Sample of Dutch FADN 2004

Design principles and quality of the sample of agricultural and horticultural holdings

H.C.J. Vrolijk
H.B. van der Veen
J.P.M. van Dijk

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The EU Farm Accountancy Data Network (FADN) requires the Netherlands to yearly send bookkeeping data of 1,500 farms to Brussels. This task is carried out by LEI and CEI. The data sent to Brussels mainly involves technical and financial economic information. For national policy purposes additional data are collected, such as pesticide use, manure production, nature management, non-farm income and rural development. This report explains the background of the farm sample for the year 2004. The report mainly focuses on the Dutch contribution to the European Farm Accountancy Data Network. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report.

Orders:
Phone: 31.70.3358330
Fax: 31.70.3615624
E-mail: publicatie.lei@wur.nl

Information:
Phone: 31.70.3358330
Fax: 31.70.3615624
E-mail: informatie.lei@wur.nl

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Preface

The EU Farm Accountancy Data Network (FADN) requires the Netherlands to yearly send bookkeeping data of 1,500 farms to Brussels. This task is carried out by LEI and CEI. This report explains the background of the sample for the year 2004. All phases from the determination of the selection plan, the recruitment of farms to the quality control of the final sample are described in this report. This report provides essential background information for the European Commission the Dutch Ministry and researchers of the LEI and other organizations to fully understand the statistical aspects of the Dutch FADN sample.

Dr J.C. Blom
Director General LEI B.V.

Summary

Sample of Dutch FADN 2004; Design principles and quality of the sample of agricultural and horticultural holdings

1. Introduction

The EU Farm Accountancy Data Network (FADN) requires the Netherlands to yearly send bookkeeping data for 1,500 farms to Brussels. This task is carried out by the Agricultural Economics Research Institute (LEI) and the Center for Economic Information (CEI). The legislation of the FADN demands that the member states prepare a selection plan and a report on the results of the selection. This report fulfils this obligation. Furthermore the report gives an analysis of the quality of the sample.

2. Population and Selection plan 2004

The population (field of survey) of the FADN is defined as all farms above the threshold of 16 European Size Units (ESU). In the Netherlands farms between 16 and 1,200 ESU are included in the population (table 3.1). A stratified random sample is drawn, in which economic farm size and type of farming are used as stratification variables. The scheme for the types of farming is based on a Dutch version of the Common Agricultural Typology that is also used by EUROSTAT. The total agricultural population contains 83,888 farms according to the agricultural census. The field of survey contains 64,483 farms. These farms cover an important part (91%) of the production capacity (table 3.1). In the selection plan, LEI plans to select 1,500 farms for the 2004 accounting year. The real number has been lower in the last few years due to capacity problems.

3. Result of recruitment and quality of the sample 2004

In 2004, 1,420 farms were included in the sample and were delivered to Brussels (table 5.8). Chapter 6 gives a quantitative evaluation of the resulting sample. A comparison of the field of survey with the total agricultural population shows that 23% of the farms are below the lower threshold. These farms are responsible for a small percentage of production only. The sample results in a coverage of more than 90% of the production for most of the agricultural activities. In horticulture, part of the production is not covered because it takes place on farms above the upper threshold. Table 6.2 gives a description of the coverage of a large number of activities. Table 6.3 shows the relationship between types of farming and agricultural activities. The numbers show that only a limited percentage of pigs are produced on specialised pig farms, while at the other extreme almost all mushrooms are produced on specialised mushroom farms. Two important aspects of a sample, the representativeness of the sample and the reliability of estimates are evaluated

in section 6.3.3 and 6.3.4. Table 6.3 evaluates for many variables whether there is a difference between the agricultural census and the estimate based on the FADN sample. These tables provide useful information for specific research projects enabling the researcher to determine whether the sample is representative for his or her topic.

1. Introduction

1.1 Objective of the report

In 1965 the European Commission adopted a regulation (nr. 79/65/EEG) in which member states were obliged to set up a network for the collection of accountancy data on the incomes and business operation of agricultural holdings in the European Economic Community. The purpose of the data network is defined as the annual determination of incomes on agricultural holdings, and a business analysis of agricultural holdings. The Netherlands were required to provide financial economic information on 1500 farms to Brussels.

For the management of the system, the EU requires information on the selection of farms that included in the national FADN systems. In particular the regulation prescribes the provision of data on the establishment of a selection plan and the recruitment of farms.

With respect to the selection plan the regulation EEG 1859/82 prescribes (article 6): Each Member State shall appoint a liaison agency whose duties shall be 'to draw up and submit to the National Committee for its approval, and thereafter to forward to the Commission:

- the plan for the selection of returning holdings, which plan shall be drawn up on the basis of the most recent statistical data, presented in accordance with the Community typology of agricultural holdings;
- the report on the implementation of the plan for the selection of returning holdings.'

This report provides all the relevant background information on the population, the selection plan, implementation of the selection plan and quality of the sample of data that it to be provided to Brussels and which forms the basis for a wide range of national research projects.

1.2 Structure of the report

Chapter 2 gives a description of the background and the design principles of the Dutch FADN system. Chapter 3 describes the agricultural population in the year 2004. This chapter will also consider the demarcation of the population as used in the Dutch FADN. Also the design of the sample of the Dutch FADN system is described. Chapter 4 reports on the selection plan 2004. Chapter 5 provides information on the implementation of the selection plan and the recruitment of new farms. Chapter 6 provides a qualitative and quantitative evaluation of the sample 2004.

2. Design principles of the Dutch FADN sample

2.1 Introduction

In the Dutch FADN detailed records on 1,500 agricultural and horticultural farms are kept. Besides financial economic information, a broad set of technical-economic, socio-economic and environmental-economic data is collected. One of the reasons for the Dutch FADN system is the legal obligation to provide information on the financial economic situation of farms to Brussels. However, an even more important use of the data can be found at the national level. Data from the FADN system are used for many national policy evaluations and research projects.

Based on a sample of farms estimations are made for the whole population. This might raise the question: 'How can conclusions be drawn for the whole population if only a limited number of farms are observed?'. The answer to this question can be found in the selection of farms that are included in the sample. A cook also doesn't eat all the soup to judge the quality of the soup. It is important to stir well before tasting; the spoon of soup should reflect all flavours in the pan of soup. The spoon of soup should be representative for the whole pan of soup. The same is true for the FADN sample. The farms that are included in the FADN should be representative for the whole population. In this way a sample can provide better information than a census (in which all units are observed). With a fixed budget it is much easier to collect good data on a limited number of farms instead of collecting information on all farms. With a limited number of farms and thus a limited number of data collectors, it is easier to ensure good procedures and good training to collect reliable data.

An important issue is how to ensure that the farms that are included in the FADN sample are representative for the whole population. Use is made of a disproportional stratified random sample. A stratified sample implies that the population is divided into a number of groups. Subsequently farms are selected from each of the groups. The variables on which the groups are defined should be relevant variables to make sure that the farms that are included in one group are similar (at least in the important aspects). Using this stratification, and selecting farms from each group, ensures that farms from all groups and thus with different characteristics are included in the sample.

Disproportional means that not all farms have the same chance of being included in the sample. Groups which are relatively homogeneous, i.e. farms which show large similarities, have a lower chance of being included in the sample. After all if all the farms are very similar, a limited number of observations is enough to draw reliable conclusions (in the extreme case that all farms are exactly identical, it would be enough to have only one observation). In case of less homogeneous groups it is important to have a larger number of observations to make reliable estimates.

The choice of the stratification variables has therefore an important impact on the representativeness of the sample.

This way of selecting farms make it possible to make unbiased estimates for the whole population of farms. Based on the sample farms in a certain group, estimations can be made for all the farms in that group. Stratification assures that farms are selected from all groups and therefore allowing estimations for all groups. All groups together make up the whole population. In the Dutch FADN this is achieved by assigning a weight to each sample farm. The weight is calculated by dividing the number of population farms in a group by the number of sample farms in this same group.

Stratification also improves the representativeness in case of non-response. If a farm, which is asked to join the FADN system, refuses, another farm in the same size class and of the same type of farming can be selected. If there is a difference between the selection plan and the actual implementation, stratification helps to improve the representativeness by taking into account the real sampling fraction.

Finally, stratification makes the maintenance of the sample easier. Due to attrition and changes in the population it is sometimes necessary to supplement certain groups. Stratification makes a more focused replacement possible.

This chapter will further explore some general design principles of the Dutch FADN sample. The quality of the sample and especially the representativeness of the sample are important factors in designing the sample. Representativeness is an often-mentioned criterion by stakeholders. Elaborating on this issue shows that there is not a single clear definition of representativeness. Some define representativeness as the overall quality of data. Others require that all possible groups of farms should be included in the sample. Groups can be defined on basis of region, type of farming, size class, legal status, age group etcetera. To assure a good quality of the sample it is important to establish sound procedures for the design of the sample and the selection and recruitment of farms.

In this chapter these procedures will be described. Section 2.2 presents the overall structure of these procedures. A distinction is made between yearly activities and a set of initial activities. The initial activities will be described in section 2.3 and the yearly activities will be described in section 2.4.

2.2 Activities for the selection of farms

A set of activities has to be conducted every year to construct a selection plan and to recruit farms. Besides these yearly activities, it is also worthwhile to conduct a set of initial activities. These initial activities are aimed at setting the proper goals for the data collection system and to align the design of the system to these goals. These activities are called initial activities in chapter. These activities do not have to be repeated every year (however, an evaluation of the results of these activities after a couple of years is useful). These initial activities are:

- establish goals of FADN;
- definition of the population;
- selection of important goal variables;
- analyses and selection of stratification variables;
- definition of strata;

- importance of Population Strata (policy making);
- choice of allocation procedure.

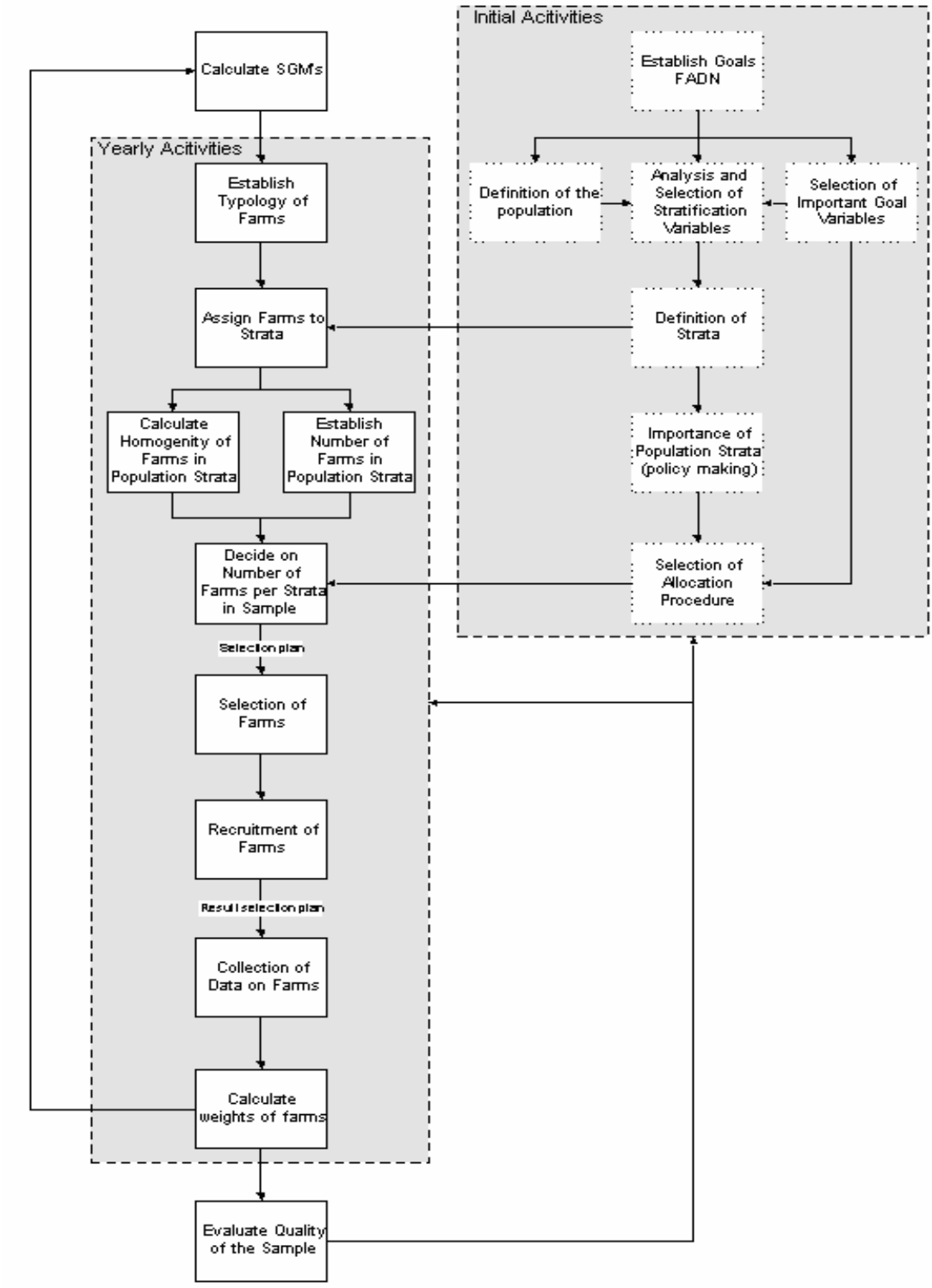

Figure 2.1 Activities related to the selection of farms

The selection and recruitment of farms requires a number of activities to be performed annually (or biannually). These activities are:

- calculate Standard Gross Margins (every two years!);
- establish typology of farms;
- assign farms to strata;
- calculate homogeneity of farms in population strata;
- establish importance of stratum in population;
- decide on number of farms per stratum;
- selection of farms;
- recruitment of farms;
- collection of data on farms;
- calculate weights of farms;
- evaluate quality of sample.

The activities will be described in more detail in this chapter. This description provides a short methodological introduction but also the decisions or choices that have been made in the design of the Dutch FADN sample. Figure 2.1 displays the dependency relationships between the activities, with the initial activities displayed at the right side.

2.3 Initial activities for the design of the sample

Goals of FADN sample

The (re-)design and construction of the Dutch FADN sample started with a thorough discussion about the goals of the FADN. One of the obvious goals is the provision of data to the European Community. Besides EU objectives, national objectives play a major role in the design of the sample. For example, if a specific farming group is very important from a policy making point of view, it is worthwhile including this group as a separate type of farming in the FADN design. A group discussion with policy makers and researchers of LEI and university was organised to discuss the goals of the system. The discussion resulted in the following list of important goals of the FADN sample. The goals that were mentioned are presented here in a number of categories:

- general:
    1. relevant research information;
    2. provide insight in developments in agriculture and horticulture;
    3. economic, technical and environmental data of farms for research purposes;
    4. broad set of data for environmental and economic research.
- monitoring and policy evaluation:
    1. dataset for ex-post policy evaluation;
    2. dataset for the monitoring of trends which are relevant for policy makers;
    3. monitoring of relevant developments: for example: farm income, use of pesticides etcetera;
    4. basis for calculations for policy interventions;
    5. provide information on need for subsidies;

6. fulfill requirements for economic analysis of ministries and other clients;
7. provide early warnings for relevant developments.

- representativeness of sector:
  1. whether representative of 90% of the agricultural production?
  2. representative for the whole Dutch agro sector;
  3. provide representative socio-economic information on agriculture as provider of food and manager of the natural landscape;
  5. provide enough observations to provide a reliable and representative view of the agricultural sector;
  6. a representative sample which provides the opportunity to monitor the economic and technical developments of farms during a number of years;
  7. overview of developments on farms;
  9. base of information on the situation and developments in agriculture.
- customer oriented:
  1. panel of farmers that provides the opportunity to collect ad-hoc policy relevant information;
  2. a panel of farms of which a limited set of data is collected on a continuous basis and additional questions can be asked on ad-hoc basis;
  3. service for research, also for other parts of Wageningen University and Research Centre;
  4. a dataset with which a wide range of needs of the main client - Ministry of Agriculture, Nature and Food Qualits - can be fulfilled;
  6. research opportunities (new opportunities, new developments).
- consumer concerns:
  1. information on environmental issues, animal health and food security;
  2. relationship with economic, ecological and social processes;
  3. provide representative socio-economic information on agriculture as provider of food and nature management.
- EU comparability:
  1. to provide data to EU commission;
  2. provide information to compare Dutch agriculture and horticulture with other EU countries;
  3. comparisons at EU level.
- representativeness chain:
  1. offer data to monitor the whole chain from seed to cutlet.
- unique:
  1. data set which offers added value compared to other existing data sets;
  2. to be as unique as possible compared to other data sets.

Subsequently the importance of the different goals was discussed. Customer orientation was considered to be very important. This orientation requires a large degree of flexibility to allow data collection on relevant policy topics. Furthermore the representativeness was considered very important. The representativeness for the primary producers was considered to be more important than representativeness for the chain or space. The third important goal is policy evaluation. Policy evaluation requires the

monitoring of relevant developments and the ability to perform ex-post and ex-ante policy analysis.

Definition of the population

According to the EU regulation, the field of observation consists of 'commercial farms'. A commercial farm is defined as a farm which is large enough to provide a main activity for the farmer and a level of income sufficient to support his or her family. In order to be classified as commercial, a farm must exceed a minimum economic size. The economic size of farms is expressed in terms of European Size Units (ESU), which is based on the total SGM of the farm (see section 2.4). As stated previously, those farms, which exceed a certain economic size in ESU, are defined as commercial, and thus fall into the field of observation. However, because of the different farm structures in the European Union, it is necessary to specify separate thresholds for each Member State. In the EU regulation, the lower threshold for the Netherlands is defined as 16 ESU.

Selection of Important goal variables

In the deliberations on the goals of the FADN it is also important to pay attention to the question what the important goal variables are in the FADN. The answer to this question directly affects the information to be collected in the FADN. If the only goal of the FADN is to provide Brussels with information, the answer to this question can to a large extend be found in the European Farm Return. The content of the information to be collected also affects more fundamental design issues of the structure of the sample. In the past the design of the sample was aimed at estimating farm incomes as reliable as possible.

The variables that were mentioned during the group discussion as useful are:

1. animal health;
2. dynamics of enterprises;
3. environmental efficiency farms;
4. non agricultural activities such as nature management, tourism, health care;
5. continuity of farms;
6. environmental impact;
7. savings per farm (continuity);
8. fiscal position of the agricultural sector (fiscal policies);
9. land use;
10. innovation;
11. investments on farms;
12. land lease and the impact of policies;
13. economic and societal return on investment per hectare;
14. labor input;
15. social-economic position of the farm (poverty, stress etcetera);
16. monitoring farm incomes, environmental impact and farm structure;
17. financial structures;
18. survival strategies;
19. quality of production process;

20. organization of the agricultural production;
21. profitability and farm income development;
22. relationship between agricultural and non agricultural activities;
23. total income situation (also off farm income);
24. technical aspects of production process.

The list of variables shows that the Dutch FADN system is used for a wide range of topics. A discussion was held on the importance of the different variables for research and policy making. The discussion revealed that financial economic indicators are still of main importance. Environmental issues such as pesticides, manure and artificial fertilizers, agro-tourism, nature management become increasingly more important but are still of secondary importance. Therefore, the traditional financial economic indicators are still of major importance in allocating farms to ensure an efficient sample (see choice of allocation procedure).

Analyses and selection of stratification variables

Stratification is a statistical technique that is used to increase sampling efficiency (i.e. to minimise the number of farms required to represent the variety of farms in the field of observation). The Commission makes extensive use of this technique and uses three criteria for stratification: region, economic size and type of farming.

One interpretation of representativeness means including all possible groups (and intersections of groups) in the sample. This leads to a sample design in which as many variables as possible are used as stratification variables. The obvious advantage of this approach is that all groups are included in the sample; the major drawback of this approach is that often the number of sample farms is insufficient even to be able to draw one farm from each stratum.

It is therefore interesting to study this problem from the other extreme of no stratification at all. A sample can be drawn based on a simple random sampling procedure (in which each farm has the same chance of being selected into the sample). This sample can be used to make estimates for the population. This is a very acceptable procedure to make estimations for the population.

Subsequently one can consider distinguishing a limited number of groups/strata in the sample. The available number of sample farms will provide some degrees of freedom to define strata. Two reasons for defining strata can be applied.

1. Reporting considerations. If policy analysis or other research questions are related to specific groups it is useful to have separate estimators for these groups. In that case it might be worthwhile to define the groups as separate populations and treat them as separate strata.
2. Statistical considerations. If the total population is rather heterogeneous, but at the same time homogeneous sub-groups can be defined, it can be worthwhile to define these groups as separate strata in order to make more reliable estimates. Judging whether the population is homogeneous or heterogeneous requires the selection of important goal variables.

If separate reporting is not necessary and the groups are rather similar, it is not worthwhile to define them as separate groups. If there are homogeneous groups in which the farms are rather similar and there are large differences between the groups, it is interesting to define more strata from a statistical perspective. If one wants to report or study separate groups, it can be interesting to define separate strata even if the groups are homogeneous. This depends on the number of population units, the number of sample units and the resulting chance of having enough sampling units for each separate group if these groups are not explicitly distinguished in the sample design.

In the Dutch FADN sample, type of farming and size class are used as main stratification variables. In the past a larger number of variables were used but that caused several problems related to empty or near empty cells. Furthermore it was hard to prove that this improves the efficiency of the sampling procedure (see Vrolijk and Lodder (2002)). The list of types of farming can be found in table 3.2. Within each type of farming three size classes are distinguished (see section 3.3).

Definition of strata

Given the selection of the stratification variables the definition of the strata is rather straightforward. Each combination of the levels of the stratification variables results in a stratum. In the Dutch situation it is somewhat more complicated due to the fact that the size classes are different within different types of farming. The size distribution of, for example, horticultural farms is completely different than the size distribution of arable farms. To take these differences into account the borders of the size classes have been established for each type of farming separately. Despite this complication the strata are still a cross section between types of farming and size-classes. In total, 87 strata have been distinguished.

Importance of strata

For the allocation of sample farms over the strata it is necessary to make some statements about the importance of strata. There is no unique indicator of the importance of strata. Indicators for the importance of strata that could be used are for example the number of population farms in a stratum or the economic importance of a stratum (sum of the sgms). Another aspect might be the policy importance of certain types of farming. Policy makers

Table 2.1 Important types of farming

Type of farming
Specialised dairy farms
Arable farms
Fattening pig farms
Flowers under glass
Vegetables under glass

might be more interested in types of farming that are more influenced by the Common Agricultural Policy, or which provides many jobs. Table 2.1 presents five types of farming which were considered extremely important by policy makers as well as researchers.

Choice of allocation procedure

Sampling fractions vary from cell to cell. In some Member States, the Liaison Agencies have sufficient data on the variability of farms within the field of observation to compute optimal sampling fractions (optimal allocation to minimise the variance of estimators). In other cases, this is not possible and sampling fractions are set according to the number of farms in the cell (proportional allocation). In the Dutch FADN system a combination of allocation methods is used. The distribution of capacity over the types of farming is based on the economic importance of the sector, the number of farms involved and the policy relevance of the type of farming. Within each type of farming optimal stratification and allocation was used. Given the number of elements the thresholds of the size classes and the number of elements of each size class were calculated in order to minimise the expected variance of important financial economic goal variables (see Vrolijk and Lodder (2001) for a more detailed description). Economic size was used as a proxy for these financial economic variables. The size classes can be found in table 3.2.

2.4 Yearly activities for the selection of farms

Calculate SGMs (bi-annual)

Based on the FADN and other data the Standard Gross Margins are calculated. Standard Gross Margins (SGM) are used to determine the economic size of the activities of farms. The standard Gross Margin (SGM) of a crop is calculated as the value of the output from one hectare minus the cost of direct inputs to produce that output. In case of a livestock item it is defined as the value of output from one animal less the cost of direct inputs required to produce that output.

In the European Community the Member States calculate the SGMs on the basis of empirical data collected from farms. To avoid biases caused by fluctuations, the calculations are based on empirical data of three years. The fluctuations can for example be caused by weather conditions or variations in input and/or output prices. SGMs have to be updated every two years. Separate SGM values are calculated for different regions and for more than 90 types of crops and livestock. Detailed information on the SGM values and the methodology to calculate these SGMs can be found in De Bont, et al. (2003) or on the LEI website.

Establish typology of farms

The typology of a farm gives a description of the principal type of farming on that farm. The principal type of farming can subsequently be broken down in a more detailed type of farming. The typology defined at the European Union level is broad enough to cover the

many different types of farming that are found in the Union. The farming type of a farm is established by calculating the economic importance of the different activities on the farm. The relative economic size of the activities determines to what farming type the farm belongs. The economic importance is measured by the amount of SGMs. In the Dutch system, the typology of each farm in the agricultural census is calculated. By connecting the farms included in the FADN system to the agricultural census, the typology of the FADN farms is also known.

Assigning farms to strata

Based on the SGM values and data from the agricultural census, the economic size of the agricultural activities and the size and typology of the farm is established. When the economic size of the farm and the type of farming is established, a farm can be assigned to the stratum it belongs to. In the electronic bookkeeping system of the LEI, a method is used to determine the stratum a farm belongs to. This method is shown in the appendix.

Calculate the homogeneity of farms in strata

In some Member States information is available on the homogeneity of farms in the population and within the different groups of farms. This information can be used to compute optimal sampling fractions. If this information is not available sampling fractions can be set according to the number of farms in each stratum/group. To be able to compute optimal sampling fractions it is necessary to calculate the homogeneity of farms in the strata. As mentioned in section 2.3, economic size is used as a proxy.

Determine the importance of the strata in the population

After assigning the individual farms to strata it is easy to count the total number of farms in each stratum in the population. Table 3.3 provides information on the distribution of farms over different types of farming. Besides the number of farms, it is important to consider other indicators for the importance of a stratum, for example the economic size and the policy relevance. Although these factors are somewhat more subjective it is still worthwhile to include these factors in the deliberations.

Decide on number of farms per strata in sample

Based on the information from the previous stages, a decision can be made on the number of sample farms per stratum. As stated previously, a possible allocation would be based on the number of farms in the population; this is the so-called proportional allocation. Where additional information is available about the homogeneity of farms, this information can be used to make more precise estimates, this is called optimal allocation. The principle of optimal allocation is based on the fact that fewer observations are needed when the farms in a stratum are rather homogeneous.

Selection of farms

This task involves choosing the farms that will be asked to participate in the FADN. The actual selection of farms can be done in several ways. From a theoretical point of view there are two approaches: random selection and non-random selection. Random selection means that each unit in the population has a known chance of being included in the sample. In non-random sampling it is not a statistical chance but an explicit choice of a human being which farm is appropriate to be included in the sample. The latter approach introduces subjective elements in the sampling process. This means that not every farm has the same (and known) chance of being included in the sample. In that case it is difficult to make population projections based on the information in the sample. The most useful non-random sampling procedure providing a minimal amount of representativeness is quota sampling. In quota sampling the population is divided into a number of groups (quot as) and one continues selecting units in each quota until the number of sample units in a quota equals a predefined number of units. At a first glance this might look similar to stratified random sampling. The main difference is that in quota sampling a human being chooses units that belong to a quota and in stratified random sampling the units are randomly selected from each quota.

In case of (stratified) random sampling, a sampling frame from which to randomly choose the farms must be available. For the FADN sampling process, a recent Farm Structure Survey is a good sampling frame. Based on this survey, a list of farms per stratum can be made available. Actually choosing farms can be done in several ways. Using random numbers assures the randomness of the sample. For example, each farm in the list is assigned a random number and the farms with the highest random numbers are selected.

Although random sampling is the most preferred option from a theoretical point of view, practical problems might prevent the use of random sampling:

- the availability of a sampling frame (for example a farm structure survey) is necessarily;
- participation in the FADN is voluntary. If a large percentage of farmers refuse to participate, the recruitment of randomly selected farms can be very cumbersome.

If random sampling is not a feasible solution, quota sampling might be the second best option. In practise, in quota sampling the actual selection of farms is often done by accounting offices.

In the Dutch FADN random sampling is used. Based on the number of farms to be recruited a random selection of farms is made from the agricultural census. The random selection is made per stratum.

Recruitment of farms

Selected farms should be visited in order to ask whether they are willing to cooperate. A certain percentage of farms will refuse to participate. This causes a few problems. The first evident problem is that the cost of recruitment increases due to the fact that a larger number of farms must be visited. A second and from a statistical point more serious

problem is the possible bias in the non-response. A bias might occur when the farms that are willing to cooperate are systematically different from the farms that refuse to cooperate. If for example only efficient firms are willing to cooperate the results of the FADN will give a too positive picture of the population. Chapter 5 provides an analysis of the non-response. A more in depth analysis of non response can be found in Vrolijk and Cotteleer (2004) and Vrolijk (2005).

Collection of Data on Farms

This step involves the actual data collection on the farms. This step will not be further discussed in this report. Further information can be found in Poppe (2004).

Calculate the weights of farms

At the European level a weighting system is used in the calculation of FADN results. The purpose of the weighting system is to take into account the different sampling fractions for different cells. In the production of FADN results, weighted averages are calculated. For each holding in the sample, an individual weight is calculated. In order to calculate this individual weight, holdings in the sample and in the field of survey are stratified according to the same criteria: type of farming and economic size class and national sample criteria. The individual weight is equal to the ratio between the number of holdings in the population and in the sample (in a specific stratum).

The weight of the farm should reflect the sampling fraction or more precisely the inclusion probabilities of farms. Chapter 6 will provide a qualitative and quantitative evaluation of the weighting system. In the Dutch FADN system, two sets of weights are calculated. One is based on the typology of farms in the agricultural census and one is based on the typology of farms in the FADN system.

Evaluate Quality of the Sample

After the sample has been established (when the farms have been recruited) the quality of the sample can be evaluated. A first simple check is whether the number in the selection plan is equal to the number of farms in the sample. A more sophisticated check is whether the characteristics of the firms in the population are different from the farms in the sample. This gives some indications about the representativeness of the sample with respect to these variables. For example, a comparison of the average economic size in the population with the average economic size in the sample will indicate whether the sample is representative for economic size. To make a real comparison not only the average in the sample should be calculated but also the standard error of the estimate. Economic size is not the only indicator. A list of variables could be constructed to conduct this analysis, for example: the number of animals, the acreage of the farm etc. The list of variables is most easily constructed based on the variables, which are available in the Farm Structure Survey. Chapter 6 provides analyses on a wide range of aspects. The conclusions of the evaluation can result in short term changes in the yearly activities, and in long-term changes (periodic re-evaluation of the initial activities) (see feedback loops in figure 2.1).

3. Population 2004

3.1 Introduction

This chapter will describe the population or more precisely the field of observation as covered by the FADN sample. Threshold is used to define the field of observation. This threshold and the consequences of this threshold will be described in section 3.2. Section 3.3 describes the strata which are used to subdivide the population. Section 3.4 reports the number of farms in each of the strata.

3.2 Defining the field of observation

Collecting detailed information at farm level requires considerable time and money. To assure an efficient and effective allocation of the available budget, the sample design focuses on certain groups in the population (demarcation of the population). Given limited capacity it is important to apply a sampling procedure that optimizes the reliability of the sample estimates (through stratification).

Regulation 1859/82 of the EU Commission (adapted by regulation EEG nr. 3548/85) defines the population (field of observation) for the Dutch FADN as those farms with a size of more than 16 European size units (ESU). Until 2001 this threshold was translated into 16 Dutch size units (DSU), which is roughly similar to 18.7 ESU. For the statistical use of the data and the comparability of results it was considered advisable to apply the ESU threshold. Therefore the lower limit of the Dutch FADN system has been 16 ESU since the year 2001.

In addition to a lower threshold there is also an upper threshold. This upper threshold has been adjusted every few years to take into account the growth of the average size of farms. Until 2001 the upper threshold was 800 DSU. In 2001 the upper threshold was raised to 1,200 ESU. The percentage of farms and the agricultural output excluded due to this upper threshold has been growing since 2001. This is the reason why the upper threshold will be increased again from 2005.

In 2004, 307 farms were excluded from the field of observation because of the upper threshold. These farms were responsible for 6.96% of the total production. Due to the lower threshold 19,098 farms were not covered by the FADN sample. Although this is a large number of farms, they are only responsible for 1.98% of the total agricultural production capacity. The population (field of observation) of the Dutch contribution to the EU FADN system is displayed in table 3.1.

Table 3.1 Number of farms and their relative economic importance (measured in European size units - ESU) in the agricultural census 2004

	Number of farms	Percentage ESU
All farms in the agricultural census (a)	83,888	100
Minus farms less than 16 ESU	19,098	1.98
Minus farms larger than 1,200 ESU	307	6.96
Total of non covered farms (b)	19,405	8.95
Total of covered farms (a) - (b)	64,483	91.05

3.3 Design of the stratification scheme

Farms are allocated to strata according to the following stratification variables: type of farming and size class. In the past a more detailed stratification scheme was used, but this resulted in numerous practical problems due to empty or nearly empty cells. Combining cells can easily lead to a distortion in the calculated results (a bias). Farms of a certain type of farming are divided into three size classes. In the past four size classes were used. The reduction of size classes can be explained by the problem of empty or nearly empty cells and the conclusion that a fourth size class only provided a very limited value in increasing the efficiency of the estimators (Vrolijk and Lodder, 2002).

In total 29 types of farming are distinguished (see table 3.2). For a number of types of farming a distinction is made between organic farm and non-organic farming. A compromise was found to fulfill the increasing demand for research on organic farms. Random selection of organic farms from the total population would result in a very low number of observations because of the low proportion of organic farms. The definition of separate strata would result in many practical problems. The number of strata would double. The problem of empty or nearly empty strata would increase seriously. In line with the existing stratification, a number of types of farming were selected where organic farming is especially relevant. The types that were originally selected were: field crop farms, dairy farms, field vegetables and combined crop farms (Vrolijk en Lodder, 2002). The growth in the organic sector was however lower than expected and aimed for by policy makers. This resulted in practical problems in the recruitment of organic farms, for example due to the fact that the number of farms according to the selection plan was close to or even higher than the actual number of farms in the population. To deal with this problem a number of organic strata have been combined. Organic field crops farms, field vegetables and combined crop farms have been integrated in one stratum organic crop farms.

The break down in subtypes is as follows: field crop farms have been itemised in starch potato farms, organic crops and all other field crop farms. The vegetables under glass farms have been broken down in paprika, cucumber, tomato and other. Cut flowers under glass are divided in roses, chrysanthemums and other cut flowers. The dairy farms

are split into organic and non-organic dairy farms. Within field vegetables and the combined crop farms the organic farms have been separated. These are subsequently combined with the organic field crop farms.

The final stratification and the size thresholds for each of the strata are displayed in table 3.2. The thresholds are determined by optimal stratification (see Vrolijk and Lodder, 2002).

Table 3.2 Stratification of the Dutch FADN sample with the size thresholds for each of the strata

Type of farming	Size class		
	1	2	3
Field crop farms			
- starch potatoes	16.0- 73.2	73.2-177.9	177.9-1200.0
- organic crops	16.0- 45.0	45.0- 90.0	90.0-1200.0
- other field crop farms	16.0- 66.3	66.3-139.7	139.7-1200.0
Horticulture			
Vegetables under glass:			
- paprika	16.0-245.1	245.1-479.5	479.5-1200.0
- cucumber	16.0-201.3	201.3-392.7	392.7-1200.0
- tomato	16.0-268.5	268.5-518.0	518.0-1200.0
- other	16.0-106.1	106.1-335.8	335.8-1200.0
Cut flowers under glass:			
- rose	16.0-260.2	260.2-494.7	494.7-1200.0
- chrysanthemum	16.0-193.7	193.7-373.4	373.4-1200.0
- other	16.0-141.9	141.9-342.2	342.2-1200.0
Plants	16.0-185.4	185.4-463.5	463.5-1200.0
Other glass	16.0-107.5	107.5-292.3	292.3-1200.0
Field vegetables	16.0- 85.8	85.8-256.5	256.5-1200.0
Fruit	16.0- 63.9	63.9-139.2	139.2-1200.0
Nurseries	16.0- 84.9	84.9-250.7	250.7-1200.0
Mushroom	16.0-187.5	187.5-444.6	444.6-1200.0
Bulbs	16.0-185.4	185.4-476.9	476.9-1200.0
Other open air	16.0-116.3	116.3-356.1	356.1-1200.0
Grazing livestock			
Dairy:			
- organic	16.0- 86.0	86.0- 127.5	127.5-1200.0
- non-organic	16.0- 88.7	88.7-159.0	159.0-1200.0
Calf fattening	16.0- 63.7	63.7-150.1	150.1-1200.0
Other grazing livestock	16.0- 46.6	46.6-145.5	145.5-1200.0
Intensive livestock			
Breeding pigs	16.0-115.5	115.5-263.0	263.0-1200.0
Fattening pigs	16.0- 60.4	60.4-160.5	160.5-1200.0
Integrated pig farms	16.0-128.8	128.8-252.9	252.9-1200.0
Laying hens	16.0-137.6	137.6-344.8	344.8-1200.0
Poultry	16.0-100.2	100.2-203.2	203.2-1200.0
Other intensive livestock	16.0-113.0	113.0-261.1	261.1-1200.0
Combined	16.0- 81.1	81.1-205.5	205.5-1200.0

3.4 Number of farms in the population 2004

Table 3.3 presents the number of farms in the population (agricultural census 2004). In this table the stratification according to size class and type of farming is applied.

Table 3.3 The number of farms per stratum according to the agricultural census 2004

Type of farming	Size class			
	1	2	3	total
Field crop farms				
- starch potatoes	461	425	188	1,074
- organic crops	69	87	82	238
- other field crop farms	4,295	2,493	691	7,479
Horticulture				
Vegetables under glass:				
- paprika	140	190	115	445
- cucumber	132	105	41	278
- tomato	108	140	103	351
- other	493	275	85	853
Cut flowers under glass:				
- rose	122	168	167	457
- chrysanthemum	106	101	85	292
- other	932	700	279	1,911
Plants	602	450	252	1,304
Other glass	386	244	145	775
Field vegetables	514	291	76	881
Fruit	686	604	182	1,472
Nurseries	1,113	628	232	1,973
Mushroom	200	91	34	325
Bulbs	470	316	186	972
Other open air	878	402	130	1,410
Grazing livestock				
Dairy:				
- organic	146	104	80	330
- non-organic	7,727	10,187	3,493	21,407
Calf fattening	383	516	180	1,079
Other grazing livestock	5,401	1,987	338	7,726
Intensive livestock				
Breeding pigs	1,020	483	83	1,586
Fattening pigs	854	350	49	1,253
Integrated pig farms	652	312	72	1,036
Laying hens	532	289	46	867
Poultry	185	204	59	448
Other intensive livestock	171	120	55	346
Combined	3,314	1,936	665	5,915
Total				64,483

This table shows that 64,483 farms fall within the field of observation. Dairy farms are clearly the largest group of farms. Almost one in every three farms is classified as a dairy farm.

4. Selection plan 2004

4.1 Introduction

The allocation of the total capacity of sample farms is based on the relative importance and the heterogeneity of the different types of farming (see Dijk et al., 1995a and Vrolijk and Lodder, 2002). Within each type of farming an optimal stratification (determination of thresholds of size classes) and optimal allocation is applied (distribution of sample capacity over the different size classes) (see section 2.3).

4.2 Selection plan 2004

The EU regulation prescribes the use of size class and type of farming as important variables in the stratification and the choice of farms. Due to differences in the exact stratification scheme it is necessary to take into consideration the different weights of farms in different strata (Dijk et al., 1995b).

The design principles of the sample of the FADN system facilitate an efficient alignment with the goals of the system (see chapter 2). A summary of the selection plan 2004 is provided in table 4.1. Given the goals of the FADN system the numbers provided in the table are the required number of observations per type of farming (see section 2.3).

Table 4.1 Desired sampling size per type of farming (selection plan) 2004

Type of farming	Code	Number of farms		
		main type	type	sub type
Field crop farms	*1*	*210*		
- starch potatoes			30	
- organic crops			30	
- other field crop farms			150	
Horticulture	*2 + 3*	*520*		
Vegetables under glass	2012		120	
- paprika				30
- cucumber				30
- tomato				30
- other				30
Cut flowers under glass	2022		100	
- rose				30
- chrysanthemum				30
- other				40
Plants	2022		30	
Other glass	other 2022 and 2013, 2023, 2039, 349 (> 50% glass)		30	
Field vegetables	2011		60	
Fruit	3210		40	
Nurseries	3480		40	
Mushroom	2033		30	
Bulbs	2021		40	
Other open air	other 2022 en 2013, 2023, 2039, 349 (< 50% glass)		30	
Grazing livestock		*420*		
Dairy	4110, 4120, 4370		340	
- non-organic				310
- organic				30
Calf fattening	4380		30	
Other grazing livestock	4410, 4420, 4430		50	
Intensive livestock	*5*	*230*		
Breeding pigs	5011		50	
Fattening pigs	5012		50	
Integrated pig farms	5013		40	
Laying hen	5021		30	
Poultry	5022		30	
Other intensive livestock	overig 5		30	
Combined	*6,7 en 8*	*120*		
		-------+		
Total		*1500*		

5. Recruitment of farms 2004

5.1 Basic principles 2004

The recruitment for 2004 took place in the late autumn of 2004. The goal of the recruitment was to increase the number of available farms in the bookkeeping system and apply a more strategic approach in the choice of types of farming in the EU variant and the CSP variant. The EU variant focuses on the financial economic indicators as required by the European Commission, the CSP (Corporate Social Performance) variant covers data on a wide range of topics, such as environment and animal welfare (see section 5.3 for a more detailed description of these variants).

5.2 Elaboration of selection plan

Table 5.1 gives a more detailed description of the selection plan as presented in table 4.1.

5.3 Recruitment of farms

Based on the available number of farms in the FADN sample and the expected number of farms ending their participation in 2004 an estimate is made of the number of farms to be recruited. Furthermore the variant of bookkeeping has been explicitly considered. An evaluation has been made of the policy and research relevance of sectors and based on this importance a decision has been made whether a type of farming is assigned to the EU variant, the CSP variant or a combination of both. This implied that some farms had to be switched to the other variant. In some cases this would result in the drop-out of the farm. This has been taken into consideration in the number of farms to be recruited.

Based on the number of farms to be recruited, as displayed in table 5.2, farms were randomly selected from the agricultural census. The random draw of farms took place per stratum. The number of drawn farms per stratum was seven times higher than the required number of farms to be sure to have enough addresses even with a high non-response rate in specific types of farming. The addresses were requested from an agency (Dienst Regelingen) of the Ministry of Agriculture. The farm identifiers of the randomly selected farms were sent to the Ministry who sent back the addresses of these farms (under the strict condition that this information was only used for the recruitment of farms for the FADN). Using these addresses farms were contacted and asked to participate in the FADN. Table 5.3 gives the number of farms that were recruited based on the random draw of farms conducted in the late autumn of 2004.

Table 5.1 Detailed selection plan 2004 per stratum

Type of farming	ESU size class			
	1	2	3	total
Field crop farms				
- starch potatoes	10	10	10	30
- organic crops	10	10	10	30
- other field crop farms	45	51	54	150
Horticulture				
Vegetables under glass				
- paprika	10	10	10	30
Cucumber	10	10	10	30
Tomato	10	10	10	30
Other	10	10	10	30
Cut flowers under glass				
- rose	10	10	10	30
- chrysanthemum	10	10	10	30
- other	13	14	13	40
Plants	10	10	10	30
Other glass	10	10	10	30
Field vegetables	20	20	20	60
Fruit	12	14	14	40
Nurseries	13	13	14	40
Mushroom	10	10	10	30
Bulbs	13	13	14	40
Other open air	10	10	10	30
Grazing livestock				
Dairy				
- organic	10	10	10	30
- non-organic	103	104	103	310
Calf fattening	10	10	10	30
Other grazing livestock	17	16	17	50
Intensive livestock				
Breeding pigs	20	16	14	50
Fattening pigs	16	16	18	50
Integrated pig farms	14	12	14	40
Laying hen	10	10	10	30
Poultry	10	10	10	30
Other intensive livestock	10	10	10	30
Combined	37	41	42	120
Total				1,500

Table 5.2 Number of farms to be recruited

Type of farming	Variant	ESU size class			
		1	2	3	total
Field crop farms					
- starch potatoes	combi	0	0	0	0
- organic crops	csp	5	0	0	5
- other field crop farms	combi	6	8	9	23
Horticulture					
Vegetables under glass					
- paprika	csp	5	0	3	8
- cucumber	csp	4	2	1	7
- tomato	csp	1	0	6	7
- other	csp	3	4	8	15
Cut flowers under glass	csp				
- rose	csp	9	1	0	10
- chrysanthemum	csp	5	3	5	13
- other	csp	4	0	7	11
Plants	csp	0	1	0	1
Other glass	csp	8	3	3	14
Field vegetables	combi	14	6	11	31
Fruit	combi	2	0	0	2
Nurseries	eu	6	5	7	18
Mushroom	eu	10	5	7	22
Bulbs	combi	4	0	0	4
Other open air	eu	0	6	3	9
Grazing livestock					
Dairy					
- organic	csp	2	3	4	9
- non-organic	combi	9	0	24	33
Calf fattening	combi	4	0	0	4
Other grazing livestock	combi	4	4	8	16
Intensive livestock					
Breeding pigs	csp	4	0	8	12
Fattening pigs	csp	2	4	16	22
Integrated pig farms	csp	8	0	10	18
Laying hen	csp	5	5	8	18
Poultry	csp	8	7	6	21
Other intensive livestock	eu	8	10	10	28
Combined	combi	6	16	9	31
Total					412

Table 5.3 Number of farms recruited

Type of farming	ESU size class			
	1	2	3	total
Field crop farms				
- starch potatoes	1	0	0	1
- organic crops	5	1	0	6
- other field crop farms	2	9	7	18
Horticulture				
Vegetables under glass				
- paprika	6	1	4	11
- cucumber	5	2	2	9
- tomato	2	0	9	11
- other	1	5	3	9
Cut flowers under glass				
- rose	4	1	2	7
- chrysanthemum	3	4	3	10
- other	5	0	9	14
Plants	0	0	1	1
Other glass	2	1	3	6
Field vegetables	4	5	6	15
Fruit	2	0	0	2
Nurseries	1	1	2	4
Mushroom	2	4	3	9
Bulbs	3	1	0	4
Other open air	1	8	3	12
Grazing livestock				
Dairy				
- organic	3	5	3	11
- non-organic	9	11	24	44
Calf fattening	0	1	0	1
Other grazing livestock	1	1	2	4
Intensive livestock				
Breeding pigs	7	0	2	9
Fattening pigs	0	2	5	7
Integrated pig farms	12	2	9	23
Laying hen	6	12	3	21
Poultry	9	12	6	27
Other intensive livestock	0	2	0	2
Combined	3	18	7	28
Total	99	109	118	326

Table 5.4 Response rate in different types of farming

	Refusals	Recruited	Unsuitable	Total	% unsuitable	% response
Field crop farms						
- starch potatoes		1		1		100.0
- organic crops	10	6	4	20	20.0	37.5
- other field crop farms	6		6	12	50.0	
Horticulture						
Vegetables under glass						
- paprika	25	10	8	43	18.6	28.6
- cucumber	17	8	5	30	16.7	32.0
- tomato	8	9	7	24	29.2	52.9
- other	54	9	22	85	25.9	14.3
Cut flowers under glass						
- rose	25	5	18	48	37.5	16.7
- chrysanthemum	49	7	13	69	18.8	12.5
- other	33	13	23	69	33.3	28.3
Plants	7	1	5	13	38.5	12.5
Other glass	33	4	26	63	41.3	10.8
Field vegetables	2			2		
Fruit			1	1	100.0	
Nurseries			2	2	100.0	
Mushroom						
Bulbs						
Other open air	4		6	10	60.0	
Grazing livestock						
Dairy						
- organic	2	12	1	15	6.7	85.7
- non-organic	1		1	2	50.0	
Calf fattening	1			1		
Other grazing livestock	5	1	4	10	40.0	16.7
Intensive livestock						
Breeding pigs	52	9	9	70	12.9	14.8
Fattening pigs	40	8	7	55	12.7	16.7
Integrated pig farms	63	21	6	90	6.7	25.0
Laying hen	63	16	10	89	11.2	20.3
Poultry	81	21	12	114	10.5	20.6
Other intensive livestock	2			2		
Combined	14	5	2	21	9.5	26.3
Total	597	166	198	961	33.2	21.8

Farms are asked to participate in the system in order to compensate for attrition and to take structural changes in agriculture into account. Some of the farms approached during the recruitment phase refused to participate. These refusals do not cause problems if these farms do not differ from farms that participate in their place. In the case where farms that refuse to participate systematically differ from the participating farms, this could result in a bias. If for example older farmers are less inclined to participate, this will result in a different age distribution in the sample compared to the population. The representativeness of the data with respect to age will be called into question (whether this is a problem or not depends on the research goals and the extent to which the important variables correlate with age). The representativeness is analysed in chapter 6. Table 5.4 describes the response rate in the different types of farming. The number of recruited farms in table 5.4 is lower than in table 5.3 because the analyses presented in table 5.4 are restricted to the CSP observations.

To develop a better understanding of the reasons for non-response a number of questions were asked to all farmers approached. Table 5.5 shows the results for the questions asked. In these questions the farmer had to indicate to which extend he/she agrees with a statement about his knowledge or his attitude. The table shows a clear difference between those farmers who are willing to cooperate and those who are not. The ones who are willing to participate are more informed about the activities of the LEI and the existence of the FADN. The participants are also better informed about the use of the FADN data. The non participants on average disagree with the statement that they are aware of the use of the FADN data. Providing data is considered more useful by those who are willing to participate. The opinion about the LEI with respect to the objectivity and the carefulness is better among the participants. The last question shows that non participants have a significant lower trust in the government.

Table 5.5 Attitude of farmers (-2 not agree till 2 agree)

	Non participant		Participant	
	average	SE	average	SE a)
Informed about the LEI	1.32	0.05	1.59	0.06
Informed about the FADN system	0.24	0.07	0.66	0.12
Informed about the use of FADN data	-0.04	0.06	0.33	0.12
Usefulness of FADN system	0.34	0.05	1.22	0.07
Usefulness of providing data	0.32	0.05	1.27	0.07
Carefulness of LEI	0.43	0.04	1.09	0.08
Objectivity of LEI	0.49	0.05	1.17	0.08
Trust in the government	-0.58	0.05	-0.01	0.08

a) SE = standard error.

Table 5.6 Number of farms with 2004 as first year of completion of bookkeeping

Type of farming	ESU size class		
	1	2	3
Field crop farms			
- starch potatoes	1		
- organic crops	5	1	
- other field crop farms		1	
Horticulture			
Vegetables under glass			
- paprika	3		3
- cucumber	4	1	2
- tomato	1		3
- other		4	1
Cut flowers under glass			
- rose	1		1
- chrysanthemum	2	1	2
- other	1		2
Plants			
Other glass	2		
Field vegetables			
Fruit			
Nurseries			
Mushroom			
Bulbs			
Other open air			
Grazing livestock			
Dairy			
- organic	2	4	2
- non-organic	1		1
Calf fattening			
Other grazing livestock			
Intensive livestock			
Breeding pigs	6		2
Fattening pigs		2	5
Integrated pig farms	11	1	7
Laying hen	6	9	
Poultry	6	8	3
Other intensive livestock			
Combined		2	2
Total	52	34	36

Using these same variables discriminant analysis was applied to find the factors that are most discriminating between farmers who are willing to participate and farmers who refuse to participate. The analyses of the attitude of farmers shows that 'usefulness of FADN system', 'usefulness of providing data' and the extent to which LEI treats the data in a careful way are the most important factors in predicting the participation of an individual farmer. Compared to the previous analysis (Vrolijk, 2005) the trust in the government has decreased in importance as a predicting variable. This is partly caused by the change in attitude of the participants. In the previous study the respondents had on average positive trust in the government. In the current year the participants had on average a slight distrust in the government.

Table 5.6 describes the number of farms where accounts were completed for the first time for the bookkeeping year 2004. Due to several factors this is not exactly the same as the number of farms recruited (as described in table 5.3). Firstly, farms can drop out during the first year of participation. Secondly, some farms were already recruited during a previous year, but due to capacity problems their bookkeeping was not completed for that year.

In table 5.7 a distinction is made between CSP observations (corporate social performance) and the total number of observations. Poppe (2004) describes that the introduction of a new bookkeeping system and budget cuts have resulted in a large pressure on available capacity. To deal with this pressure, a flexible data collection system has been introduced with two main variants in the data collection; the EU variant and the CSP variant. In the EU farm income variant the most essential financial economic information is collected. This is the information that each member state is obliged to provide to Brussels. The information covered in this variant mainly focuses on family farm income, the balance sheet, a limited number of technical data (cropping pattern, livestock) and information on the EU subsidies. In the second variant, the CSP variant, a wide range of data is collected for EU and national purposes. It covers all the topics that are nowadays considered relevant in a report on the corporate social performance of a company or a farm. Therefore, besides the financial economic information as collected in the EU variant, a wide range of data is collected such as environmental data, other farm incomes, off farm income, animal welfare, animal health and the level of innovation of firms.

Table 5.7 Comparison of the field of observation (population) and the sample available for research purposes 2004 (agricultural census 2004)

Type of farming	Code	Number of farms	Number of farms in the sample	
		population	CSP	total
Field crop farms	*1*			
- starch potatoes		1,074	28	33
- organic crops		238	22	32
- other field crop farms		7,479	94	126
Horticulture	*2+3*			
Vegetables under glass	2012			
- paprika		445	28	34
- cucumber		278	28	36
- tomato		351	23	29
- other		853	18	27
Cut flowers under glass	2022			
- rose		457	18	23
- chrysanthemum		292	20	23
- other		1,911	31	42
Plants	2022	1,304	25	26
Other glass		775	9	18
Field vegetables	2011	881	9	41
Fruit	3210	1,472	25	40
Nurseries	3480	1,973	4	26
Mushroom	2033	325	13	28
Bulbs	2021	972	18	35
Other open air		1,410	5	34
Grazing livestock	*4*			
Dairy	4110+4120+4370			
- organic		330	26	32
- non-organic		21,407	243	307
Calf fattening	4380	1,079	15	30
Other grazing livestock	4410+4420+4430	7,726	19	34
Intensive livestock	*5*			
Breeding pigs	5011	1,586	34	55
Fattening pigs	5012	1,253	21	44
Integrated pig farms	5013	1,036	20	41
Laying hen	5021	867	21	37
Poultry	5022	448	13	34
Other intensive livestock	other 5	346	1	16
Combined	*6-8*	5,915	56	109
Total		64,483	887	1,392

5.4 Supply of farm results to the European Commission 2004

January 2006 the final delivery of 2004 data to EU has taken place. Data of 1,420 farms have been provided to Brussels (table 5.8).

Table 5.8 Comparison between the number of farms supplied to the EU and those available for research

Bookkeeping year	Provided to the European Commission	Weighted farms available for research	Other available farms a)
1990/91	1.587	1.576	12
1991/92	1.505	1.547	8
1992/93	1.513	1.516	7
1993/94	1.525	1.520	7
1994/95	1.546	1.534	13
1995/96	1.536	1.530	6
1996/97	1.551	1.545	6
1997/98	1.529	1.522	7
1998/99	1.368	1.363	5
1999/00	1.341	1.334	7
2000 b)	N/A	N/A	N/A
2001	1.330	1.310	20
2002	1.358	1.344	14
2003	1.437	1.399	38
2004	1.420	1.392	28

a) Other available farms are farms that are also available but without a weight. Reasons for not having a weight are: a farm is outside of the defined field of observation because a farm is too large or to small according to the information in the agricultural census; b) Bookkeeping year 1999/00 ended for arable farms and husbandry at April 30, 2000. Due to capacity problems related to IT problems, farm data for the period of April 30, 2000 till December 31, 2000 (respectively January 1, 2000 till December 31, 2000) are not processed but estimated based on data of 1999/00 and 2000/01.

6. Evaluation sample 2004

6.1 Introduction

In this chapter the FADN sample for the year 2004 is evaluated in a qualitative and quantitative way. Section 6.2 provides an evaluation of the methodology of stratification and weighting. A crucial element is the calculation of weights. Section 6.3 provides the quantitative evaluation of the year 2004. This section focuses on the quality of the estimations that can be made based on the sample.

6.2 Evaluation of stratification and weighting

6.2.1 Introduction

This section deals with some practical problems related to the estimation process. Weights of individual farms are used to make estimations of frequencies, totals and averages of groups of farms (aggregated results) based on the data from the agricultural census and the FADN data.

The method to calculate the weights of individual farms is crucial. The goal is to achieve unbiased estimates with a minimal variance. This enables the estimation of the confidence interval of the real population value and the minimisation of the total error. This is true for direct estimators. In case of ratio estimator this is not necessarily true, but ratio estimators are outside the scope of this publication (see Vrolijk et al., (2001) for a more extensive description of ratio estimators and other estimators).

In the next section the method to calculate the weights of the farms is described in general terms. The method applied to calculate the weights is evaluated from a practical and theoretical perspective.

6.2.2 Method of calculation of weights

The objective of the Dutch FADN system is to give a representative view of the total population. The question is therefore how to draw conclusions on totals, averages and frequencies that are valid for the whole population based on individual farm data. For example how much is the average family farm income of all farms in agriculture and horticulture. The solution is found in weighting: the individual farm data are raised to the population level (for some variables the estimated values can be compared to the data that is available for the whole population, i.e. data which is included in the yearly agricultural census). A weight is assigned to every observed farm in the FADN system. The weight is defined as the ratio between the number of farms in a stratum according the agricultural census and the number of farms in the sample (in the FADN system). For the assignment

of farms in the FADN system to strata the information from the year 2004 is used. This data can be different from the data when the farm was chosen in the system for the first time. This implies some kind of post-stratification. Weights can be calculated as soon as a substantial number of farms have been completed. During the year, when additional farms are completed, the weights are recalculated. The weights of the farms are recalculated until the accounts of all farms are completed and the final set of weights can be established. For preliminary estimations based on for example 50% of the farms, one should be aware of the fact that this 50% is not necessary representative for the whole population.

The (post) stratification of the farms is based on the agricultural census 2004. The population in a specific stratum is continuously changing; therefore the farms that belong to a stratum in 2003 are not exactly the same as the farms that belong to that stratum in 2004. Due to these changes farms included in one stratum could have had different inclusion probabilities at the time of recruitment. In theory, to achieve unbiased estimators these differences in inclusion probabilities should be taken into account in the estimation process. However, the consequence of this would be a very complicated system with many different substrata with different inclusion probabilities. Therefore this complicated procedure is not applied. As a result, the theoretical assumption of a strict a-select sample can not be validated.

Although the calculation method applied in practice can lead to systematic distortions between estimated values and real values, the assumption of a random sample is made. This leads to several attractive consequences. The method to calculate weights is relatively easy, it involves a limited set of homogenous strata and it results in a more effective use of data.

Because of the applied sampling procedure (see section 2.1) the different strata have different sampling fractions. Strata with relatively homogenous units have a lower sampling fraction than very heterogeneous strata. This also implies that farms have very diverging weights. Farms from a homogenous cluster will have a larger weight (in principal the reciprocal of the sampling fraction) and therefore represent a larger number of farms. The differences in sampling fractions are shown in table 6.1. These percentages are calculated by dividing the required number of farms in the selection plan (table 5.1) by the number of population units (table 3.3).

Table 6.1 Sampling fractions in different strata

Type of farming	ESU size class		
	1	2	3
Field crop farms			
- starch potatoes	0.02	0.02	0.05
- organic crops	0.14	0.11	0.12
- other field crop farms	0.01	0.02	0.08
Horticulture			
Vegetables under glass			
- paprika	0.07	0.05	0.09
- cucumber	0.08	0.10	0.24
- tomato	0.09	0.07	0.10
- other	0.02	0.04	0.12
Cut flowers under glass			
- rose	0.08	0.06	0.06
- chrysanthemum	0.09	0.10	0.12
- other	0.01	0.02	0.05
Plants	0.02	0.02	0.04
Other glass	0.03	0.04	0.07
Field vegetables	0.04	0.07	0.26
Fruit	0.02	0.02	0.08
Nurseries	0.01	0.02	0.06
Mushroom	0.05	0.11	0.29
Bulbs	0.03	0.04	0.08
Other open air	0.01	0.02	0.08
Grazing livestock			
Dairy			
- organic	0.07	0.10	0.13
- non-organic	0.01	0.01	0.03
Calf fattening	0.03	0.02	0.06
Other grazing livestock	0.00	0.01	0.05
Intensive livestock			
Breeding pigs	0.02	0.03	0.17
Fattening pigs	0.02	0.05	0.37
Integrated pig farms	0.02	0.04	0.19
Laying hen	0.02	0.03	0.22
Poultry	0.05	0.05	0.17
Other intensive livestock	0.06	0.08	0.19
Combined	0.01	0.02	0.06

6.2.3 Remarks on the weights of 2004

In the report on farm results 2004 the research population is defined as all farms in the agricultural census 2004 (between the lower and upper threshold). The weight per farms is calculated as the ratio between the number of farms in the census and the number of farms in the sample.

In the calculation of aggregated results (averages, frequencies and totals) for the year 2004 the agricultural census 2004 is the starting point. Because of the complete registration of farms in the population (almost all farms are registered in the agricultural census) the aggregated numbers of farms are exactly the same as the number of farms in the census. However, in using these numbers in the calculation of weights for estimations for 2004 two remarks should be made.

Every year all horticultural and agricultural farms are registered in the agricultural census, but this registration only represents the situation at a certain moment during the year. Therefore it is possible that farms are missing from this registration. Furthermore the trend is for number of farms to fall significantly (this trend is stronger for certain types of farms and less strong for others). As a consequence estimations for the year 2004 might be overestimations of reality.

Distortions in the number of farms in the census can therefore cause incorrect estimations of aggregates.

Furthermore, the typology of farms according to the agricultural census might differ from the typology according to the FADN data. The census reflects the situation at a certain point in time, while the FADN system describes the farm during a whole year. In order to take into account these differences two weighting methodology are available in the Dutch FADN system.

6.3 Quantitative evaluation of 2004

6.3.1 Introduction

This section focuses on the quality of the estimations based on the FADN sample 2004. Section 6.3.2 provides information on the coverage of the sample. Section 6.3.3 analyses the extent to which distortions might occur between the sample and the population due to over or under representation of farms with specific characteristics; for example due to non-response in relation to factors explaining the non-response and the applied weighting methodology. Section 6.3.4 provides information on the reliability of estimates.

6.3.2 Coverage

It is desirable to have a sample that represents the population as well as possible. A clear distinction should be made between the coverage and the representativeness. This section describes the coverage, section 6.3.3 deals with the representativeness. To get an idea about the extent to which the total population is covered by the sample it is relevant to distinguish several aspects. Farms that are too small or are not registered in time are not

part of the agricultural census (b). The sampling frame (c) is the basis for the choice of sample farms and consists of farms registered in the agricultural census and have a size of more then 16 ESU and less then 1200 ESU. From this sampling frame the sample is drawn (d).

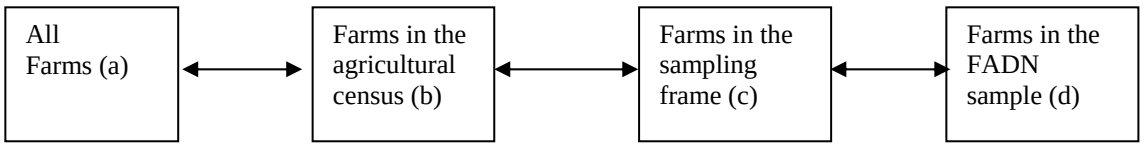

Figure 6.1 Relationship between FADN sample and all farms

Table 6.2 gives an indication to what extent the FADN sample covers the whole population. Therefore a comparison is made between the farms in the sampling framework (all the farms that have a chance of being included in the FADN sample) (c) and the total population as described by the agricultural census (b). Direct comparison with all farms (a) would be better but the unregistered farms are unknown, and the practical difference is very limited. The sampling framework covers the population to a large extent. For example with respect to the production, more than 91% is covered by the sample. Small farms are excluded from the sampling framework, this means that a substantial number of the farms and to a lesser extent also of labour are outside of the sampling frame. With respect to agricultural activities, the table shows that some activities are not well covered by the sample. This mainly concerns the activities that are commonly found on very small or on very large specialised farms.

Table 6.2 Coverage of the sample compared to agricultural census (2004)

Variable agricultural census	Number according to census	Not covered in sample (%)		Percentage covered by sample
		of which <16 ESU	of which >1,200 ESU	
Numbers				
Farms	83888	22.8	0.4	76.9
Dutch size units	7236097	2.0	7.0	91.1
Farm managers	95552	11.1	0.3	88.6
Family labor	115756	10.9	0.3	88.8
Paid labor	41805	2.5	9.0	88.5
Total labor	157561	8.6	2.6	88.7
Size in hectares				
Agricultural area	1924524	5.1	1.3	93.6
Arable	820610	4.4	1.2	94.3
Grassland	983381	6.0	0.7	93.3
Horticulture under glass	10486	0.1	15.3	84.5
Field vegetables	102613	1.4	6.6	92.0

Table 6.2 Coverage of the sample compared to agricultural census (2004) (continued)

Variable agricultural census	Number according to census	Not covered in sample (%)		Percentage covered by sample
		of which <16 ESU	of which >1,200 ESU	
Other agricultural area	3164	9.3	2.6	88.1
Number of animals				
Dairy cows	1470589	0.1	0.2	99.7
Fattening calves	765063	0.7	1.6	97.7
Young cattle	1139079	1.4	0.2	98.4
Beef cattle	365822	15.2	0.2	84.6
Ewes	633462	20.7	0.2	79.2
Fattening pigs	5382515	1.9	0.6	97.5
Breeding pigs	1246342	0.2	0.7	99.1
Laying hens	35668320	0.4	4.0	95.6
Poultry	44262247	0.1	1.3	98.6
Size in hectares				
Winter cereal	117224	4.2	1.3	94.5
Seed potatoes	39739	0.2	1.6	98.3
Consumption potatoes	72669	1.5	1.6	96.9
Starch potatoes	51496	0.9	1.8	97.4
Sugar beets	97736	2.8	1.4	95.8
Peas for canning	4861	1.4	4.7	93.9
Seed onions	19888	0.4	1.1	98.4
Grass seed	25325	2.7	1.4	95.9
Green maize	224468	6.4	0.3	93.4
Celeriac	1326	0.2	1.6	98.2
Brussels sprouts	3465	0.4	0.1	99.5
Cabbage all types	4893	1.3	0.6	98.2
Carrots	2435	3.3	2.9	93.8
Winter carrot	5451	0.3	5.0	94.7
Chicory	2937	0.4	0.1	99.5
Asparagus	2361	2.7	1.7	95.7
Horticultural seeds	759	9.2	8.6	82.2
Tulips	11020	0.2	11.4	88.4
Hedges	2300	2.9	1.2	95.8
Trees	4736	1.0	13.7	85.2
Apples	10217	2.1	0.0	97.9
Pears	6493	2.1	0.0	97.8
Tomatoes under glass	1352	0.0	34.4	65.6
Cucumbers under glass	623	0.0	6.1	93.9
Paprika under glass	1205	0.0	16.0	84.0
Roses	848	0.0	17.5	82.5
Chrysanthemum	679	0.0	4.0	96.0
Freesia	191	0.0	2.1	97.9
Ornamentals green	573	0.1	20.5	79.4
Ornamentals flower	767	0.0	21.8	78.2
Mushrooms	85	0.0	29.8	70.1

In policy analysis and research it is essential to distinguish between farming types (for example specialised pig fattening farms) and agricultural activities (pig fattening). In the report on the redesign of the FADN sample it was illustrated that types of farming should not only be the focus of research (Vrolijk and Lodder, 2002). Agricultural activities are important in many research projects.

To give a complete picture of a certain agricultural activity it is therefore important to look at the activities on all farm types. For example, not only pig fattening farms will create added value from pig fattening, also other types of farms can be involved in this activity (although it is not their main business). The next table describes to which extent a certain activity can be found on certain types of farming. The figures in italic express that an activity belongs to that type of farming (based on the principal types of farming). For example, 80.5% of the agricultural activity fattening pigs can be found on the intensive livestock farms. This means that 19.5% of this activity can be found on farms that belong to other types of farming, for example arable farms. Looking in more detail, the skewness is even larger. Types of farming 5011, the specialised pig fattening farms are responsible for 55% of the pig fattening activity. This implies that 45% of this activity takes place within other types. Production of mushrooms is a very specialised agricultural activity. In contrast, more than 99% of this activity takes place on specialised mushroom farms (table 6.3).

6.3.3 Representativeness

Because of the stratification scheme the sample will provide a good representation of the population on the main characteristics (stratification variables) at the beginning of a year. During the year farms might drop out of the sample and changes might occur in the population. Despite these changes the representativeness is maintained by applying post-stratification on the resulting sample and the changed population. Representativeness with respect to the stratification variables does not necessary imply that the sample is representative for all variables. Such a full representativeness is impossible unless the sample size approximates the whole population. Table 6.4 shows to what extent the sample is representative for a number of variables in the agricultural census.

The following guideline can help in the interpretation of the table: a relative difference which is close to the relative standard error cannot be regarded as proof of systematic differences between the sample and the population. If the relative difference is more than two times the relative standard error then it is less likely that these differences can be explained by sampling errors. It is very unlikely that the difference is caused by coincidence if the relative difference is more than three times the relative standard error.

An example can illustrate how the table should be interpreted. The average number of DSU (Dutch size units) of pigs as measured in the agricultural census 2004 is 6.6 (i.e. the average of all farms within the field of observation). If the same variable is estimated based on the FADN sample an average of 7.0 is calculated. It might seem that the number of pigs is slightly overestimated in the sample. However, the relative standard error of the estimate is 3.7%. When this standard error is compared to the relative difference between both values (6.2%) than the conclusion, that there is a significant difference, cannot be

supported. The information in table 6.4 gives an indication for which variables and thus for which research projects it might be wise to perform post-stratification or use alternative estimation techniques to take into account the differences between the sample and the population. For example, in studies in which the age of the farmer plays an important role it might be useful to apply alternative estimation techniques.

Table 6.3 Relationship between types of farming and agricultural activities - share of ESU (farms between 16 and 1,200 ESU) 2004

Type of farming	Dairy	Cattle	Sheep	Goat	Grass-land	Fattening pig	Other pig	Laying hen	Poultry
Field crop farms									
- starch potatoes	0.00	0.31	0.17	0.03	0.21	0.02	0.43	0.13	0.78
- organic crops	0.00	0.15	0.16	0.02	0.21	0.24	0.06	0.03	0.00
- other field crop farms	0.05	2.40	3.33	0.07	4.55	0.24	1.88	0.82	2.73
Horticulture									
Vegetables under glass									
- paprika	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
- cucumber	0.00	0.00	0.01	0.00	0.03	0.01	0.00	0.00	0.00
- tomato	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
- other	0.00	0.00	0.09	0.00	0.10	0.00	0.05	0.00	0.00
Cut flowers under glass									
- rose	0.00	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.00
- chrysanthemum	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.00
- other	0.00	0.01	0.08	0.01	0.13	0.00	0.01	0.00	0.00
Plants	0.00	0.00	0.06	0.00	0.13	0.00	0.00	0.00	0.00
Other glass	0.00	0.00	0.04	0.01	0.07	0.00	0.00	0.00	0.00
Field vegetables	0.01	0.36	0.09	0.01	0.13	0.01	0.08	0.02	0.00
Fruit	0.00	0.03	0.14	0.01	0.29	0.02	0.11	0.07	0.00
Nurseries	0.02	0.13	0.11	0.01	0.23	0.15	0.21	0.01	0.00
Mushroom	0.00	0.01	0.02	0.00	0.07	0.00	0.02	0.00	0.00
Bulbs	0.05	0.11	0.17	0.00	0.30	0.02	0.09	0.00	0.25
Other open air	0.01	0.15	0.13	0.01	0.25	0.06	0.23	0.12	0.23
Grazing livestock									
Dairy									
- organic	*1.23*	*0.88*	*0.50*	*0.11*	*0.43*	0.05	0.12	0.13	0.00
- non-organic	*93.03*	*50.30*	*24.39*	*1.70*	*3.74*	2.92	11.14	1.73	1.60
Calf fattening	*0.02*	*0.71*	*0.61*	*0.08*	*0.12*	0.01	0.31	0.19	0.00
Other grazing livestock	*1.32*	*27.20*	*58.15*	*91.35*	*72.81*	0.41	1.50	0.45	0.44
Intensive livestock									
Fattening pigs	0.04	0.35	0.94	0.05	1.31	*55.25*	*4.79*	*0.04*	*0.10*
Breeding pigs	0.00	0.21	0.41	0.02	0.73	*0.02*	*32.36*	*0.02*	*0.00*
Integrated pig farms	0.02	0.34	0.63	0.07	0.73	*23.78*	*24.33*	*0.03*	*0.27*
Laying hen	0.03	0.08	0.46	0.02	0.70	*0.03*	*0.41*	*80.58*	*0.06*
Poultry	0.02	0.10	0.20	0.02	0.35	*0.03*	*0.24*	*0.04*	*67.37*
Other intensive livestock	0.03	0.08	0.16	0.23	0.22	*1.42*	*1.43*	*3.91*	*3.88*
Mixed	4.13	16.07	8.88	6.17	12.07	15.30	20.21	11.67	22.28
Total	100	100	100	100	100	100	100	100	100

Table 6.3 Relationship between types of farming and agricultural activities - share of ESU (farms between 16 and 1,200 ESU) 2004 (continued)

	Wheat	Root crops	Vege-table open air	Fruit	Tree	Mush-room	Bulbs	Vege-tables glass	Cut flowers glass	Orna-mentals glass
Field crop farms										
- starch potatoes	*6.34*	*13.87*	0.10	0.05	0.01	0.00	0.03	0.00	0.00	0.00
- organic crops	*1.85*	*1.12*	2.43	0.32	0.02	0.00	0.31	0.27	0.00	0.00
- other field crop farms	*54.58*	*60.64*	2.91	1.03	0.13	0.00	0.59	0.01	0.01	0.00
Horticulture										
Vegetables under glass										
- paprika	0.03	0.00	0.01	0.00	0.00	0.00	0.00	*28.27*	0.03	0.09
- cucumber	0.01	0.00	0.12	0.00	0.00	0.00	0.00	*10.20*	0.00	0.00
- tomato	0.02	0.01	0.04	0.00	0.00	0.00	0.00	*32.20*	0.02	0.00
- other	0.12	0.03	2.67	0.21	0.02	0.00	0.00	*25.09*	0.17	0.01
Cut flowers under glass										
- rose	0.03	0.00	0.00	0.00	0.05	0.00	0.00	0.02	*29.72*	0.07
- chrysanthemum	0.01	0.00	0.00	0.07	0.04	0.00	0.00	0.02	*10.98*	0.02
- other	0.12	0.02	0.11	0.06	0.19	0.00	1.03	0.14	*47.71*	0.86
Plants	0.04	0.00	0.06	0.04	0.33	0.00	0.01	0.15	0.69	*95.01*
Other glass	0.09	0.04	1.79	0.27	3.10	0.00	2.59	2.11	5.19	3.14
Field vegetables	0.54	0.55	58.01	0.26	0.08	0.00	0.01	0.34	0.01	0.00
Fruit	0.41	0.18	0.35	*83.7*	0.08	0.00	0.01	0.03	0.00	0.00
Nurseries	0.47	0.12	0.48	0.19	*84.4*	0.00	0.00	0.01	0.06	0.03
Mushroom	0.03	0.01	0.05	0.21	0.00	*99.28*	0.00	0.00	0.00	0.00
Bulbs	0.95	0.96	0.64	0.01	0.08	0.00	*77.00*	0.00	1.39	0.00
Other open air	0.69	0.57	6.86	1.71	4.07	0.01	9.61	0.69	3.34	0.11
Grazing livestock										
Dairy										
- organic	0.23	0.02	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
- non-organic	4.47	4.40	0.95	0.59	0.37	0.01	0.41	0.01	0.00	0.00
Calf fattening	0.28	0.08	0.08	0.02	0.05	0.00	0.03	0.00	0.00	0.00
Other grazing livestock	4.07	0.63	0.29	0.45	0.08	0.00	0.10	0.00	0.00	0.00
Intensive livestock										
Fattening pigs	2.01	0.40	0.17	0.02	0.05	0.00	0.01	0.00	0.00	0.00
Breeding pigs	1.12	0.16	0.04	0.03	0.03	0.00	0.00	0.00	0.00	0.00
Integrated pig farms	2.01	0.56	0.22	0.05	0.06	0.00	0.03	0.00	0.00	0.00
Laying hen	0.63	0.22	0.09	0.06	0.04	0.00	0.02	0.00	0.00	0.00
Poultry	0.34	0.08	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Other intensive livestock	0.24	0.06	0.02	0.02	0.03	0.00	0.00	0.00	0.00	0.00
Mixed	18.30	15.27	21.43	10.64	6.63	0.70	8.20	0.43	0.67	0.66
Total	100	100	100	100	100	100	100	100	100	100

Table 6.4 Comparison of average farm in the agricultural census (16-1,200 ESU) and average farm in the Dutch FADN (agricultural cenus 2004)

Variable	Average calculated based on		Relative standard error (FADN)	Ratio Census and FADN		
				all farms	farms with value > 0	
	Census (1)	FADN (2)		average (1 / 2)	number	average per farm
Size						
Dutch size units	102.2	107.4	0.9	95.2	100.0	95.2
Activities (DSU)						
Field crops	12.4	13.6	2.7	90.7	92.1	98.6
Grassland	2.0	2.0	14.9	101.1	101.5	99.7
Fallow land	0.0	0.0	25.1	132.0	116.4	113.4
Horticulture in the open	14.4	15.2	2.9	94.7	98.8	95.8
Horticulture under glass	22.2	23.5	2.0	94.2	95.8	98.3
Cattle	36.0	37.4	1.7	96.3	98.8	97.5
Dairy cows	28.8	29.6	1.6	97.1	96.5	100.6
Fattening cattle	1.1	1.5	25.2	74.3	86.4	85.9
Veal	1.7	1.8	11.6	93.7	96.2	97.4
Horses	2.1	0.9	28.1	229.4	144.6	158.6
Sheep	0.5	0.8	30.6	59.4	96.7	61.5
Goats	0.4	0.7	36.3	51.5	79.0	65.2
Pigs	6.6	7.0	3.7	93.8	98.0	95.7
Fattening pigs	2.7	2.7	5.4	100.0	105.3	95.0
Breeding pigs	3.9	4.3	4.6	90.5	89.5	101.1
Poultry	3.0	3.4	6.1	86.3	84.7	102.0
Fattening peepers	0.9	1.0	12.6	91.4	88.9	102.8
Laying hen	1.4	1.9	9.9	70.4	72.8	96.6
Dugs	0.0	0.0				
Turkey	0.1	0.2	34.4	48.2	72.3	66.6
Other poultry	0.0	0.0	93.6	205.4	49.7	413.5
Rabbits	0.1	0.1	61.4	75.2	156.4	48.1
Fur animals	0.5	0.5	19.1	95.0	118.5	80.2
Sizes (ha)						
UAA	27.9	29.1	1.6	95.9	100.1	95.8
Field crops	12.0	12.9	2.6	93.1	94.7	98.3
Horticulture open air	1.5	1.6	4.3	92.5	98.8	93.7
Horticulture glass	0.1	0.2	2.4	94.8	95.8	98.9
Permanent grass	10.9	10.9	4.2	99.8	102.6	97.3
Temporary grassland	3.3	3.5	7.5	94.7	96.1	98.6
Fallow	0.0	0.0	25.1	132.0	116.4	113.4
Other	2.0	1.2	12.7	176.1	91.3	192.8
Forest	0.7	0.0	39.9	2,497.2	118.3	2,111.2

Table 6.4 Comparison of average farm in the agricultural census (16-1,200 ESU) and average farm in the Dutch FADN (agricultural cenus 2004) (continued)

Variable	Average calculated based on		Relative standard error (FADN)	Ratio Census and FADN		
				all farms	farms with value > 0	
	Census (1)	FADN (2)		average (1 / 2)	number	average per farm
Acreages field crops						
Grains	3.1	3.2	5.6	96.1	93.9	102.4
Leguminous plants	0.1	0.1	30.4	69.7	81.3	85.8
Commercial crops	0.1	0.1	30.1	124.8	116.3	107.3
Seeds	0.4	0.5	11.6	73.6	66.5	110.6
Tuberous and carrots	4.0	4.4	3.4	90.8	91.3	99.5
Green fodder	3.4	3.6	4.9	95.6	93.3	102.5
Green fertilizer	0.3	0.4	11.2	86.7	87.0	99.8
Horticulture in the open air						
Vegetables (market garden)	0.6	0.7	8.5	94.0	95.6	98.3
Vegetables (field scale)	0.4	0.4	12.8	97.8	93.6	104.5
Stone fruit	0.3	0.3	7.6	94.8	113.3	83.7
Small fruits	0.0	0.1	46.4	40.5	85.3	47.4
Horticultural seeds	0.0	0.0	72.7	140.6	63.7	220.8
Flower nursery	0.0	0.0	24.8	120.5	123.3	97.7
Tree nursery	0.2	0.2	11.8	101.3	104.6	96.8
Flower bulbs	0.3	0.4	5.8	84.8	79.3	106.9
Glass houses						
Vegetables	0.1	0.1	3.1	99.6	103.5	96.2
Tomatoes	0.0	0.0	4.7	104.6	95.2	109.9
Cucumbers	0.0	0.0	5.7	88.2	87.5	100.8
Paprika	0.0	0.0	4.0	98.9	105.1	94.1
Fruit	0.0	0.0	83.2	21.4	31.8	67.4
Cut flowers	0.1	0.1	3.5	87.9	95.4	92.2
Roses	0.0	0.0	5.6	92.7	87.6	105.8
Chrysanthemum	0.0	0.0	10.8	94.4	70.2	134.5
Plants	0.0	0.0	6.3	95.8	109.9	87.2
Tree nursery	0.0	0.0	26.4	89.5	90.4	98.9
Flat glass	0.0	0.0				
Standing glass	0.1	0.1	2.1	96.2	98.6	97.6
Mushrooms						
Cell	0.0	0.0	6.0	92.5	96.0	96.4
Size (are)	0.0	0.0	8.5	102.9	96.0	107.2
Chicory						
Size (are)	0.0	0.1	32.5	34.4	34.6	99.6
Bulbs						
Tulips (pieces)	18.6	18.2	18.2	102.0	96.2	106.0
Narcissus (kg)	0.1	0.0	86.1	210.7	91.4	230.6

Table 6.4 Comparison of average farm in the agricultural census (16-1,200 ESU) and average farm in the Dutch FADN (agricultural cenus 2004)(continued)

Variable	Average calculated based on		Relative standard error (FADN)	Ratio Census and FADN		
				all farms	farms with value > 0	
	Census (1)	FADN (2)		average (1 / 2)	number	average per farm
Substrate growing (are)						
Vegetable	0.0	0.0	5.0	89.3	84.5	105.8
Flowers	0.0	0.0	11.6	74.5	72.7	102.5
Stable capacity (number of animals)						
Fattening calves	14.4	15.9	13.9	90.6	98.7	91.8
Fattening pigs	101.0	105.1	5.4	96.1	105.7	90.9
Peepers	796.7	895.2	15.1	89.0	93.2	95.5
Laying hen	483.8	699.9	11.6	69.1	75.1	92.1
Characteristics firm and entrepreneur						
Main occupation (%)	1.1	1.1	1.7	102.5	100.3	102.2
Legal entity (%)	5.3	2.7	13.1	193.4	194.0	99.7
Age	52.1	50.7	0.9	102.6	100.3	102.3
Labour						
Total	3.4	3.7	3.2	90.6	100.3	90.3
Male	2.2	2.3	2.3	95.8	99.4	96.4
Female	1.2	1.5	6.0	82.5	93.4	88.4
Paid labour	1.2	1.4	6.9	85.4	89.9	95.0

Source: Agricultural census 2004.

The last two columns of table 6.3 provide more detailed information on the difference between the population and the sample. These differences can be explained on one hand by differences in the number of farms on which a certain activity occurs (a value larger than zero) and on the other by the average of this activity on farms which are in this activity. For example: the number of DSU dairy cows in the FADN is higher than in the agricultural census. This difference is partly explained by a lower estimation of the number of farms with dairy cows and partly by a 0.6% higher estimation of ESU of dairy cows on farms with dairy cows (97.1 = 96.5% * 100.6).

A comparison between the sample and the population as registered in the agricultural census does not fully answer the question whether estimations of financial, economic and technical characteristics are bias free. It is for example possible that farms with relatively good or bad management skills and therefore performance are over represented in the sample.

6.3.4 Reliability

The previous subsection provides some indicators whether there are systematic differences between the sample and the population (representativeness of sample). This section focuses on the reliability of the estimates.

The calculation of averages of groups based on sampling units implies that there can be differences between the estimated value and true population value. These differences can occur due to the random selection of units to be included in the sample. Table 6.4 provides an indication of the level of precision of the estimates for a set of important goal variables.

The precision of estimates can be measured by the standard error of the estimate of a variable. The standard error is used to calculate the confidence interval. This confidence interval describes the range in which the true population value will be given a certain level of certainty. The confidence interval ranges from the calculated average minus two times the standard error to the calculated average plus two times the standard error. The calculated averages of two groups are significantly different (with a 95% certainty) if the difference is larger than two times the square root of the sum of squares of the standard errors of the two group averages.

This section provides the reliability of estimates for a number of important goal variables for different types of farming. This calculation is based on the available CSP observations (see section 5.3).

There are clear differences in the significance of estimates between different types of farming. The estimates for the dairy sector are the most reliable because of the large number of farms included in the sample, which reflects the importance of the dairy sector in Dutch agriculture. The decision on the number of farms is described in Vrolijk and Lodder (2002).

Tables 6.6 and 6.7 describe the relative standard error (coefficient of variance). This is the standard error divided by the group average. A higher relative standard error implies less reliable estimates, but the value is strongly affected by the absolute value of the average. If the average value approaches zero, the relative standard error can become very large. A meaningful evaluation of the standard error requires a simultaneous use of tables 6.5 and 6.6 on one hand and tables 6.7 and 6.8 on the other.

Table 6.5 Reliability of estimates of important goal variables per type of farming, based on FADN sample (2004)

Type of farming	Goal variable					
	family farm income	total revenues	return a)	savings	income farm	net farm result
Field crop farms						
- starch potatoes	8,415	16,022	4.2	7,796	6,363	5,553
- organic crops	22,365	40,147	4.3	21,320	21,537	26,599
- other field crop farms	8,271	29,154	2.3	7,121	8,280	6,490
Horticulture						
Vegetables under glass						
- paprika	21,734	40,389	1.9	17,232	21,781	15,853
- Cucumber	21,153	62,475	3.1	20,928	19,938	17,773
- tomato	38,765	70,633	2.2	33,071	38,644	21,581
- other	13,655	50,164	2.9	12,161	13,698	12,899
Cut flowers under glass						
- rose	33,845	111,447	3.6	31,048	35,886	27,027
- chrysanthemum	22,816	143,365	2.6	22,407	22,767	27,344
- other	10,264	40,099	2.5	9,836	10,618	10,762
Plants	28,763	82,432	3.3	22,501	27,825	24,177
Other glass	18,934	79,893	17.9	23,415	25,793	18,638
Field vegetables	33,438	160,184	6.9	37,235	24,154	21,028
Fruit	23,290	29,350	5.1	23,974	22,536	21,683
Nurseries	*	*	*	*	*	*
Mushroom	15,497	93,002	5.0	15,458	14,791	11,783
Bulbs	32,228	46,954	6.7	30,577	25,127	29,360
Other open air	*	*	*	*	*	*
Grazing livestock						
Dairy						
- organic	4,723	6,841	2.1	5,930	4,278	5,998
- non-organic	3,525	4,720	0.7	3,616	2,151	2,219
Calf fattening	6,702	16,734	3.0	6,598	6,103	6,837
Other grazing livestock	12,157	14,467	3.4	14,498	7,732	6,531
Intensive livestock						
Breeding pigs	10,426	48,595	2.5	11,463	10,679	7,915
Fattening pigs	12,722	61,200	3.4	10,229	11,941	7,876
Integrated pig farms	15,555	36,194	2.0	13,108	14,057	12,524
Laying hen	26,956	53,093	3.9	29,028	26,779	27,267
Poultry	9,547	43,799	3.9	11,049	12,176	11,990
Other intensive livestock	*	*	*	*	*	*
Mixed	14,205	30,059	2.6	14,783	14,392	13,643

a) Revenues per 100 euro costs.
* Insufficient number of observation in CSP variant.

Table 6.6 Reliability of estimates of important goal variables per main type of farming, based on FADN sample (2004)

Type of farming	Goal variable					
	family farm income	total revenues	return	savings	income farm	net farm result
Field crops	7,310	25,572	2.08	6,304	7,284	5,718
Vegetables under glass	10,995	28,755	1.47	9,498	10,949	8,248
Cut flowers under glass	9,719	38,003	1.92	9,189	10,122	9,505
Pigs	7,242	29,542	1.60	6,748	6,943	5,330
Poultry	18,067	38,053	2.89	19,505	18,137	18,436
Grazing livestock	3,952	4,969	1.00	4,465	2,479	2,283
All farms	3,023	7,006	0.72	3,115	2,573	2,304

Table 6.7 Coefficient of variation of estimates of important goal variables per main type of farming, based on FADN sample (2004)

Type of farming	Goal variable					
	family farm income	total revenues	return	savings	income farm	net farm result
Field crops	0.29	0.13	0.03	-0.36	0.51	-0.09
Vegetables under glass	0.23	0.05	0.02	-0.34	0.27	-0.11
Cut flowers under glass	0.17	0.06	0.02	-0.59	0.19	-0.15
Pigs	0.07	0.06	0.02	0.10	0.08	1.59
Poultry	-0.66	0.08	0.04	-0.25	-0.44	-0.16
Grazing livestock	0.08	0.03	0.02	0.26	0.07	-0.03

Table 6.8 Coefficient of variation of estimates of important goal variables per type of farming, based on FADN sample (2004)

Type of farming	Goal variable					
	family farm income	total revenues	return	savings	income farm	net farm result
Field crop farms						
- starch potatoes	0.16	0.09	0.05	0.75	0.17	-0.18
- organic crops	1.96	0.17	0.06	-0.89	-53.44	-0.36
- other field crop farms	0.39	0.15	0.03	-0.33	0.77	-0.10
Horticulture						
Vegetables under glass						
- paprika	0.27	0.05	0.02	-7.49	0.33	-0.43
- cucumber	0.20	0.07	0.03	0.61	0.20	-0.69
- tomato	-0.83	0.09	0.03	-0.21	-0.77	-0.10
- other	0.26	0.14	0.04	-2.07	0.29	-0.22
Cut flowers under glass						
- rose	0.39	0.10	0.04	1.31	0.45	2.28
- chrysanthemum	-10.88	0.13	0.03	-0.35	-5.40	-0.28
- other	0.18	0.08	0.03	-0.57	0.20	-0.14
Plants	0.50	0.13	0.04	-1.16	0.55	-0.66
Other glass	0.27	0.23	0.26	0.71	0.41	-0.64
Field vegetables	1.67	0.44	0.10	-0.92	12.25	-0.23
Fruit	0.78	0.13	0.07	-1.81	1.09	-0.35
Nurseries	*	*	*	*	*	*
Mushroom	0.33	0.16	0.06	-1.40	0.38	-0.21
Bulbs	1.17	0.11	0.09	-3.01	5.63	-0.27
Other open air	*	*	*	*	*	*
Grazing livestock						
Dairy						
- organic	0.10	0.04	0.03	0.89	0.12	-0.10
- non-organic	0.06	0.02	0.01	0.16	0.05	-0.03
Calf fattening	0.15	0.13	0.04	-0.70	0.17	-0.28
Other grazing livestock	0.32	0.14	0.06	2.82	0.39	-0.11
Intensive livestock						
Breeding pigs	0.10	0.09	0.03	0.21	0.12	-0.94
Fattening pigs	0.17	0.17	0.04	0.21	0.22	2.02
Integrated pig farms	0.10	0.06	0.02	0.13	0.10	0.60
Laying hen	-0.49	0.12	0.05	-0.25	-0.41	-0.19
Poultry	0.36	0.07	0.05	-1.25	2.80	-0.20
Other intensive livestock	*	*	*	*	*	*
Mixed	0.38	0.11	0.04	-3.15	0.55	-0.20

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Appendix A

((**<fabrieksaardappelbedrijven>**
als
(Landbouwtellingsbedrijf.fabrieksaardappelen
[NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,33)
anders
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als
(Landbouwtellingsbedrijf.biologisch [x1] = 1)
anders
<akkerbouwbedrijven>)
als
Landbouwtellingsbedrijf.mei_neg [x1] < 2000

anders
(**<biologische melkveebedrijven>**
als
Landbouwtellingsbedrijf.biologisch [x1] = 1
anders
<melkveebedrijven>)
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 4110
or
(Landbouwtellingsbedrijf.mei_neg [x1] = 4120
or
(Landbouwtellingsbedrijf.mei_neg [x1] = 4370)))
anders
<kalvermesterijbedrijven>
als
Landbouwtellingsbedrijf.mei_neg [x1] = 4380
anders
<andere graasdierbedrijven>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 4330
or
(Landbouwtellingsbedrijf.mei_neg [x1] = 4390
or
(Landbouwtellingsbedrijf.mei_neg [x1] = 4410
or
(Landbouwtellingsbedrijf.mei_neg [x1] = 4420

```
        or
      (Landbouwtellingsbedrijf.mei_neg [x1] = 4448
        or
      (Landbouwtellingsbedrijf.mei_neg [x1] = 4449
        or
      (Landbouwtellingsbedrijf.mei_neg [x1] = 4430)))))))
 anders
<fokvarkensbedrijven>
 als
      Landbouwtellingsbedrijf.mei_neg [x1] = 5011
 anders
<vleesvarkensbedrijven>
 als
      Landbouwtellingsbedrijf.mei_neg [x1] = 5012
 anders
<gesloten varkensbedrijven>
 als
      Landbouwtellingsbedrijf.mei_neg [x1] = 5013
 anders
<legkippenbedrijven>
 als
      Landbouwtellingsbedrijf.mei_neg [x1] = 5021
 anders
<vleespluimveebedrijven>
 als
      Landbouwtellingsbedrijf.mei_neg [x1] = 5022
 anders
<andere hokdierbedrijven>
 als
      (Landbouwtellingsbedrijf.mei_neg [x1] >= 5023
        and
      (Landbouwtellingsbedrijf.mei_neg [x1] <= 5032))
        anders
      <biologische gewascombinatiebedrijven>
        als
      (Landbouwtellingsbedrijf.mei_neg [x1] >= 6000
        and
      (Landbouwtellingsbedrijf.mei_neg [x1] < 7000
        and
      (Landbouwtellingsbedrijf.biologisch [x1] = 1)))
 anders
<andere combinatiebedrijven>)
als
      (Landbouwtellingsbedrijf.mei_neg [x1] < 2000
        or
```

(Landbouwtellingsbedrijf.mei_neg [x1] >= 4000)
anders
((<**paprikabedrijven**>
als
(Landbouwtellingsbedrijf.paprika [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67)
anders
<**komkommerbedrijven**>
als
(Landbouwtellingsbedrijf.komkommer [NGE]/Landbouwtellingsbedrijf. bedrijfsgrootte [NGE] > 0,67)
anders
<**tomatenbedrijven**>
als
(Landbouwtellingsbedrijf.tomaten [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67)
anders
<**overige glasgroentebedrijven**>)
als
Landbouwtellingsbedrijf.mei_neg [x1] = 2012
anders
(<**chrysantenbedrijven**>
als
(Landbouwtellingsbedrijf.chrysanten [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67)
anders
<**rozenbedrijven**>
als
(Landbouwtellingsbedrijf.rozen [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67)
anders
<**overige snijbloembedrijven**>)
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 2022
and
(Landbouwtellingsbedrijf.snijbloemen [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67))
anders
<**plantenbedrijven**>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 2022
and
(Landbouwtellingsbedrijf.planten [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67))
anders

(<**biologische opengrondsgroentebedrijven**>
als
(Landbouwtellingsbedrijf.biologisch [x1] = 1)
anders
<**opengrondsgroentebedrijven**>)
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 2011)
anders
<**fruitbedrijven**>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 3210)
anders
<**boomkwekerijbedrijven**>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 3480)
anders
<**paddestoelbedrijven**>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 2033)
anders
<**bloembollenbedrijven**>
als
(Landbouwtellingsbedrijf.mei_neg [x1] = 2021
and
(Landbouwtellingsbedrijf.bol [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] > 0,67))
anders
<**overige opengrondsbedrijven**>
als
(Landbouwtellingsbedrijf.glas [NGE]/Landbouwtellingsbedrijf.bedrijfsgrootte [NGE] <= 0,50)
anders
<**overige glasbedrijven**>)