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THE USE OF FARM ACCOUNTANCY DATA NETWORKS IN GENERATING ENVIRONMENTAL DATA

Paper submitted by the Agricultural Economics Research Institute LEI,
Netherlands¹

Abstract

Consumers, the food industry, farmers and most of all governments (including taxpayers, the public and policy research) need environmental statistics. These statistics include indicators on the pressure to the environment, its state and the response towards environmental problems. This information is however not always easy to provide. Problems include lack of scientific know how on the relation between use of inputs and emission, problematic observation, lack of administrative data sources, and high costs for data in a declining economic sector.

The four main options for data collection are the re-interpretation of existing data, adapt available statistical data collection systems, design new data collection systems and use Farm Accountancy Data Networks (FADNs).

The Dutch FADN has more than 10 years experience in gathering environmental data, especially on the use of inputs and modelling of emissions. This includes data on energy use, mineral balances, pesticide use, organic farming, environment related investments, water use and landscape maintenance. An annual report describes and analysis trends.

The Dutch situation has been positively influenced by some factors that do not necessarily exist in other European countries. FADNs differ in their attitude to innovation, mainly depending on the way the FADN is organised internally. In a number of countries environmental data is already gathered and a majority of FADN managers think that such data gathering is technical feasible.

At the European level, FADNs will concentrate on a voluntary approach to collect environmental data on those topics where policy makers are interested in the relationship between policy instruments on one hand and farm income and environmental performance on the other. Environmental statistics will therefor probably be not more than an interesting by-product of FADNs. FADNs could co-operate with statistical offices in making such data available to the public.

¹ Prepared by Krijn J. Poppe.

I. Introduction

1. This paper discusses the need for environmental statistics in agriculture, and the possibilities to gather data for those statistics by Farm Accountancy Data Networks (FADNs). There is no need to define very exactly the scope of environmental data or statistics for the purpose of this paper. However besides data on well known environmental issues like pollution and use of pesticides or use of minerals, energy use and emission of green house gasses, use of scarce water resources, and erosion, it could include data of special farm types like organic farming, and on positive externalities like landscape maintenance by agriculture.

2. The paper starts by discussing user requirements to environmental statistics and listing some options for data collection. It then moves on to the core issue: can environmental data be collected by FADNs and does this has advantages over other options.

3. This issue is first discussed by presenting the experiences of the Dutch FADN. Then an assessment is given of the chances to broaden this experiences to other European countries.

II. User requirements ²

4. Environmental statistics are gathered to provide a user or a group of (different) users with information. Typical categories of end-users (we assume that researchers work for the interest of those groups) are:

- consumers;
- the food industry;
- the government (including the public and the taxpayer);
- farmers.

5. Consumers that care about the environment need information about the environmental impacts of products to make a decision to buy a product. It is unlikely that environmental statistics directly support such decision making. It is more likely that the environmental effects of production are aggregated by the food industry into one or two indicators or that special brands or labels are available that guarantee the 'green-ness' of the product.

6. An agri-business/food industry that supplies products to supermarkets and consumers focuses a number of decisions which concern environmental issues. First of all there is the overall awareness to the environmental effects of the production chain of which the individual agri-business is part of. If these effects are high, and government action can be expected, this influences strategic decision making of the firm (including options like bringing the effects down, moving production to regions were effects are smaller or to less environment friendly regions and moving out of this type of production). Secondly there is the issue of product liability and demands from consumers and super markets for tracing and tracking: in case of food pollution one wants to know what activities have influenced the product and if the quality control of such processes have worked (e.g. by installing ISO or HACCP procedures). Thirdly there is, if one produces under a green label,

² This section is an adapted version of a part of the paper by Poppe and Meeusen-van Onna (1999).

the fact that one has to install procedures that guarantees the buyer and/or the label issuing authority that the environmental effects of the production does not exceed the limits set by the green label. As these limits are relative and sharpened over time there is a need for constant monitoring as well as to install a learning process in the production chain to reduce environmental effects even further. It is clear that this needs quite a sophisticated information system, for instance based on Life Cycle Analysis. The contribution of environmental statistics to this process is probably small, but environmental information can provide useful background information to the food industry (e.g. in comparing the regional production chain with other European regions) and provide support to set standards.

7. The government's need for information depends on the stage of the political process (see *Meeusen-van Onna and Poppe, 1996*, for more details). In the stage of problem recognition there is mainly a need for fact finding to define and locate the problems. In policy formulation representative monitoring systems and statistics are used to estimate the costs and effects of a proposed policy. The government should adapt its statistics and databases according to new realities as topics and policies change (*Fletcher and Phipps, 1991*). In the stage of implementing solutions policies often evolve from extension and soft policies that include compensation for negative consequences of a policy towards more severe effects, including the questioning of the necessity of production as such. Economic effects on micro-level are often a central issue in the discussion, as well as the efficiency of the policy. This requires detailed information. The fulfilment of policies by farmers can demand simple taxes and auditable data for these levies. In the stage of control of the policy the main need for information is monitoring that leads to less detailed information needs than in the previous stages.

8. The need for environmental statistics by governments has been well documented and has been detailed. For instance the OECD has suggested a framework of indicators in the domains of Pressure, State and Response. Based on this it has been suggested to distinguish between Driving Forces, Pressures, State, Impact and Responses (*ELISA, 1999*).

9. It is for the needs of the government, including the public (as a voter and taxpayer) and the research carried out for this group, that environmental indicators play an important role in day to day decision making on policies - not uncomparable to statistics on agricultural prices, income or monetary statistics.

10. Farmers have to take environmental issues into account in their decision making in several ways. On one hand they (potentially) face environmental legislation from the government that influences their strategic, tactical and operational decision making. It could even mean (like in the case of mineral accounting in the Netherlands) that they have to record the environmental impacts of their farm in an auditable way. For many years it already influences strategic decisions in investments and the choice of the farm system.

11. On the other hand farmers, especially those that produce for green-labelled products, face contractual obligations from the agri-business to report on the environmental aspects of their production. Until now these obligations often focus on one product, for which the activities have to be recorded (logging). It has been argued elsewhere (*Udo de Haas, 1996*) that an ISO 9001 or 14000 procedure for the whole farm could make more sense, and can lead to audits that provide more guarantees and cheaper data.

12. As with the food industry, the contribution of environmental statistics to the day to day decision making is probably small, but environmental information can provide useful background information for strategic decisions.

III. Problems and options in data collection

13. The clear need for environmental statistics, especially from governments, research and the public, invites the question how to satisfy this demand. Environmental data on agriculture seem to have a number of special problems, and there are several options in designing data collection systems. First we take a look at some of the problems:

- many statistics on environmental pressure are difficult to observe. Stocking rates (livestock units per hectare) are relatively easy to gather by e.g. a Farm Structure Survey. However the impact of pesticides (where hundreds of types are used, and the environmental impact depends on the type of chemical, the crop, the location (close to water surface or not), the doses, the exact timing (wind speed) etc.) is a much more difficult issue. Like income they are not easy to observe without going through documents or being on the spot at the moment of application. It is not easy to recall by memory at the end of a year what the use of fertilisers has been exactly. Sometimes the costs of the use are rather small, and farmers not interested (e.g. energy use in arable farming);
- in addition a lot of scientific know-how between the use of potentially damaging inputs and the emission to a specific compartment of the environment (e.g. soil, air, groundwater) is still missing (*Weidema and Meeusen, 1999*);
- pollution is very often point pollution, and especially for policy research it is very important to have data on the distribution of an indicator;
- statistics on the state of the environment are sometimes available from measurements on e.g. water quality for catchment areas, but such data is difficult to link to pollution sources like agriculture as more sectors of the economy are involved, and because there is a (too often unknown) time lag between the application of chemicals and the measurement of its effects;
- collecting data on the response of the society is also not easy. Measurements of costs are difficult in cases where for instance chemical inputs are restricted and have to be substituted by family labour or lead to a risk of lower harvests. Costs of policy measures that makes some options on machinery obligatory are difficult to estimate, as the old versions of the machinery are not marketed any more (*Leneman et al., 1999*).
- there are not yet many administrative databases available, like in other domains (like tax data for income measurement). Good examples are records of pesticide admission. As farmers have to keep environmental accounts (like on minerals in the Netherlands, see *Breembroek et al., 1996*) this will change;

- in statistical offices the collection of agro-environmental statistics is sometimes difficult to organise. There is some tension between the sector approach and the domain approach: should agricultural statisticians take the lead and 'green' their current tools like the farm structure survey (FSS) with a focus on pressure indicators? Or should environmental statisticians take the lead? And how to deal with differences in definitions?;
- an additional issue is that agriculture statistics already take a part of the statistical budget that is larger than the declining share of this sector in the economy. One should realise in such a discussion that governments are in this domain not only a sponsor of statistics but also an intensive user due to the government intervention in this sector and that agriculture is by far the biggest land user. But such arguments not always count, and decision makers in statistical offices are often struggling to provide more statistics on environmental issues in agriculture.

14. There are a number of options to design the data collection system that provides the users with environmental data. In choosing from these options, it is necessary to take into account the user and the background of the information need of that user. There are two reasons for this necessity. First of all environmental data and the data collection system have a cost. Secondly (or better: generally) information systems must provide information of a certain quality at an acceptable cost. Quality, however, is a user-based concept: there is no such thing as an absolute quality and quality comes at a certain price. Quality can be defined as 'the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs' (ISO 8402).

15. Attributes of quality for an information system can be: relevance, accuracy, timeliness and punctuality, accessibility and clarity of the information, comparability, coherence and completeness (*Abitabile et al., 1999*). This quality approach leads to the conclusion that there is probably not one preferred method to collect data. The user and the circumstances shape the solutions in a particular case.

16. The four main options for data collection are:

- use existing data (statistical or administrative), and interpret them from an environmental point of view;
- take on board environmental issues in current statistical data collection systems;
- take on board environmental issues in FADNs;
- design new data collection systems.

17. Most of the work carried out at EU level in agricultural environmental issues have until now taken the first approach. Some examples (taken from the concerted action *ELISA, 1999*): the FSS provides data on stocking rates per farm and region and can be used to calculate the output of N from manure per hectare. The Corine-database provides data on land cover; data on birds counts can be matched with land use data, data from the quality of the water in rivers like the Rhine can be correlated with sales on nitrogen to agriculture, costs spend on pesticides by farmers in the FADN can be used for a first screening to identify farm types and regions where pesticides might be an issue. It is however clear that such an approach misses a good theoretical framework and can be the victim of the MacNamara fallacy:

'The first step is to measure whatever can be easily measured. This is OK as far as it goes. The second step is to disregard that which can not be easily measured, or give it an arbitrary quantitative value. This is artificial and misleading. The third step is to presume that what can not be measured easily really is not important. This is blindness. The fourth step is to say that what can not be easily measured does not exist. That is suicide' (D. Yankelovich - 192, cited in Gray, 1993).

18. The advantage of re-using existing data is of course that it is very cost effective (no new data gathering is needed) and that the statistics can be delivered rather quickly.

19. The second approach is now also used in some countries and at the level of EUROSTAT work is going on to take some environmental issues into account in e.g. designing a new edition of the FSS. Steps in this direction are necessary, but not always easy. Not everybody always agrees to a redirection of the objectives of a survey and adding something new also often means that one has to agree on what to delete. In essence the FADNs have a similar problem. The rest of this paper focuses on their experiences to gather environmental data.

20. The fourth approach is from the user point of view perhaps the most attractive, but it seems also to be the most expensive one.

IV. Experiences in the Dutch FADN

21. Farm Accountancy Data Networks have been set up in nearly all European countries, and have currently the objective to support decision making on the agricultural policy. The data sets are based on farm accounts and all the countries in the European Union organise a harmonised compilation of accounting information from a sample of farms in their own country (in total nearly 60,000 farms). The data is compiled and combined in one database by the European Commission in Brussels. Countries in Central and Eastern Europe are building up FADNs, and it is expected that their data will be comparable ³.

22. In the Netherlands the FADN is managed by the Agricultural Economics Research Institute, that gathers the data with its own staff, directly from the farmers. Since the late nineteen eighties, the FADN has started to gather environmental data in its FADN on each of the 1,500 individual holdings. Currently this includes:

- energy use in quantities, specified per type of energy;
- flows of manure to and from the farm per type of manure and the use of it per arable crop;
- mineral accounts for N, P, K at farm level, calculated on the mineral content of inputs and outputs in quantities;
- manure storage capacity;
- use of pesticides allocated per crop, specified per individual admitted type of pesticide (more than 1,000 types);
- veterinary medicines per type;

³ A lot of other countries (for example, the USA, Canada, Australia, New Zealand) also compile farm accountancy data from a sample of farms. Their methods however are not harmonised with EU methods, which makes comparisons of the results extremely difficult (Morisset, 1994).

- housing systems for animals, as they influence ammonia emission;
- payments and subsidies received for landscape maintenance contracts;
- use of water, especially from sources of ground water and surface water and their use on different crops;
- data from organic farming;
- investments in environment-related assets (including quota).

23. This list shows that the FADN is well suited to measure the inputs and outputs of a farm in volume terms, even of small pesticides. This is due to the fact that the accountants of the FADN see all the invoices a farmer receives, and can take this information from those invoices. If the co-operation of the farmers is good, one can also ask them more specific questions on the use of inputs and the allocation to enterprises (crops, animal operations). We even organised surveys, interviews and in one project had soil and water samples taken to be analysed and correlated the results with the management practices on the farm. As the FADN is a representative sample, connected to the FSS, the results can be aggregated to the level of the field of survey or even to all Dutch farms.

24. It is clear however that the environmental data from the FADN do not necessarily measure the real emissions on the farm (and hence the pressure of farming on the environment), nor the state of the environment in a region. Models can be used to estimate such emissions, and show the response of farmers to environmental policies.

25. The gathering of environmental data in the Dutch FADN has been positively influenced by a number of factors, that not necessarily exist in other countries:

- the FADN played and plays an important role in providing the government with data on agriculture, and such data plays a relatively important role in the consensus decision making that characterises Dutch politics;
- due to an environmental awareness and environmental problems since the nineteen seventies, policy makers in the Netherlands have been interested in this issue for a long time;
- the FADN already collected a large number of technical data (e.g. protein content of milk, volumes of inputs) for research purposes, that are also useful for environmental data;
- the data collection is done by the institute itself, and the institute has good command over the software used. Software could therefore be adapted to gather environmental data;
- the research-departments of the institute, and therefore the management, had a clear interest in this type of data gathering.

26. In 1993 the LEI started the annual publication 'Agriculture, environment and economics' (*Mulder et al., 1993*). This publication has been explained and summarised on request by the OECD by *Brouwer (1995)*. It is a yearly review of trends in environmental issues in agriculture, providing descriptions, analysis and original statistics. These statistics are mainly based on the FADN. Other statistics are used in the first part of the publication (the description of trends and analysis) but not reproduced once more in the statistical part. Appendix 1 provides some examples of tables from the 1994 publication, just to show what has been already available at that time (and to underline that now also time series are available).

27. Most of the FADN-data has been very well received. The energy-data in glasshouse horticulture are used as the official monitor for an energy-reduction contract between the government and the farmers organisations. Some

of the data is provided to Statistics Netherlands for official statistics. The Environmental Planning Agency RIVM is also an important customer of research based on FADN-data. Currently the use of environmental data from the FADN for Life Cycle Analysis (LCA) is on trial (*Poppe and Meeusen, 1999*). One of the attractivenesses of the FADN data to the farming community and to researchers is that it provides not only distributions but also the characteristics of farmers with a good environmental performance (that to a certain extent often correlates with good farming practice and not necessarily implies low efficiency and low income).

28. Gathering and providing such data has however implicated changes for the FADN. First of all many adaptations in software were needed, with the result that in the end a total renewal of the system was the only solution to solve the problems of high maintenance costs due to spaghetti-software. This has lead to very flexible software, which will become available for other FADNs and statistical offices too (see *Poppe, 1999*).

29. Providing new types of data for new clients also meant that definitions had to be reviewed. An example is the definitions on environmental costs of pesticide reduction (*Leneman et al., 1999*) where, at least in the Netherlands, definitions are used in cost benefit analysis that are different from those in the FADN. The FADN is now also used by Statistics Netherlands to make the national accounts, this showed that the FADN cannot standardise its outside world, but that it should have software tools to handle different definitions on comparable topics for different clients.

V. An assessment of using FADNs for environmental data in other EU countries

30. The experiences in the Netherlands raise the question in how far FADNs in other countries are also an interesting source for environmental data. The factors, identified above, that supported the development of the Dutch FADN into the market for environmental data, are not necessarily existing in other countries.

31. The concerted action PACIOLI (*Poppe, 1997*) indicated that the FADNs in Europe show large differences. There seem to be two arch-types, labelled X and Y (figure 1), who have very different attitudes towards innovation in this direction.

32. In a number of FADNs there are activities on environmental data that are quite similar to those in the Netherlands. Belgium for instance gathers comparable data on energy use in glasshouse horticulture (*Van Lierde et al., 1999*). Several member states collect mineral balances. And data on organic farms are now available in several member states.

33. Changes in the Common Agricultural Policy and dissatisfaction with the rather old current farm return have been incentives for the European Commission to review its current farm return (the data set it gathers) by asking a group of experts from 4 member states to conduct a survey and put forward proposals for renewal. In this so called Ricastings-project (*Abitabile et al., 1999*) clearly different views on the data content of the farm return were aired by stakeholders and FADN managers. On one hand there is are people in favour of increasing the data content of FADN with data on environmental issues, pluri activity and non-farm income. Others however oppose this, pointing to high costs, reluctance of farmers, and lack of data quality. These opinions illustrate the different FADN systems between member states.

34. The survey also showed that a lot of data is already available on topics like organic farms, mineral balances and landscape maintenance payments (figure 2). A large majority of FADN managers thought data gathering technically feasible, and were mainly opposed for a lack of funds.

Aspect	Type X: 'low cost - low value'	Type Y: 'high risk - high value'
Central organisation in FADN	Ministry of Agriculture	Research Institute
Type of finance	internal budget	output-related
Data gathered by	buying from accounting offices	own staff
Farmer's participation	is paid	free
Information feedback to farmers	low	high
Data flow and its: - information and - innovation	low low	high high
Data used by research	incidentally	often, and critical success factor
Political culture	data monopolised by ministry; no open access by others	policy advise and consensus building in the public
Main role of EDI	can solve lack of interest	can reduce higher costs
Typical example	Germany	The Netherlands

Figure 1 Two different types of FADN

35. The Ricastings study advocated to solve this issue by making a distinction in the new farm return between a hard core of obligatory data and a set of voluntary data. It was also noted that accounting systems as such should not preferably be used to gather data on new topics. The only reason to gather such data in an FADN is if the policy makers are interested in the relationships within the farm between e.g. policy measures (subsidies, quota etc.) on one hand and the effect on income and (e.g. environmental) performance/behaviour of the farm on the other hand. If one is only interested in environmental issues as such (e.g. a state indicator like water quality) other data sources are probably cheaper and do not have to burden farmers and the FADN data collecting system. However in an increasing number of cases the policy makers are interested in such links, and especially FADNs with low marginal costs for extra data variables are attempted to provide such data.

Topics	Countries with data		Countries that have data available, at least for subsamples in some years														
	available	gathering feasible	B	Dk	D	G	E	F	Irl	I	L	NL	A	P	Fin	S	UK
nitrate and others	6	12							x		x	x	x		x		
gross margins, physical data	11	13		x			x		x	x	x	x	x	x			x
cost of production	8	11	x	x			x		x	x				x			x
organic production	9	14	x	x	x				x	x	x	x	x		x		
processing on the farm	9	13	x				x		x	x	x	x	x	x			x
agri-tourism	9	13	x				x		x	x	x	x	x	x	x		x
landscape maintenance	5	9	x				x		x	x							x
forestry	7	11		x	x		x		x		x	x	x		x		
non-farm activities	5	9		x								x	x		x		
non-farm income/capital	7	13		x	x							x	x		x		x

2 Data availability

36. Modern information and communications technology can support a division into obligatory and voluntary data. This view has been adopted by the Commission and, recently, by the management committee of the FADN.

VI. Concluding remarks

37. The experiences in the Netherlands show that an FADN can be a valuable source for environmental data. The trend towards more environmental data in FADNs is also clear in other European countries. However it is unlikely that the European FADNs will be able to provide the bulk of environmental data in the coming years. In some countries the FADN is not suited for this. Secondly the FADNs concentrate on pressure indicators (at best) and especially on those topics where policy makers are interested in the relationships within the farm between alternative policy measures (subsidies, quota etc.) on one hand and the effect on income and environmental performance/behaviour of the farm on the other hand. This leads to the conclusion that some of the need for environmental data by governments can and will be fulfilled by FADNs, but environmental statistics will probably at most be an interesting by-product of FADNs.

38. This also invites a few remarks on the co-operation between FADNs and statistical offices. With the exception of Sweden (where SCB, Statistics Sweden runs the FADN) this means in all European countries a co-operation between the statistical office and the FADN managing unit (often the Ministry of Agriculture or a Research Institute). Such co-operation already exists on typology and using the FSS for selection and weighting. These issues have however a more technical character than 'competition with marketable products' like data; in the Netherlands we had at a certain time a lot of discussions and competition between e.g. energy or pesticide data from the FADN and comparable data from Statistics Netherlands. It is clear that this is in the end not in the interest of anybody.

39. Where the FADN concentrates on data collection and data base management for detailed policy analysis with panel data, it should not necessarily move into the field of publishing statistics for the general public. The future funding of an expensive exercise as the FADN is better secured when it provides the statistical office with valuable data on a relatively small sector which can be used in national statistics. In some cases a Statistical Office could have a positive influence on the quality management in an FADN. Issuing a quality label, like Statistics Finland does with its SVT label, to providers of data like the FADN is an interesting management instrument.

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Appendix 1

Table A1.1 Energy consumption by energy carrier in 1992 (PJ and guilders)

Sector	Natural gas		Electricity		Diesel		Total	
	PJ	Dfl	PJ	Dfl	PJ	Dfl	PJ	Dfl
Arable	0.0	0.2	0.3	16.9	3.1	65.1	3.4	82.2
Cattle	0.3	5.5	2.7	134.1	5.1	121.8	8.1	261.3
Intensive livestock	7.6	151.2	2.2	110.1	0.1	2.6	9.9	263.9
Horticulture	133.3	986.6	3.0	131.7	0.8	27.0	137.1	1,145.2
- vegetables	54.3	404.9	0.9	39.3	0.3	9.5	55.4	453.8
- greenhouse floriculture	47.5	345.1	1.3	59.4	0.3	9.8	49.1	414.4
- pot plant under glass	22.8	170.4	0.6	24.3	0.2	5.8	23.5	200.6
- other	1.8	23.9	1.2	56.8	1.7	46.4	4.7	127.1
Total	143.0	1,167.4	9.4	449.6	10.9	262.9	163.2	1,879.7

Source: Poppe et al., 1994b.

Table A1.2 Nitrogen balance (kg of nitrogen) per farm by farming type in 1992

	Arable farms	Dairy farms	Granivore farms	Mixed farms	Average farms a)
Total input	14,524	14,670	23,400	15,049	15,574
- animal products	48	133	920	296	261
- feed	651	4,902	21,872	9,402	7,101
- fertilisers	6,734	7,487	297	3,397	5,557
- organic manure	4,745	532	45	805	1,211
- other	2,346	1,616	265	1,148	1,444
Total output	6,292	3,219	17,285	7,331	6,170
- crop products	5,970	95	260	131	1,232
- livestock	256	840	6,141	2,678	1,761
- milk products	7	1,803	27	458	998
- organic manure	7	333	9,323	2,287	1,803
- other	51	148	1,534	596	375
Total surplus	8,233	11,451	6,115	7,718	9,404
Surplus per hectare	173	393	1,415	346	347

a) Excluding horticulture.

Source: Poppe et al., 1994b.

Table A1.3 Characteristics of specialised dairy farms by nitrogen surplus per hectare in 1989/90

Characteristics	All farms	Group 'low'	Group 'high'
Nitrogen surplus (kg N/ha)	421	243	608
Fertilisers used (kg N/ha grassland)	336	202	429
Utilised agricultural area (ha)	28.9	24.4	27.5
Milk production (kg/ha)	11,950	9,007	15,959
Milk production (kg per dairy cow)	6,584	5,823	6,829
Dairy cows per ha	1.8	1.6	2.4
Total use of nitrogen (kg/ha)	529	342	762
- of which feed concentrates	147	97	284
- of which inorganic fertilisers	307	186	403
Total costs per hectare (Dfl)	12,799	11,177	18,393
Total output per hectare (Dfl)	12,377	9,066	17,340
Share of output in total costs (%)	97	83	96
Family farm income (Dfl/entrepreneur)	61,491	40,121	66,669

Source: Mulder and Poppe, 1993.

Table A1.4 Use of plant protection products by sector in 1992 (x 1,000 kg)

Sector	Insect-icides	Fungi-vides	Herbi-vides	Nema-cides	Other	Total	Average (kg/ha)
Arable	190	2,660	1,700	5,600	1,150	11,320	19.3
Cattle	40	0	700	0	550	1,290	1.0
Horticulture under glass	254	177	33	225	304	993	98.3

Source: Poppe et al., 1994b.

Table A1.5 Use of plant protection products per farm in 1992 by farming type
(kg of active ingredients per hectare)

	Insect- icides	Fungi- cides	Herbi- cides	Growth regula- tors	Nema- tici- des	Other	Total
Arable farms	0.4	4.5	3.2	0.2	7.9	1.9	18.2
Grazing livestock	0.0	0.2	0.6	0.0	0.0	0.4	1.3
Field vegetables	4.3	2.0	1.3	0.0	7.9	1.5	17.0
Greenhouse vegetables	13.1	7.2	0.8	0.2	25.8	17.1	64.2
Outdoor floriculture	0.9	19.4	5.6	0.0	6.1	24.3	56.3
Greenhouse floriculture	18.5	13.8	2.8	2.7	3.5	19.0	61.0
Mushrooms	13.9	3.3	1.9	0.0	0.0	105.5	124.6
Orchard	1.9	8.3	3.4	0.5	0.3	1.4	15.8
Tree nursery	2.3	4.2	3.1	0.1	12.9	11.3	34.0
Average	0.5	2.2	1.6	0.1	3.4	1.3	9.2

Source: Poppe et al., 1994b.

Table A1.6 Intensity and efficiency of using inputs by farming type

Farming type	Intensity of inputs used a)			Efficiency b)		
	energy	nutrients	plant protection products	energy	nutrients	plant protection products
Arable	2.2	5.8	7.4	-6.4	6.3	15.3
Field vegetables	2.0	2.4	2.6	. d)	. d)	. d)
Greenhouse vegetables	17.5	2.3	1.4	14.0	15.1	25.9
Outdoor floriculture	2.2	1.5	3.7	13.1	4.3	24.9
Greenhouse floriculture	12.3	0.9	1.4	10.1	11.0	14.0
Mushrooms	4.5	19.9	1.1	14.1	-16.5	81.4
Orchard	1.2	0.8	4.2	. d)	. d)	. d)
Tree nursery	0.8	2.2	1.2	4.2	25.8	-8.7
Grazing livestock	2.0	26.5 c)	0.3	6.0	0.2 c)	5.8
Granivores	2.6	58.2 c)	0.1	8.1	10.2 c)	40.8
Mixed farms	2.5	36.9 c)	1.4	7.8	-8.0 c)	-16.3
Average	4.1	2.8	1.5	7.5	-0.5	6.1

a) Percentage of total costs; average of the period 1986-1990; b) Change in 1992 compared to 1991 (%); c) Total of fertilisers and feed; d) No assessment made.