CHAPTER 15. TAXES AS A TOOL TO REDUCE HEALTH AND ENVIRONMENTAL RISK FROM PESTICIDE USE IN NORWAY

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Abstract

As a follow-up of the Norwegian Action Plan for Pesticide Risk Reduction (1998-2002), a new pesticide tax system was implemented in 1999, replacing a system based on import value. The new tax system consisted of seven tax bands based on patterns of use, and human health and environmental risk. Each band has a set tax rate per treated area. Product specific standard area doses (SAD) are then used to convert the tax per hectare to a tax per kg or litres of product. The new tax system was evaluated in 2003. The experience so far is that the area-based tax system seems to be better than the old system. The increase in pesticide tax that followed the introduction of the new system led to the hoarding of pesticides by importers and users in the year before. This resulted in such a large variation in the sales data that it was too early to draw clear conclusions about the new systems effect on sales and risk. There was some concern that the area-based system using SAD would favour high application rates, which in turn would lead to higher recommended application rates on the product labels. This has not been the case. The biggest weakness of the SAD system is that for certain products it can be difficult to determine which crop(s) represent the main area of application. As a result, the determined SAD can be based on the wrong premises and thus lead to inconsistencies. User surveys will probably reduce this problem. Improvement points with respect to criteria for both human health and the environment were identified. The evaluation provided other important inputs into revising the banded tax system which was implemented in October 2004.

Background

The Norwegian pesticide tax system consists of three parts: a registration fee; a levy to fund the efficacy and residue trials, inspections and the registration process; and a banded tax system. Only the banded tax system will be covered in this paper.

Taxation of the agricultural pesticides was first introduced in Norway in 1988, as a percentage of the import value of the pesticides. A new system was developed in 1998 (NAIS, 1999) as a follow-up of the Norwegian Action Plan for Pesticide Risk Reduction (1998-2002) (Ministry of Agriculture, 1998).

Changing the tax scheme reflected the goal of reducing use of pesticides that represent the greatest risk to human health and the environment. In order to link the tax more directly to pesticide use, the Action Plan proposed an area-based approach. In addition, the tax system should be banded according to patterns of use, and potential human health and environmental risk. The products with the highest potential risk should have the highest tax.

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The banded tax system

General description

The tax system is area-based in the sense that it is uses a system of differentiated tax rates per hectare and SAD per hectare. The Ministry of Agriculture evaluates the level of the pesticide taxes in connection with the annual National budget process, and decides upon any changes. The base rate was initially fixed at NOK 20 (about EUR 2.4) per hectare (increased to NOK 25 per hectare from January 2005).

The banded tax system consists of seven tax bands, as shown in Table 1. Adjuvants are placed in a separate band with no tax (factor 0). There is a separate band for seed treatment pesticides and biological pesticides with a low tax. Ordinary pesticides for professional use have three tax bands (2-4). There are two bands for pesticides used in home gardens with the highest tax rates.

The three tax bands for the professionally used pesticides are differentiated according to human health and environmental risk (intrinsic properties and exposure). The placement in these three tax bands is determined by the product's placement in one of two health categories and one of two environmental categories, as described below.

The tax per hectare (ha) for each of the tax bands is calculated by multiplying the base rate (*e.g.* NOK 20) with the factor for the tax band in question:

Tax per hectare = base rate x factor for the given tax band.

Table 1. Description of the different tax bands

Tax band	Tax rate	Product type
0	(base rate x 0)	Adjuvants
1	(base rate x 0.5)	Seed protectants and biological pesticides
2	(base rate x 1)	Products with a low human health risk and a low environmental risk
3	(base rate x 4)	Products with a low human health risk and a high environmental risk, or a high human health risk and a low environmental risk
4	(base rate x 8)	Products with a high human health risk and a high environmental risk
5	(base rate x 50)	Concentrated home garden products
6	(base rate x 150)	Ready-for-use home garden products

The SAD, which is determined by the maximum application rate (in grams or millilitres per hectare) for the main crop(s) for which the pesticide is used, is then used to calculate a tax per litre or kg of product from the tax per hectare. The conversion is done by multiplying the per hectare rate by 1 000 and dividing by the SAD:

Tax per kg or litre = (base rate x factor) x 1 000 / SAD.

The Plant Protection Centre of the Norwegian Crop Research Institute proposes the SADs based on SAD guidelines (NCRI, 1998). The Norwegian Food Safety Authority (NFSA) then approves the SADs and also determines the product's tax band, in connection with pesticide registration. Before 2004, the Norwegian Agricultural Inspection Service (NAIS) was responsible for pesticide

registration. NFSA was formed in January 2004 from the amalgamation of a number of organisations, including most of the NAIS.

Human health criteria

The human health criteria are based on a qualitative assessment of intrinsic properties and exposure, where the degree of exposure depends on the type of formulation and the application method. Each product is placed in one of three risk classes (low – medium – high) based on its intrinsic properties. This is combined with scores for exposure during mixing and during application of the pesticide. The degree of exposure (low or high) during mixing is based on the formulation type, while degree of exposure (low or high) during application of the pesticide is based on equipment and crop type.

Table 2 shows the different combinations of properties and uses. The figures in brackets specify factors. The result for each pesticide product is obtained by multiplying the factor for inherent properties with the exposure factors. According to this, products are divided into two health categories. Products that obtain a score of 8 or more are placed in the high health risk category. Products with lower scores are placed in the low health risk category.

Table 2. The different combinations of properties and uses making up the human health criteria

	Exposure during mixing			
	Low (1)		**High (3)**	
	Exposure during spraying		**Exposure during spraying**	
Intrinsic properties	**Low (1)**	**High (2)**	**Low (1)**	**High (2)**
Low (1)	1	2	3	6
Medium (2)	2	4	6	12
High (4)	4	8	12	24

Environmental criteria

The pesticide products are placed in one of two environmental categories based on a system of threshold values. The pesticides are assessed according to their toxicity in aquatic and terrestrial ecosystems, as well as their bioaccumulation, persistence and leaching potential. If an active ingredient exceeds the threshold value for at least one of these parameters, it is placed in the high environmental risk category. Remaining products are placed in the low-risk category. Pesticides used in greenhouses are placed directly in the low-risk category because of low environmental exposure.

Evaluation of the tax system

As part of an evaluation of the Action Plan, the tax system was evaluated in 2003 (NAIS, 2003). The main parts of the evaluation were:

- Identification of strengths and weaknesses of the tax scheme, including the human health and environmental criteria and the SAD;
- Comments from farmers (farmer survey);
- Consequences for the farmers' costs;

- Comments from industry;

- Assessment of the effect of the tax scheme with regard to use and risk trends.

Human health and environmental criteria

The human health classification system is designed as a simple risk matrix, combining both intrinsic properties and exposure parameters. To a large degree, this reflects the actual risk associated with pesticide use. The system is easy to understand but it does not cover such risk factors as exposure during handling of treated plant material and seed protectants, or the toxicity of relevant metabolites.

The guidelines for the environmental categories are simple, and are more or less based on international standards. Not much is left to individual judgement, and the system is easy to understand. A weakness of such a threshold system is that a pesticide with near-threshold values for several parameters (without exceeding any of them) is classified in the low-risk category, whereas products which exceed only one threshold value, and otherwise have low risk in all other aspects, are placed in the high-risk category.

A general drawback of only having two categories for both human health and environment risk is that it can lead to a proportionately large tax difference between products that have only slightly varying risk parameters. This applies to products whose risk parameters are in the "grey area" between the two categories. It is difficult to justify such a sharp distinction. Ideally, it would therefore be desirable to have a more differentiated system with additional categories.

Use of standard area dose

Maximum application rate

When the new tax system was introduced there were protests against the effect of SAD on the tax, since a high SAD would result in a low tax per kg or litre of pesticide and vice versa. It could appear that the system favours the use of high application rates, which contradicts the policy of reducing overall pesticide use. This could in turn encourage pesticide companies to increase the suggested application rates on their labels instead of the opposite.

However, the crop application rates on the labels are based on field trials that are mainly conducted by the Plant Protection Centre, and they make ant necessary changes to the recommendations of the pesticide companies. In Norway, each pesticide is re-evaluated using the substitution principle every five years, and the continued certification of a pesticide may depend on reductions of application rates in order to reduce the risk to human health or the environment.

Further, the application rate is one of the factors affecting the environmental classification. By increasing the application rate, the producer/importer risks having the product moved to a higher tax band, or in the worst case, having it refused. Due to these mechanisms, the NFSA feel confident that the SAD is not set higher than is scientifically justifiable.

Choosing the main crop

The choice of the SAD crop is important in both the human health and environmental evaluations. In the human health assessments, the user's exposure to a pesticide is estimated based on the product's main crop. For example, spraying greenhouse crops exposes the user to a greater risk

than spraying field crops. Thus, the definition of the main crop can have an effect on which category for human health risk the product is assigned to. The same is true for the environmental assessment.

The biggest weakness of the SAD system is that for certain products it can be difficult to determine which crop or crops represent the product's main area of application. As a result, the determined SAD can be based on the wrong premises and thus lead to inconsistencies. This applies mainly to products that are certified for use in many different crops and against numerous pests. These considerations are further complicated by possible annual variations of the pest populations.

So far there is not sufficient data available that can be used to support these assessments. In 2001 and 2003, Statistics Norway in co-operation with the NAIS/NFSA undertook pesticide user surveys (Statistics Norway, 2002 and 2004). The results from these surveys will be helpful in choosing the SAD crop(s) for the different pesticides. The surveys include the most widely used pesticides for the most common crops.

Other factors that complicate the determination of SAD include the incomplete user guidelines on some labels, *e.g.* when information about application rates is incomplete. However, this issue is being continuously updated and clearer guidelines have been recently introduced. Some pesticides are formulated in a way that makes it difficult to convert the product's application rates to a per-area basis. This mainly applies to products such as game repellents and some home garden products.

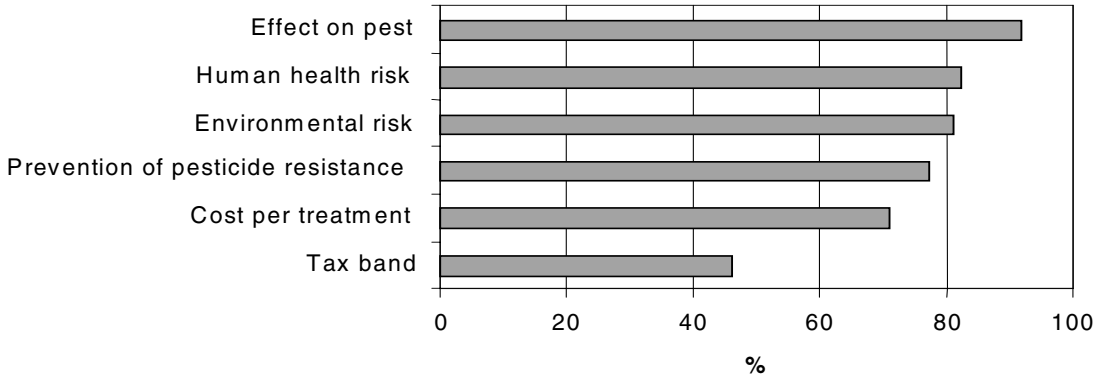
Farmer survey

As part of the evaluation of the Action Plan, a farmer survey was conducted in the autumn of 2002 (Prosjektforum, 2003). The survey contained several questions related to the tax scheme and its effect.

The survey asked which factors were the most important in a given pest control situation in which there was a choice between alternative products (Figure 1). As could be expected, farmers replied that the "effect on pest" was the most important factor. "Health risk" and "environmental risk" ranked above "cost per treatment" and "prevention of resistance". The pesticide's tax band seemingly was the least important factor.

Figure 1. Importance of different factors when choosing pesticides

(% of respondents stating that the shown factors were either "important" or "very important" when choosing between alternative pesticides)



Source: *Prosjektforum,* 2003.

Only 17% of the farmers stated that they were familiar with the tax scheme and nearly half replied that they had not received sufficient information about the new system. As the new scheme was more complicated than the previous one, the farmers' replies should perhaps not come as a surprise, even though information about the system was presented among others in annually revised product catalogues. More than 70 % said that the tax scheme led to increased costs.

Almost 40 % replied that the new tax scheme has led to use of products with lower human health and environmental risk. It is somewhat surprising that relatively many farmers claim that a product's tax band in itself is not so important when choosing a pesticide (Figure 1). However, cost per treatment does have a significant effect on their choice of product. Considering that there is quite a close correlation between tax band and cost per treatment, the focus on a product's tax band is perhaps not so important for the achievement of the tax scheme's objectives.

Costs for farmers

Calculations were made to assess the effect of using pesticides from various tax bands on the user's costs per treatment. The calculations were based on a limited number of products in the tax bands 2-4. When interpreting the data, one must keep in mind that it only represents a small percentage of the total number of the products on the market. When dealing with "alternative products", these are not always real alternatives. The farmers' choice of product depends on the occurring/dominating pest, and the application rates vary, depending on the infection pressure. Some products may be especially effective against one specific pest, whereas others may have varying degrees of effectiveness against several different pests. In some cases, spraying is preventive, while at other times it may be necessary to use a product with a curative effect. The interpretation is further complicated by the fact that farmers often use lower application rates than the SAD, which makes the actual tax burdens differ from the theoretical figures.

The comparisons showed that the new tax system generally made pesticides in the higher tax bands more expensive per hectare than alternative pesticides in the lower tax band, which is in accordance with the intentions. There are, however, examples where the tax differences between products from different tax bands are minimal, and in certain cases, it can even be more profitable to use products from higher tax bands. In certain cases, market forces including production costs, seem to have a greater effect on the cost than tax band classification. In certain situations, this may lead to farmers using products from higher tax bands, even if there are alternatives available with a lower risk to human health or the environment.

Comments from the pesticide companies

In their feedback to the evaluation, the pesticide companies did not comment on the use of SAD. When the new tax system was introduced the NAIS received complaints about SAD for certain products, which were subsequently re-evaluated. Since then there have only been a few appeals. The companies commented that they did not want any tax at all, and that the tax differentiation between tax bands 2-4 was too big. Their other comments can be summed up as follows:

- There are too few pesticides on the Norwegian market for such a banded system to be fully effective since the alternatives (if there are any) are often placed in the same tax band. The farmers often do not have a real possibility to choose pesticides in lower tax bands.

- The lack of sufficient alternatives in each tax band counteracts the prevention of pesticide resistance. Farmers choose pesticides according to their biological effect, and prefer the

cheapest ones if the effect is the same. This gives an increased risk of resistance. With less pronounced differentiation, the use of pesticides would presumably be more varied.

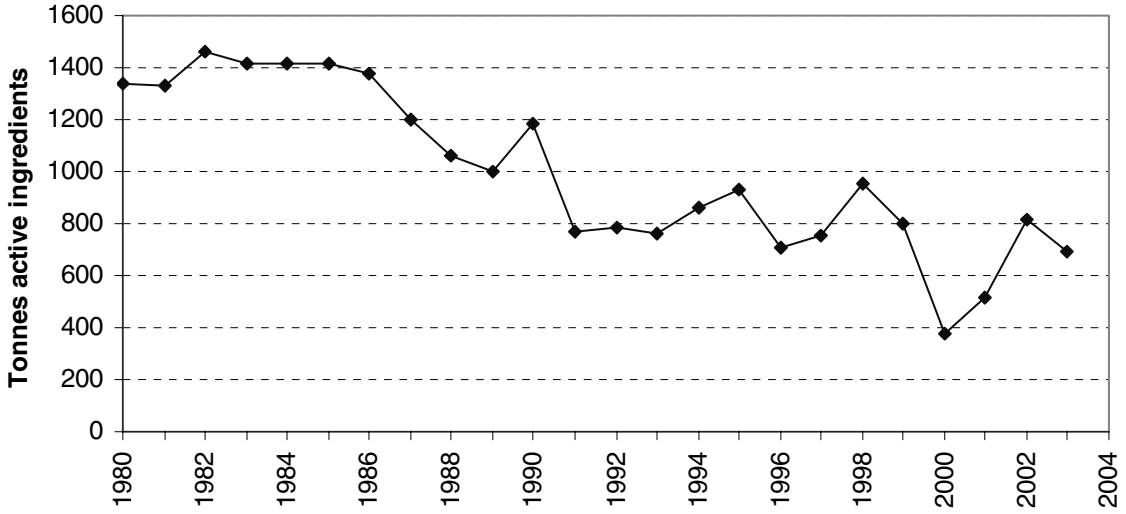
- Using pesticides in the lowest tax band does not automatically lead to reduced risks since choosing a low-risk products at the expense of effectiveness can result in additional treatments. Using only one or a few products also increases the risk of resistance, which may lead to the need for additional treatments.

- The environmental criteria should be better differentiated, and should take factors such as application rates and formulation type into account. The environmental differentiation should be based on modelling of real risk and not threshold values for intrinsic properties.

Effect on sales

Figure 2 shows the development of pesticide sales (mainly import) from 1980 to 2003. The main trend is a reduction but the variation is considerable. All the major bumps in the curve can be attributed to stockpiling before tax increases, and corresponding low import the following year(s). This shows that taxes can be a powerful tool to affect pesticide use.

Figure 2. Pesticide sales in Norway in the period 1980-2003



When the new tax scheme with tax increases was announced in 1998, farmers and importers hoarded large amounts of the pesticides that were expected to be placed in the highest tax bands. When it was announced in 1999 that the taxes were to be further increased in 2000, there was further hoarding at the end of 1999. As a result of the accumulated stockpiles, total sales in 2000 and 2001 were very low. Eventually, the stockpiles were used up, and 2002 was expected to be a "normal year". Excluding a doubled amount of glyphosate due to other factors, the total sales of active ingredients in 2002 would have been about 650 tonnes. The large variations in the sales data makes it almost impossible to evaluate effects of the tax system before the sales data are stabilised.

It is more interesting to look at the separate sales trends for the professionally used pesticides (tax bands 2-4) since these account for the largest share of marketed pesticides (by volume) and because they are banded by human health and environmental risk. By dividing the sales volume (in kg or litres) by the SAD, one arrives at a theoretic value for treated area. This area is an underestimate since

maximum application rates are used in the calculation. Nevertheless, the figure is an interesting indication of trends when comparing results from several years. Due to the way the figure was calculated, areas treated twice count as double acreage. Figure 3 shows the development for the period 1996 to 2003.

Figure 3. Trends in theoretic treated area for pesticides in tax bands 2-4

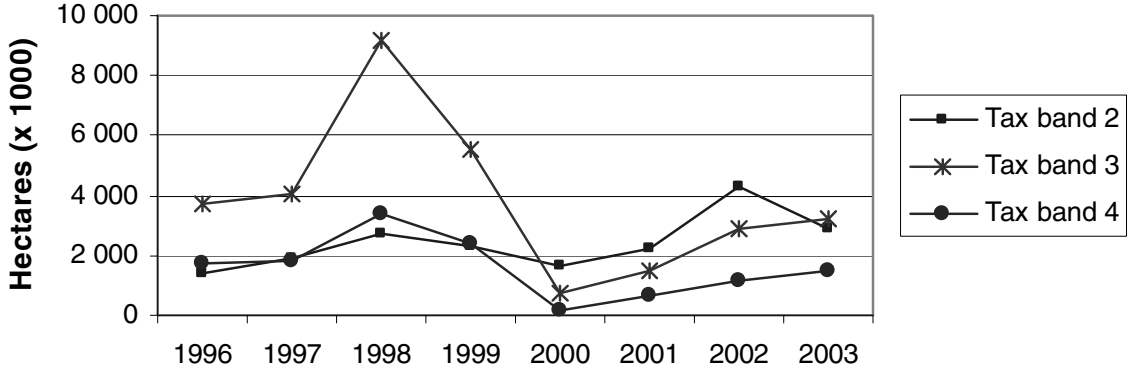
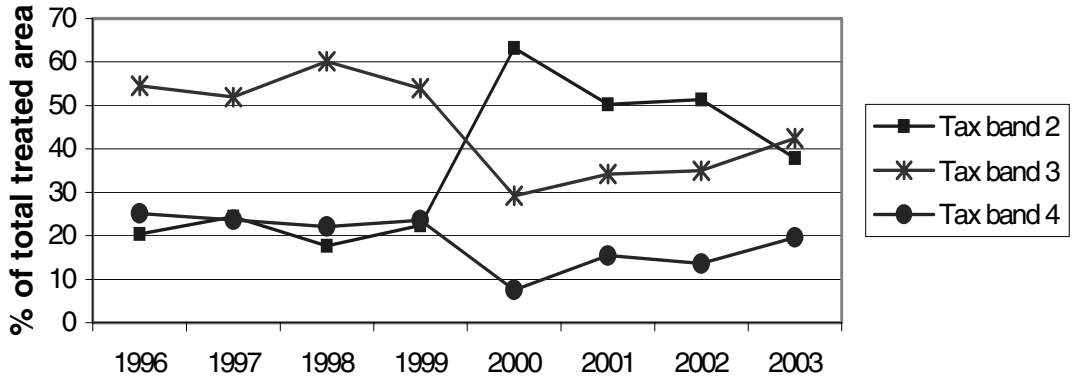


Figure 4 shows the relative development over the same period. In order to facilitate the comparison between tax bands, the total (theoretic) treated area each year is set to 100% to avoid the fluctuations due to the hoarding of pesticides. Before the hoarding in 1998, the relative distribution seemed stable, with clearly higher sales of pesticides that were to be placed in tax band 3 than pesticides in the other tax bands. After 1999, the picture changed drastically, and then seemed to be more stable again for the years 2001 and 2002. The relative share of tax-band 2 pesticides increased significantly, accounting for more than 50% of the treated area, whereas tax-band 3 pesticides showed a nearly equivalent decline. The relative share of tax-band 4 was also clearly reduced. When including the data for 2003, the picture is s not as clear, since the curves are closer to the starting point.

Figure 4. Trends for pesticides in tax bands 2-4 as a percentage of total theoretic treated area

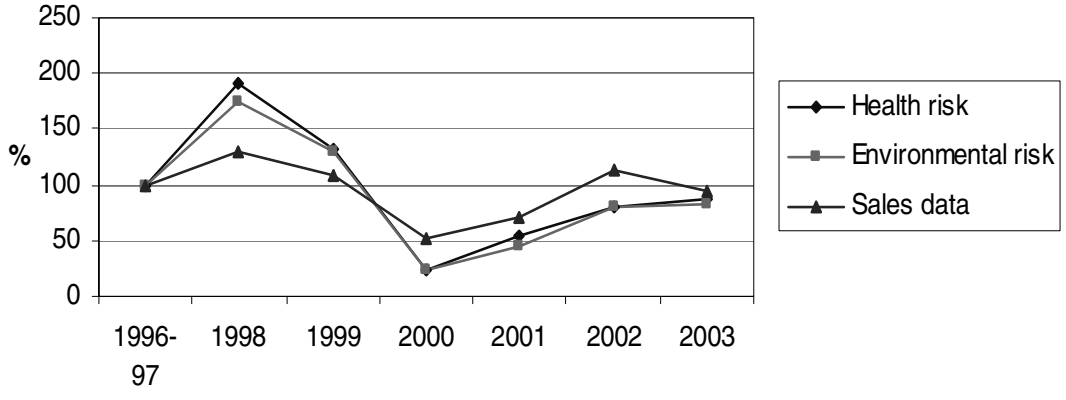


Risk trends

As a follow-up of the Action Plan, indicators were developed to describe the trends of human health and environmental risks associated with pesticides use (NAIS, 2000). Figure 5 shows the trends for the two indicators and for sales data for the period 1996/97 to 2003. The average of 1996/97 was set as a baseline value of 100 %.

Figure 5. Trends for sales data and of human health and environmental risk indicators

(The average of the years 1996 and 1997 is set as a baseline value of 100%)



The calculations of the risk indicators are based on sales data, not actual use data. The disadvantage is clear as the fluctuations due to hoarding affect the indicators considerably. It is therefore difficult to make reliable comments on the risk development. The risk indicators for human health and the environment were considerably higher than the sales figures for 1998, and somewhat higher in 1999, since much of the hoarded pesticides were those expected to be placed in the highest tax-bands. From 2000 to 2002 the indicator data were lower than the sales figures. The trend is not as clear when the data for 2003 data are included, as the curves are almost back to the baseline. It is therefore not possible to come to a clear conclusion on the risk trends before the system has had time to stabilise after the hoarding.

Further development of the tax system

As a result of the evaluation, several modifications to the pesticide tax system were introduced in October 2004 (NFSA, 2004). Specifically:

- The number of tax bands for professionally used pesticides was increased from three to five to give a better differentiation (combinations of three health and three environmental categories);

- The human health criteria were changed to include exposure to pesticides during handling of treated plant material, differentiation of seed protectants, and inclusion of relevant metabolites;

- The environmental criteria were changed to take more of the overall environmental risk into account;

- The system was changed to the same basic system as the Norwegian pesticide risk indicators.

Conclusions

The hoarding activities made it too early to draw clear conclusions about the effects of the banded tax system on sales and risk. Nevertheless, the evaluation provided important input to a revised tax system which was implemented in October 2004. The main conclusion so far is that the banded area-based tax system is a better system for human health and the environment than the old system based on import value. The limited number of products to choose between on the Norwegian market makes the tax system less effective than it theoretically could be. The banded tax system corresponds well to the polluter-pays-principle since the pesticides with the highest human health and environmental risks are the most heavily taxed.

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Part V

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