12 000
Coffee	105 000	105 000	106 000	105 000	108 966
Sugar Cane	42 000	42 200	43 000	43 314	43 000
Total	*192 716*	*195 600*	*200 619*	*209 708*	*216 673*
Grains (ha)					
Rice	67 848	61 084	55 700	62 217	46 899
Beans	63 664	69 580	63 160	59 030	56 856
Maize	49 381	40 170	31 666	23 620	17 561
Sorghum	2591	1 610	320	0	0
Total	*183 484*	*172 444*	*150 846*	*144 867*	*121 316*
Non-Traditionals (ha)					
Orange	10 757	13 065	16 000	18 000	22 250
Macadamia	8 356	8 988	9 188	6 680	6 700
Mango	4 100	4 754	5 300	5 779	6 696
Melon	2 375	2 700	4 205	4 218	4 409
Ornamentals	3 400	3 600	3 800	4 280	4 280
Oil Palm	23 183	23 891	24 600	26 600	26 652
Pineapple	6 050	6 000	7 000	7 000	7 000
Plátano	4 200	6 800	5 800	8 300	6 500
Coco	4 500	4 450	4 500	4 500	4 500
Maracuya	858	160	150	68	60
Pepper	499	650	498	488	486
Chayote	260	220	235	220	270
Palmito	2 019	n.a.	3 500	3 822	4 000
Papaya	520	613	700	778	1 103
Strawberries	50	70	50	50	50
Total	*71 127*	*75 961*	*85 526*	*90 783*	*94 956*
Others (ha)					
Cotton	645	288	353	302	0
Onions	746	627	1 113	726	606
Roots & Tubers	5 342	14 235	7 406	8 663	10 539
Tobacco	937	818	1 008	1 045	1 042
Total	*7 670*	*15 968*	*9 880*	*10 737*	*12 187*
GRAND TOTAL	**454 997**	**459 973**	**446 872**	**456 094**	**445 132**

Source: SEPSA (1995), *) = estimate

Table 2.2: Crop production in Costa Rica from 1990 to 1994

Crop	Unit	1990	1991	1992	1993	1994*
Traditional Export Crops						
Banana	1000 cases[42]	79 000	80 800	91 400	101 100	103 300
Cocoa	t dry grain	4 300	3 400	3 000	2 800	2 000
Coffee	1000 D.Hl.	6 427	6 899	7 319	6 850	6 491
Sugar Cane	t (sugar cane)	2 436 174	2 629 138	2 839 921	2 987 019	2 985 324
Grains						
Rice	t	244 317	231 900	207 500	232 716	173 507
Beans	t	34 258	34 267	35 600	33 359	35 337
Maize	t	82 732	68 821	51 900	39 391	33 747
Sorghum	t	5 900	2 600	6 400	0	0
Non-Traditionals						
Orange	t	110 690	n.a.	n.a.	n.a.	129 573
Macadamia	t (incl. shell)	2 150	1 650	1 800	2 000	2 000
Mango	t	8 000	9 508	10 600	11 558	13 300
Melon	t	48 600	49 950	86 856	87 124	91 069
Ornamentals	t (exports)	30 240	39 249	50 122	60 011	70 000
Oil Palm	t	332 628	291 501	356 890	364 000	474 598
Pineapple	t (exports)	95 880	100 285	121 947	145 075	154 000
Plátano	1000 racimos	2 520	4 750	4 052	5 810	3 800
Coco	t	23 100	23 000	30 000	30 000	31 100
Maracuya	t	14 157	2 618	2 400	1 088	1 000
Pepper	t dry grain	868	1 950	2 170	1 952	1 944
Chayote	t (exports)	7 864	11 382	16 307	12 112	17 000
Palmito	1000 pieces	9 500	n.a.	17 500	19 110	20 000
Papaya	t	16 436	24 520	21 000	42 762	60 665
Strawberries	t	2 750	1 250	1 000	1 000	1 000
Others						
Cotton	bales	1 900	1 008	948	660	0
Onions	t	16 145	18 409	20 456	21 284	13 776
Potatoes	t	49 500	54 487	64 678	52 661	43 235
Tobacco	t	1 717	1 305	1 936	2 050	1 797

Source: SEPSA (1995), *) = estimate

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[42] 1 case = 18.14 kg

Table 2.3: Yields in Costa Rica's agriculture from 1990 to 1994

Crop	Unit	1990	1991	1992	1993	1994*
Traditional Export Crops						
Banana	1000 cases[43]	2.79	2.42	2.40	2.05	1.96
Cocoa	t dry grain	0.25	0.23	0.22	0.23	0.17
Coffee	1000 D.Hl.	61.21	65.71	69.04	65.23	59.57
Sugar Cane	t (sugar cane)	58.00	62.30	66.04	68.96	69.43
Grains						
Rice	t	3.60	3.80	3.73	3.74	3.70
Beans	t	0.54	0.49	0.56	0.57	0.62
Maize	t	1.68	1.71	1.64	1.67	1.92
Sorghum	t	2.28	1.61	20.00	0.00	0.00
Non-Traditionals						
Orange	t	10.29	n.a.	n.a.	n.a.	5.82
Macadamia	t (incl. shell)	0.26	0.18	0.20	0.30	0.30
Mango	t	1.95	2.00	2.00	2.00	1.99
Melon	t	20.46	18.50	20.66	20.66	20.66
Ornamentals	t (exports)	8.89	10.90	13.19	14.02	16.36
Oil Palm	t	14.35	12.20	14.51	13.68	17.81
Pineapple	t (exports)	15.85	16.71	17.42	20.73	22.00
Plátano	1000 racimos	0.60	0.70	0.70	0.70	0.58
Coco	t	5.13	5.17	6.67	6.67	6.91
Maracuya	t	16.50	16.36	16.00	16.00	16.67
Pepper	t dry grain	1.74	3.00	4.36	4.00	4.00
Chayote	t (exports)	30.25	51.74	69.39	55.06	62.96
Palmito	1000 pieces	4.70	n.a.	5.00	5.00	5.00
Papaya	t	31.61	40.00	30.00	55.00	55.00
Strawberries	t	55.00	17.86	20.00	20.00	20.00
Others						
Cotton	bales	2.95	3.50	2.69	2.19	0.00
Onions	t	21.64	29.36	18.37	29.30	22.73
Potatoes	t	22.00	23.76	24.86	24.08	21.20
Tobacco	t	1.83	1.60	1.92	1.96	1.73

Source: author's calculations based on SEPSA (1995), *) = estimate

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[43] 1 case = 18.14 kg

Appendix 3: Background Data on Pesticides in Costa Rica

Table 3.1: Prohibited pesticides in Costa Rica

Active Ingredient	Biological Activity[44]	WHO Classifica-tion	Published in the Official Journal[45] No.	Date of Publication[46]
MERCURY COMPOUNDS	F	Ib	279	11/12/1960
2,4,5-T	H	III	76	22/04/1986
ALDRIN	I	Ib	151	10/08/1988
CHLORDECONE	I, A	Ib	151	10/08/1988
CHLORDIMEFORM	I, A	II	151	10/08/1988
DDT	I	II	151	10/08/1988
DIBROMOCHLORO-PROPANE (DBCP)	N	Ia	151	10/08/1988
DIELDRIN	I	Ib	151	10/08/1988
DINOSEB	H	Ib	151	10/08/1988
ETHYLENE DIBROMIDE	I, N, T		151	10/08/1988
NITROFEN	H	IV	151	10/08/1988
TOXAPHENE			151	10/08/1988
CAPTAFOL	F	Ia	190	12/08/1988
LEAD ARSENITE			26	06/02/1990
ENDRIN	I, R	Ib	26	06/02/1990
PENTACLORPHENOL (PCP)	I, F, H	Ib	26	06/02/1990
CYHEXATIN	A	III	122	26/06/1990
CHLORDANE	I	II	17	24/01/1991
HEPTACHLOR	I	II	17	24/01/1991

Source: Edgar Vega, MAG, Dirección General de Protección Agropecuaria

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44 A = acaricide, F = fungicide, H = herbicide, I = insecticide, N = nematicide, P = plant growth regulator, T = soil treatment

45 The Costa Rican official journal is named "Gaceta oficial".

46 date of publication in the official journal = date of prohibition

Table 3.2: Restricted[47] pesticides in Costa Rica

Active Ingredient	Biological Activity[48]	WHO Classifi-cation	Published in the Official Journal No.[49]	Date of Publication[50]
M.A.F.A.[51]	F	n.a.	201	20/10/1982
METHYL BROMIDE *	T	n.a.	130	10/07/1987
CARBOFURAN 48% *	I, A, N	Ib	130	10/07/1987
ETHYL + METHYL PARATHION *	I, A	Ia	130	10/07/1987
PARATHION METHYL 48% *	I, A	Ia	130	10/07/1987
PHORATE 48 AND 80% *	I, A, N	Ia	130	10/07/1987
ALUMINIUM PHOSPHIDE *	I, T	n.c.	130	10/07/1987
MONOCROTOFOS 60% *	I, A	Ib	130	10/07/1987
LINDANE	I	II	187	03/10/1988
DAMINOZIDE	P	IV	68	07/04/1992
CAPTAN				1995

Source: Edgar Vega, MAG, Dirección General de Protección Agropecuaria and Dr. Jaime García, UNED

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47 Restriction means use and sales restriction. Restricted pesticides can only be purchased with a prescription written by an agronomist.

48 A = acaricide, F = fungicide, H = herbicide, I = insecticide, N = nematicide, P = plant growth regulator, T = soil treatment.

49 The Costa Rican official journal is named "Gaceta oficial".

50 date of publication in the official journal = date of prohibition

51 *MAFA = metano arsenato ferrico amonico* = ferric ammonium salt of methane arsenic acid. MAFA used to be imported from Japan mainly for use in coffee production. It has not been imported for many years now (Dr. Bernal Valverde, CATIE, personal communication).

Table 3.3: Status of PIC and PAN list pesticides in Costa Rica[52]

Active Ingredient	PIC-List[53]	PAN[54] "Dirty Dozen"	Status in Costa Rica
2,4,5 T		√	P
Aldrin	√	√	P
Aldicarb (Temik)		√	r
Camphechlor (Toxaphene)		√	P
Chlordane	√	√	P
Chlordimeform	√	√	P
Cyhexatin	√		P
DBCP		√	P
DDT	√	√	P
Dieldrin	√	√	P
Dinoseb	√		P
EDB (Ethylene Dibromide)	√	√	P
Endrin		√	P
Fluoroacetamide	√		A
HCH[55]	√	√	N
Heptachlor	√	√	P
Lindane		√	R
Mercury Compounds[56]	√		P
Paraquat		√	r
Parathion		√	A
Parathion- Methyl		√	R
Pentachlorophenol (PCP)		√	P

Source: author's presentation

52 √ = included, P = prohibited, R = restricted sales and use (only available on prescription), r = restrited use , A = allowed, N = not registered

53 PIC = FAO Prior Informed Consent

54 PAN = Pesticide Action Network

55 HCH = Hexachlorocyclohexane (H)

56 mercuric oxide, mercurous chloride, calomel, other inorganic mercury compounds, alkyl mercury compounds, alkoxyalkyl and aryl mercury compounds

Appendix 4: Pesticide Taxation

Pesticides are exempted from all taxes by law no. 7293. Originally, a distinction between the different classes of pesticides had been foreseen as indicated by table 4.1.

Table 4.1: Taxation of pesticides if they were not exempted from taxes

Type of Pesticide[57]	**Import Duties**		**Sales Taxes**		**Total**[58]
	General import duty[59] (in %)	Safeguard clause[60] (in %)	General sales tax[61] (in %)	Selective Sales Tax (in %)[62]	%
Insecticides					
- without packaging	5	1	0	0	6
- bottled	5	1	11	10	28.26
Fungicides					
- for agriculture	5	1	0	0	6
- for other uses	5	1	11	0	17.66
Herbicides	5	1	0	0	6

Source: Updates of decrees no. 22593-MEIC-H, 22594-H-MEIC published in Appendix no. 39 of "La Gaceta Diario Oficial" no. 217 del 12.11.1993, Tomo II, own calculations

Pesticide trade policies

If pesticides were not exempted from import duties, they would qualify for both ad valorem duties, namely the general ad valorem import duty (derecho arancelario de importación) and a variable duty in the context of a safeguard clause (law no. 6946), that under non-emergency circumstances is 1%. All

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57 Harmonized Commodity Description and Coding System (HS) Codes:
insecticides = 3808.10.00, fungicides = 3808.20.00, herbicides = 3808.30.00

58 Totals have been calculated in the following way:

cif-value = 1.00
1.00 x (1 + import duties) = 1.06
1.06 x (1 + sales taxes) = 1 + overall tax rate

59 derecho arancelario de importación

60 law no. 6946

61 impuesto de venta (These rates may have changed in the context of the recent increase of the general sales tax from 10 % to 15 %.)

62 impuesto selectivo de consumo

pesticides (HS[63] Chapter 3808) would be taxed with a 5% import duty and with a 1% duty due to law no. 6946.

The above named tax exemption does not apply to raw materials imported for pesticide production in Costa Rica. Those are taxed either with a 1 % or a 5 % general ad valorem tariff. This duty is being negotiated, the Costa Rican pesticide industry strongly recommending its abolishment. At present, inputs for the industry cannot be exempted from import duties due to committments made in Central American trade agreements.

Pesticide sales policy - taxation within the country

The Costa Rican state applies two different sales taxes. First, a general 15 % sales tax *(impuesto de venta)* and an (additional) selective sales tax *(impuesto selectivo de consumo)*. Goods for basic consumption are exempted from all taxes, pesticides and other agricultural inputs[64], too. In Costa Rica the general sales tax is only applied to the final product, i.e., sales taxes paid for raw or intermedium inputs in the production process can be balanced with sales taxes paid for the final product of a firm.

The additional selective sales tax cannot be offset at the and of the fiscal year.

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63 HS = Harmonized Commodity Description and Coding System
64 law No. 7293

Appendix 5: Background Information on the IICA Seminar-Workshop on Crop Protection Policies in Costa Rica

Table 5.1: Institutions Involved in the Policy Evaluation

Type of Institution	**Number of Evaluators**	
Ministry	■ ■ ■ ■ ■ ■ ■ ■ ■	9
Other Government Institution	■ ■ ■ ■ ■ ■	6
Research Institution	■ ■ ■ ■ ■ ■ ■	7
Private Sector Institution	■ ■ ■ ■	4
TOTAL		26

Table 5.2: Determinants of pesticide use: mean, range, and mean absolute deviation of the evaluations

DETERMINANTS OF PESTICIDE USE	MEAN	MEAN ABSOLUTE DEVIATION	RANGE
INSTITUTIONAL FRAMEWORK AND INFORMATION			
Promotion of Pesticide Intensive Agricultural Production Systems	+3.19	1.21	-2 to +5
Lack of Implementation of the Pesticide Legislation	+2.88	1.09	-1 to +5
Education in Crop Protection	+1.59	2.10	-3 to +5
Credit Requirements	+2.59	1.26	0 to +5
Public Funding of Pesticide Research	+0.61	2.11	-2 to +5
Information Transmitted by the Chemical Industry	+3.15	1.43	-3 to +5
Recommendation of Pesticide Retailers	+2.96	1.21	-4 to +5
Lack of Information on Non-Chemical Methods	+1.77	1.30	-4 to +3
IPM Extension Programs	-1.58	1.22	-3 to +5
Insufficient Use of Economic Arguments in IPM Extension	+1.21	1.46	-4 to +3
TAX EXEMPTIONS AND HIDDEN COSTS			
Tax Exemptions for Pesticides	2.30	1.22	-2 to +5
Tax Exemptions for Complementary Inputs	1.71	1.32	-2 to +5
Health Costs (for Medical Treatments)	0.36	1.08	-2 to +4
Additional Costs Because of Pesticide Resistance	1.32	1.80	-3 to +5
Long Term Environment and Health Costs	-0.29	1.84	-5 to +5

Table 5.3: Options for the policy evaluations

A.	**TAXES**
A.1	General tax for all pesticides
A.2	Specific tax for the most dangerous pesticides
B.	**SUBSIDIES FOR IPM OR ORGANIC FARMING**
B.1	Subsidized credit for IPM and organic farming
B.2	Comercialization support for IPM and organic farming
B.3	Extension in IPM and organic farming
C.	**TAXATION PLUS REINVESTMENT IN CROP PROTECTION SECTOR**
C.1	General tax plus subsidies B.1 - B.3
C.2	Specific tax plus subsidies B.1 - B.3
D.	**REGULATORY MEASURES**
D.1	Prohibition of the most hazardous pesticides
D.2	Sales restriction of highly hazardous pesticides (prescription)
D.3	Restriction of the application of hazardous pesticides

The Pesticide Policy Project

The Pesticide Policy Project began in April 1994 as a project of GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), sponsored by the BMZ (Ministry of Economic Cooperation and Development) and is being carried out under the supervision of Prof. Waibel, Institute of Horticultural Economics, University of Hannover. The project includes four country studies in Latin America, Africa and Asia which follow the "Guidelines for Pesticide Policy Studies".

The overall hypothesis of the project states that the current use of pesticides in many cropping systems exceeds a level which is acceptable from the society's point of view. This seems to be largely a result of ignoring economic considerations in pest management. The objective of this project therefore is to augment the use of economic instruments in pesticide policy. This is expected to lead to increased agricultural productivity and ecologically benign pest management.

Within the five year duration of the project a series of reports will be published inform about the latest findings of the project as well as related topics. The series is titled "Pesticide Policy Publication Series" and is available on request through:

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Also available in this series:

AGNE, S., G. FLEISCHER, F. JUNGBLUTH and H. WAIBEL (1995): Guidelines for Pesticide Policy Studies - A Framework for Analyzing Economic and Political Factors of Pesticide Use in Developing Countries. Pesticide Policy Project, Publication Series No. 1, Hannover

MUDIMU, G.D., S. CHIGUME and M. CHIKANDA (1995): Pesticide Use and Policies in Zimbabwe - Current Perspectives and Emerging Issues for Research. Pesticide Policy Project, Publication Series No. 2, Hannover

WAIBEL, H. & J.C. ZADOKS (1995): Institutional Constraints to IPM. Papers presented at the XIIIth International Plant Protection Congress (IPPC), The Hague, July 2-7, 1995. Pesticide Policy Project, Publication Series No. 3, Hannover