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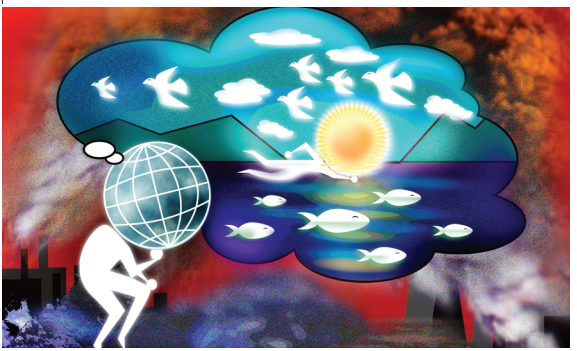

# Waste statistics on agriculture, forestry and fishing sectors

Istat

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**Waste statistics on agriculture, forestry and fishing sectors**

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CONTENTS

# FOREWORD

This publication reports the results of the pilot study on waste generation and management in Agriculture, forestry and fishing sectors - financed by Eurostat in order to implement the Regulation 2150/2002/Ec of the European parliament and council of 25 November 2002 on Waste statistics, which came into force on 29 December 2002. This pilot study was carried out by Istat with two different projects finalised in August 2004 on methodological aspects[1] and in November 2004 on data collection[2]. In this publication, the updating during year 2005 in the implementation of the Regulation 2150/2002/Ec, is reported too.

Inside environment issues, waste gained a huge priority at international level, mainly in the Community statistical programmes. The need to make available robust waste statistics, comparable among Member states, is determined by the necessity to know the origin and management of waste by businesses and private households, in order to support analyses, decision-making processes and implementation of waste policies. Up to now, data on waste at european level are mainly collected through the Eurostat/Oecd joint questionnaire, however these data are sometimes not comparable among Member states. This incomparability comes from a lack of common definitions and differences in waste management in the European states.

The adoption of the Waste statistics Regulation 2150/2002/Ec is the

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Isabella Pierantoni, head of the former Environmental methodologies and statistics Unit in Istat.

1 Bellini Giampaola, Mara Cammarrota. *Methodological Approach for Statistics on Waste Generated in Agriculture, Forestry and Fishing*. Final Report to Eurostat. Rome: Istat, 2004.

2 Ballin Marco. *Statistics on Waste Management in Agriculture, Forestry and Fisheries – Waste Statistics Regulation 2150/2002/Ec*. Final Report to Eurostat. Rome: Istat, 2004.

final result of a very long period of work run inside the Eurostat working group Statistics of the environment – sub-group Waste, which led to the agreement of all Member states. Italy participated actively both in this working group and in the European council working group with technical and scientific inputs coming from experts of the National institute of statistics (Istat) and the Agency for environmental protection and technical services (Apat), with the agreement of the Ministry of the Environment and territory protection. The contribution of Istat, represented by Mara Cammarrota, was relevant and aimed at properly setting up the Regulation, from the point of view of the methodological approaches for data collection, of the main statistical problems linked to the implementation of the Waste statistics Regulation and on consistency of statistical units chosen and waste definitions adopted with those deriving from economic statistics.

The Waste statistics Regulation was adopted in December 2002, in order to obtain homogeneous and comparable data on trends in waste generation and waste management. The regulation establishes a framework for the production of community statistics on the generation, recovery and disposal of waste. Member states shall produce statistical results and transmit them to Eurostat starting from 2006, being 2004 the first reference year.

The Waste statistics Regulation 2150/2002/Ec foresees a transitional period before regular data collection is established by Member states, and the Commission drew up a programme for pilot studies, on four waste issues, in order to develop methodologies to obtain regular data and implement statistics. These pilot studies concern statistics on waste generated in Agriculture, forestry and fishing sectors, statistics on the import and export of waste, statistics on packaging waste and statistics on preparatory waste treatment operations. The first two pilot studies are obligatory for all Member states.

This publication represents the Istat contribution to the implementation of the Regulation for waste generated in the Agriculture, forestry and fishing sectors and is the natural follow-up of the work began with the adoption process of Regulation on Waste statistics. This publication, edited by Giampaola Bellini, includes the two final reports related to Istat pilot projects and gives a complete view of methodological and applied aspects

linked to international and national legislative framework, to economic activity involved in Nace A and Nace B, to issues related to the domain of Waste statistics Regulation application and to statistical tools for data compilation, mainly with insights on results of 2003 Farm structure survey.

In the former Environmental methodologies and statistics Unit in Istat, it was developed the methodological project and the main aspects linked to the diverse way of data collection. Giampaola Bellini realised an analysis of the economic activities involved and related waste with waste encoding activity, provided a deepening on emerging overlapping on monitoring activities among Regulation on Waste statistics and existing legislation, individualised and organised a network of available expertise to compile a review ofavailable and exploitable data sources and methodologies for waste statistics calculation. Mara Cammarrota, being for long time engaged in waste issues during the adoption process of Regulation on Waste statistics provided helpful insights in relation to discussion ongoing at international and national level on some specific statistical issues related to the implementation of Waste statistics Regulation. The final report *Methodological Approach for Statistics on Waste Generated in Agriculture, Forestry and Fishing*, delivered to Eurostat on August 2004, was edited by Giampaola Bellini and Mara Cammarrota.

In the Agriculture statistics Service, coordinated by Marco Ballin, particularly in the Structural surveys on farms Unit, collection data project was developed. This project was the result of a joint effort of the researchers of the Agriculture statistics Service and the former Environmental methodologies and statistics Unit. In Structural surveys on farms Unit, the 2003 Farm structure survey was realised, with an environmental section devoted to waste production and management. Giampaola Bellini defined the additional questions on by-product and waste generation for 2003 Farm structure survey questionnaire. Marco Ballin edited the final report *Statistics on Waste Management in Agriculture, Forestry and Fisheries – Waste Statistics Regulation 2150/2002/Ec*, delivered to Eurostat on November 2004. Marco Ballin, Sabina Giampaolo and Nicola Mattaliano were in charge of the design and realisation of the 2003 Farm structure survey, particularly referring to the waste section integrated in the questionnaire.

Other manifold competences were involved in this project. One of the

Istat sector involved by former Environmental methodologies and statistics Unit was the Environmental accounts for physical units (Aldo Femia). Other Istat contributions to the discussion and provision of contacts and documents for the project purpose derived from the Statistics on agriculture inputs (Mario Adua), National agriculture accounts (Domenico Ciaccia), Agriculture price statistics (Antonietta D'Amore), Farm structure survey (Sabina Giampaolo), Forestry statistics (Antonio Macrì), and Fishing and aquaculture statistics (Federica Piersimoni) sectors.

Other involved institutes were the Italian Agency for environmental protection and technical services (Rosanna Laraia), which provided information on sector studies suitable for waste estimation purpose, the Ministry of Health for collecting information on infectious animal waste (Claudia Maddaluno) and for information on veterinary medicines use (Gaetana Ferri), the Aquaculture Division of the Ministry of Agriculture and forestry Policies, the Research centre on animal production for information on the implementation of the Integrated pollution prevention and control Directive (96/61/Eec) (Claudio Fabbri), the Central institute for research applied to the sea (Icram) for information on waste in fishing (Franco Andaloro and Enrico Tarulli), Idroconsult for information on aquaculture system characteristics (consultant Fabrizio di Pol), the Experimental institute of agricultural mechanisation – Council for agriculture research and experimentation (Isma – CRA) for information on mechanisation of dredging in aquaculture (Marco Fedrizzi) and Maria Adele Prosperoni for information on legal definition of waste and other legislations.

Last but not least, the technical contribution and collaboration in the former Environmental methodologies and statistics Unit of Teresa Di Sarro and Maria Di Gennaro, in the treatment of Agriculture census 2000 and Farm structure survey 2003 data is to be mentioned.

CHAPTER ONE

# INTRODUCTION

The Regulation 2150/2002/Ec of the European parliament and council of 25 November 2002 on waste statistics (Waste statistics Regulation, WStatR), as amended by Regulation 574/2004/Ec of 23 February 2004, establishes a framework for the production of community statistics on the generation, recovery and disposal of waste.

This Regulation states that data have to be collected on a regular basis and will provide comparable statistics on trends in waste generation and management enabling monitoring of compliance with Community waste policies.

During the adoption process of the Regulation in the European parliament and council it was decided to have pilot studies on new and difficult areas in the field of waste statistics and the Nace A - including Agriculture, hunting and forestry activities - and Nace B - referring to Fishing activity - sectors were identified, among others, as areas requiring further deepening.

Istat carried out the pilot study on waste generation and management on Agriculture, forestry and fishing with two different projects: the first one, referring to methodological aspects, was realised by the Environmental methodologies and statistics Unit of Istat. This project titled *Methodological Approach for Statistics on Waste Generated in Agriculture, Forestry and Fishing* analysed the phenomenon of waste generation and management in agriculture, forestry and fishing, in order to draw up a framework in which tools for data compilation could be implemented. The second project titled *Statistics on Waste Management in Agriculture, Forestry and Fishing. Waste Statistics Regulation 2150/2002/Ec*, carried out by the Structural surveys on farms Unit of Istat related to the collection of data.

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Giampaola Bellini, Istat.

This publication contains the results of these two projects carried out by Istat during year 2004. The updating occurred during year 2005 in the implementation of the Regulation 2150/2002/Ec, is reported too.

The main aim of the work was to analyse the phenomenon of waste generation and management in Agriculture, forestry and fishing sectors, in order to draw up a framework in which tools for data compilation could be implemented. The analysis of the most suitable tools was also performed.

The study has been carried on to deepen:

- the analysis of existing international and national legislation related to the production of statistics on waste generation and management;
- a description of the sectors and processes involved, taking into account production and product processing activities included under A and B Nace classifications;
- the definition of typology of waste generated, recovered and disposed in the involved sectors, with a comparison between the European waste statistical nomenclature Rev. 3 (EWC-Stat) and the european List of waste (LoW). In some cases also existing national legislation on their specific management was taken into account;
- the discussion on issues related to the allocation of waste to the proper economic activity;
- the statistical units to consider for the implementation of WStatR and problems related to minimum threshold value for size of enterprises;
- the analysis of tools, available or in progress, in order to compile data;
- the feasibility of the data collection approach through the Farm structure survey and the consequent estimation procedure applied to collected data.

Once the legislative framework was assessed, the study proceeded identifying the most relevant waste materials for the sectors under study, with the related classification according to EWC-Stat and LoW. The waste allocation issue to the proper economic activity was faced.

For the assessment of waste in involved sectors, it has been necessary to identify available data sources and appropriate methodologies.

For the projects purpose, in order to have an overview of available surveys and tools useful for data calculation other Units working in Istat and other Institutions, involved in specific material studies, were contacted.

Thus the project has been carried out in close cooperation with several Istat Units in order to evaluate existing consolidated experience on the sectoral statistics currently carried out. The Agriculture statistics sector was involved for its statistical activity on farm structure, on inputs used at farm level, forestry, fishing and aquaculture. Furthermore experience developed in Material flow accounts and National agriculture accounts revealed to be precious in order to account for some specific items. Also Agriculture price statistics sector gave its contribution.

The Italian Agency for environmental protection and technical services (Apat) provided information on sector studies on specific materials. These experiences have been developed in cooperation with other research Institutes, promoting case studies on some specific items - end-of-life vehicles and related discarded equipments, plant protection products waste, plastics waste and vegetal residues.

Ministry of Health cooperated on matter of animal health care legislation. The Ministry of Agriculture and forestry policies has been also contacted for being responsible of the survey on aquaculture and of some specific studies.

Furthermore, several experts gave their support.

The statistical approach was developed exploiting existing statistical data sources, verifying the possibility of using the administrative ones and reviewing estimation procedures to obtain statistical figures on waste generation and management in Agriculture, forestry and fishing sectors. For few waste items data collection is possible, in other cases estimation procedures are performed and related methodologies are here reported, including the activity of National accounts and of Environmental accounts, where the estimation procedure involves the utilisation of specific coefficients.

In more detail, the integration of environmental issues into existing surveys particularly the Farm structure survey (Fss) 2003 - realised in Istat - has been evaluated for this study purpose, as information collected on some related issues through the Agriculture census 2000. Results obtained are thoroughly presented, and the exploitation of the ones obtained with Farm structure survey through the adoption of an estimation procedure for plastic waste generated at farm level is performed.

Information on some materials management, whose classification as waste can be controversial, might be useful for defining more appropriate

criteria in decision making. For manure and bio-degradable waste for which spreading on agricultural soil is a common practice, a comprehensive management legislation overview has been reported to show that environmental concern on their use and destination is already in focus and may be helpful in defining what to consider waste.

In this publication the international and national legislative framework with reference to Waste Regulation requirements is firstly described (paragraph 2).

It follows a description of the economic activities in the sectors under study (paragraph 3). First, economic activities involved are identified (paragraph 3.1), secondly a description of the structural aspects of the Italian sectors covered by the study is given (paragraph 3.2).

Then the main aspects to cope with in order to implement the WStatR in Italy are described (paragraph 4). These are mainly given by problems linked to the definition of waste (paragraph 4.1), to the identification of waste generated (paragraph 4.2), and to waste allocation to the proper economic activity (paragraph 4.3). Then a highlight on waste management practices is reported (paragraph 4.4), and the discussion of other statistical problems (paragraph 4.5) - as the identification of the statistical unit and the consequences for the adoption of minimum threshold value for size of enterprises - follows.

Tools for data compilation (paragraph 5) are analysed; they are described as potential tools as the existing statistical surveys on farm structure (paragraph 5.1) and the administrative data source on waste (paragraph 5.2). Thus estimation procedures are reviewed (paragraph 5.3), including approaches deriving from National accounts activity (paragraph 5.3.1), from Material flow accounts (paragraph 5.3.2), and from specific sector studies (paragraph 5.3.3). Lastly, a proposal is made on generated waste estimation using data collected through Fss (paragraph 5.3.4).

With reference to the approach based on a statistical survey, the integration run in Istat on the Fss 2003 questionnaire (paragraph 5.1.1), and on the Agriculture census 2000 (paragraph 5.1.2), is described. For the Fss case, the sample survey design (paragraph 5.1.1.1), the added questions on questionnaire (paragraph 5.1.1.2), the obtained response rates (paragraph 5.1.1.3) are reported.

Finally the main conclusions are drawn (paragraph 6).

CHAPTER TWO

# INTERNATIONAL AND NATIONAL LEGISLATIVE FRAMEWORK

In the following the international and the national legislative frameworks are presented.

## *2.1 An overview of Waste statistics Regulation*

The WStatR 2150/2002/Ec, as amended by Regulation 574/2004/Ec of 23 February 2004, establishes a framework for the production of community statistics on the generation, recovery and disposal of waste.

It states that statistics are necessary for monitoring the implementation of waste policy. Statistical instruments are also required, for assessing compliance with the principle of waste prevention and to establish a link between waste generation data and global, national and regional inventories of resource use.

The potential of this Regulation is that data have to be collected on a regular basis and will provide comparable statistics on trends in waste generation and waste management, enabling monitoring of compliance with Community waste policies.

Moreover the Community task is to have a single tool for collecting waste data. In this sense the Commission (Eurostat) is currently working

Mara Cammarrota, Istat.

on a proposal abolishing overlapping reporting obligations as regards waste. The Commission cooperates in this domain with the European environment agency (Eea), in particular with its European topic centre on resource and waste management (Etc/Rwm).

The WStatR is composed by three annexes.

Annex I sets up the framework for data collection and reporting on waste amounts generated in private households and economic sectors classified within the coverage of Sections A to Q of the Statistical nomenclature of economic activities in the European community (Nace Rev. 1), including waste arising from recovery and/or disposal operations[3]. Statistics have to be produced with reference to some aggregated waste categories and to sectors. Section 2 of this Annex specifies categories (48 waste categories as amended by Regulation 574/2004/Ec of which 21 are hazardous and 27 are non-hazardous wastes) for which data on the quantity of waste generated has to be compiled. Section 8 covers 20 items, of which 19 refer to economic sectors (based on Nace Rev. 1.1) and one to households (item 20 - waste generated by households). While the quantities of waste generation have to be released at national level, the population or dwellings served by a collection scheme are requested at Nuts 2 level (regions).

Annex II of the WStatR sets up the framework for data collection and reporting on waste amounts treated by type of treatment operation. This Annex refers to the recovery and disposal operations listed in Annex IIA and IIB of the Waste framework Directive (75/442/Eec). Also in this Annex some waste categories are listed according to each recovery or disposal operation: 14 waste categories for incineration, 17 for operations which may lead to recovery (excluding energy recovery) and 16 for disposal other than incineration[4]. For each type of treatment operation, the number of treatment facilities and their capacity is also to be reported. Facilities, whose waste treatment activities are limited to the recycling of waste on the site where the waste was generated, are not covered by Annex II. Total quantities of waste treated are requested at Nuts 1 level (regions

[3] Radioactive waste, already covered by other legislation, is excluded.

[4] The List of waste categories for Annex II has been amended by Commission Regulation 783/2005/Ec.

aggregations); the number of operation facilities and their capacity are requested at Nuts 2 level (regions).

In compiling the statistics, Member states (Ms) shall observe a particular statistical nomenclature defined with reference to the *mainly substance* of waste. This statistical nomenclature (Waste statistical nomenclature, EWC-Stat Rev. 3), has a direct connection with the european List of waste, formerly named the European waste catalogue, (established by Commission Decision 2000/532/Ec, as amended[5]) which represents the reference nomenclature for all national and European reporting obligations. The List of waste is a *process oriented waste* nomenclature. Annex III of WStatR, amended by Regulation 574/2004/Ec, defines the equivalence between the statistical nomenclature and the List of waste.

Ms will furnish data on waste generation and waste treatment for every second year after the first reference year. The first reference year for which data have to be produced is the second calendar year following the entry into force of this Regulation and the results are to be transmitted within 18 months of the end of the reference year. Given that the Regulation has been adopted and published in the Official journal of the European communities in 2002, the first reference year will be 2004 and data shall be transmitted to Eurostat within June 2006.

For economic activities, according to each Ms's statistical system, statistical units can be local units or kind-of-activity units, as defined in Council Regulation 696/93/Eec on the statistical units for the observation and analysis of the production system in the Community.

WStatR states that Ms can acquire data necessary to produce statistics on waste generated, recovered and treated by mean either of:

1. surveys;
2. administrative or other sources, such as the reporting obligations under Community legislation on waste management;
3. statistical estimation procedures on the basis of samples or waste-related estimators, or
4. a combination of these means.

Ms shall transmit to the Commission (Eurostat) the data and metadata

5 The List of waste was amended by the following Commission Decisions: 2001/118/Ec, 2001/119/Ec and 2001/573/Ec.

required by Regulation 2150/2002/Ec in electronic form, in accordance with an interchange standard proposed by the Eurostat. The Regulation 782/2005/Ec sets out the format for the transmission of results on waste statistics.

The Regulation 2150/2002/Ec states that every transmission of a data set or combination of data sets must be accompanied by a quality report, indicating the degree of precision for the collected data. As there may be differences between methods from one country to another, between data sets from one country and even within individual data sets, the Regulation n. 1445/2005/Ec defines the proper quality evaluation criteria and the contents of the quality report for waste statistics. To clarify the multi-method environment, Part I of the quality report presents a general description of the data and it provides an overview of the methods. Part II follows the standard elements used to define quality in the European statistical system. The quality report to be submitted by the Ms must follow the structure set out in the chapter *Contents of the quality* report reported in Regulation 1445/2005/Ec.

In order to adapt their national statistical systems to the requirements of WStatR, Ms can request derogations for the first reference year for the production of results relating to some sectors and/or some variables of Annex I and Annex II.

As stated by article 4 (2), the transitional period is limited and may not exceed

- 2 years for the production of statistics on waste generation in the service sector (Section 8(1.1), item 16 in Annex I) and/or production of statistics in relation to recovery and disposal operations (Section 8(2) of Annex II);
- 3 years for the production of statistics on waste generation in the Agriculture, hunting, forestry, and fishing sectors (Section 8(1.1), items 1 and/or 2 of Annex I).

The derogation can only be requested for the first reference year. For the derogation Ms should send their request in written form to the Director general of Eurostat referring to Article 4 of the WStatR and indicating the particular field of statistics for which derogation should be granted.

So far the derogations have been adopted as regards Austria, France, Luxembourg (Regulation 317/2004/Ec), Belgium, Portugal, Greece, Cyprus

(Regulation 1829/2004/Ec) Lithuania, Poland, Sweden (Regulation 784/2005/Ec) and United Kingdom (Regulation 1446/2005/Ec).

Data coming from Ms according to these Annexes will provide an overview of waste lifecycle starting from its generation to its final destination. For each Ms the total amount of waste generated reported according to Annex I should be equal to the total amount of waste recovered and disposed reported in Annex II. Anyway, this identity will not be obtained with reference to a given year, considering the temporal lag between the generation of waste and its final destination, surely greater than a year. Moreover, in Annex II Ms have not to report facilities whose waste treatment activities are limited to the recycling of waste on the site where the waste is generated. It means that recovered and disposed waste, treated in some small waste treatment enterprises, which are considered from the generation point of view, might not be accounted to meet Annex II requirements. Lastly, we have also to consider some exclusion stated in the Regulation, as the one reported in paragraph 2 of article 3. In this case exclusion refers to "enterprises of less than 10 employees from surveys unless they contribute significantly to the generation of waste", that would be excluded whether data would be collected by means of surveys (Annex I).

### *2.1.1 The waste classifications*

The reference nomenclature for all national and European reporting obligations is represented by the List of waste (LoW) which is a *process oriented* waste nomenclature. The criteria adopted for the classification of waste is based, for some waste typologies, on the production sector (e.g.: waste from the leather and fur industry), while, for others, is based on the utilization cycle (e.g.: waste from organic substances used as solvents). The classification of hazardous waste is based on the origin of the waste and the hazardous substances contained in the waste.

During the adoption process of WStatR, it was agreed that the *process oriented* waste nomenclature was too detailed for a Regulation on waste statistics. A nomenclature based on the mainly substance of waste seemed to be more feasible for a statistical analysis of the treatment phase of waste, for which origin is not always known.

So a particular statistical nomenclature defined with reference to the mainly substance of waste was defined. The Waste statistical nomenclature is based on chemical composition of the waste and, in particular, on the substances.

Annex III of WStatR provides the Waste statistical nomenclature which is composed by 12 categories (e.g.: 01 *Chemical compound wastes*). Each category is divided in sub-categories of waste, identified by a three number code. The sub-categories are composed of different classes containing the waste (hazardous and/or non-hazardous) identified by LoW codes.

As since 1 January 2002 the European waste catalogue was repealed and replaced by the LoW (Commission Decision 2000/532/Ec, as amended), after the coming into force of WStatR a revision of Annex III and Annex I has been conducted by Eurostat. The Commission Regulation n. 574/2004/Ec amends Annexes I and III of WStatR. In more details, Annex I of this new Regulation replaces Annex I, Section 2(1) of WStatR, while Annex II of this new Regulation replaces Annex III of WStatR. While this new Annex I integrates the list of waste categories for which statistics have to be produced, the new Annex II replaces the previous *Waste statistical nomenclature* with a *Table of equivalence*. This Table of equivalence defines the relationship between the substance oriented Waste statistical nomenclature (EWC-Stat Rev. 3) and the European LoW established by Commission Decision 2000/532/Ec. The legal obligation to revise Annex III of WStatR was also used to address other technical issues and to improve the coherence between LoW and EWC-Stat. Annex II of WStatR has been amended by Regulation 783/2005/Ec.

Istat and Apat participated actively in the revision of Annex III and the Italy revision proposals have been accepted by the other Ms and Eurostat and represented the starting point for the actual Annex III (Apat, Istat, 2003).

### *2.1.2 Methodological approaches for data collection*

WStatR states that Ms can acquire data necessary to produce statistics on waste generated, recovered and treated by means either of:

— surveys;
— administrative or other sources, such as the reporting obligations under Community legislation on waste management;

— statistical estimation procedures on the basis of samples or waste-related estimators, or
— a combination of these means.

Surveys are no doubt very expensive and complex to realise, particularly if they are conducted as census or involve the use of personal interviews. The response burden on enterprises is higher with reference for example to administrative sources. In fact, if enterprises have already provided information to other government departments, they may become annoyed at receiving similar requests from the national statistical institution. Moreover statistical surveys generally take time to plan, to design the questionnaire, to analyse the population, to process data. A lot of staff is needed to process the data and high response rates are not certain.

The administrative source is the easiest way to obtain data, if in the country a public administration has organised it. Advantages coming from this source are:

— it can be less expensive from the point of view of national statistical institution, because administrative sources are often “free” particularly if they originated from the public sector. For respondents, on the contrary, the possible costs - given that the time of compilation of the questionnaires is the same for a statistical survey or for administrative purposes - could be higher, as obligations are normally linked with fares or taxes to pay;
— the obligation of response would help to rise the response rates of respondents;
— given the existence of an administrative source, using data from this source, in the place of a new statistical survey, would also help to reduce the response burden on businesses;
— this kind of source will improve the integration activities with statistical sources, related to other business aspects; this would help the validation of administrative source.

Although there are many good reasons for using administrative sources, there are also a number of common problems:

— sometimes the units used in those sources do not correspond directly to the definition of the required statistical units;
— administrative sources are generally set up for the purposes of collecting taxes or monitoring government policies, so they are subject

to political changes. If a policy changes, administrative source could be modified in terms of coverage, definitions, and etcetera, or possibly even abolished completely;

— the success of an administrative source is strongly related to the capacity of public administration in organisation and management of data register;

— access to administrative sources for statistical institution could be expensive in terms of data processing in order to check their quality and coverage and sometimes in terms of costs for data acquisition.

Anyway the accuracy of an administrative source is strongly related to the quality of existing Business register.

The third method that Ms can use is statistical estimation procedures on the basis of samples or waste-related estimators.

In realising a sample survey it is important to consider:

— the necessity to have a good sample;

— a good definition of waste, which is essential in order to obtain accurate answers;

— the way in which questions are asked, which is important in order to have accurate answers and higher response rates;

— how to deal with the non response rate phenomenon;

— the opportunity of realising a survey in close cooperation with businesses or with regions who can help in defining the sample survey.

A sample survey can be a useful tool with more than one aim. Beside direct data collection, it can be realised in order to define the main variables to use inside a model for estimation; otherwise a samples survey can be useful for the validation of data coming from estimation models or other gathering methods.

Another statistical estimation procedure can be based on waste-related estimators. Waste factors on involved sectors can be based on administrative sources, production data and/or sales data, and lifetime of equipment or surveys undertaken. However, waste factors have to be updated periodically.

The fourth possibility for collection of data is a mix of the above-mentioned methods.

As mentioned the WStatR does not prescribe any specific method. Methods may differ from one country to the other, between data sets from

one country and even within individual data sets.

In Chapter 5, with reference to waste generated in Agriculture, forestry and fishing, the most suitable statistical tools applicable for the Italian case will be presented.

### *2.1.3 Reference statistical units*

For economic activities, according to each Ms's statistical system, statistical units can be local units or kind-of-activity units, as defined in Council Regulation 696/93/Eec on the statistical units for the observation and analysis of the production system in the Community.

The *kind-of-activity unit* (Kau) groups all the parts of an enterprise contributing to the performance of an activity at class level (four digits) of Nace Rev. 1 and corresponds to one or more operational subdivisions of the enterprise. The enterprise's information system must be capable of indicating or calculating for each Kau at least the value of production, intermediate consumption, manpower costs, the operating surplus and employment and gross fixed capital formation.

The *local unit* (Lu) is an enterprise or part thereof (e.g. a workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. At or from this place, economic activity is carried out for which - save for certain exceptions - one or more persons work (even if only part-time) for one and the same enterprise.

During the adoption process of WStatR most of Ms was favourable to Kau as reference statistical units. Italy supported the choice of Lu as statistical units of reference in the regulation for the following reasons:

- in Italy, waste data are collected through an administrative source and the statistical unit for this survey is the Local unit;
- in order to ensure the coherence with the Integrated pollution prevention and control (Ippc) Directive (96/61/Eec) which defines the Local unit as the reporting unit;
- in order to ensure the correlation with the statistics coming from other surveys. First of all the generation of waste could be correlated with annual surveys on Products of the European community (Prodcom). The statistical unit in Prodcom is the enterprise and in

full details local units.

In order to satisfy all requests an agreement was obtained including both statistical units in WStatR.

As Ms can use these two different statistical units for the collection of data, a problem of data comparability arises. Thus, statistical methodologies have to be defined in order to compare data at european level.

### *2.1.4 The pilot studies set out in the Regulation*

During the adoption process in the European parliament and council it was decided to have pilot studies on new and difficult areas in the field of waste statistics. From the Council came the request to study first the feasibility and relevance of data collection in some areas. In addition to this the European parliament requested data by countries on some areas of political relevance. It was agreed that a number of pilot studies would be needed to clarify some fundamental issues including:

— feasibility and relevance of data collection;
— coverage of the area by statistics;
— description, definition and methodologies to be applied;
— the level of detail at which data can be collected;
— aggregation levels for waste categories and/or for economic activities.

The WStatR sets out 4 areas where pilot studies should have been undertaken before the establishment of regular data collection. These pilot studies concern the following areas:

1. statistics on waste generated in agriculture, forestry and fishing;
2. statistics on the import and export of waste;
3. statistics on packaging waste;
4. statistics on preparatory waste treatment operations.

The first two pilot studies listed are obligatory for all Ms. The pilot studies shall be conducted at the latest within two years (three years for Agriculture and Import/Export) after the coming into force of WStatR that is at the latest in 2005. The Commission will, if required, use the results and conclusions from these *voluntary* pilot studies to adopt further necessary implementation measures.

Questions concerning the inclusion of statistics on waste from

Agriculture, forestry and fishing sectors, import and export of waste, packaging waste and preparatory waste treatment operations are already to be treated within the designated pilot studies and the results from these pilot studies should be available within two-three years.

Italy carried out the two obligatory pilot studies: the pilot study related to waste generated and managed in Agriculture, forestry and fishing sectors was carried out by Istat with two different projects, while the one related to import and export of waste was carried out by Apat.

### *2.2 The waste legislation in Italy*

In Italy, as well as in many countries, waste subject has been discussed lately by juridical regulations and the production of statistical information related is rather recent.

The first waste decree dates back to 1982 when the Directives 75/442/Eec on waste, 76/403/Eec on the disposal of polychlorinated biphenyls and polychlorinated terphenyls and 78/319/Eec on toxic and dangerous waste were implemented. With this decree (n. 915/1982) some waste definitions were established and different forms of treatment were defined.

Afterwards, a lot of different juridical regulations with statistical reference were introduced but they outlined only a partial framework for such matter.

Only in 1997 the decree n. 22 defined a more complete framework for waste issues. This Italian waste decree (the so-called Ronchi's decree from the name of the Minister of the Environment at that time), implemented the Waste framework Directive 91/156/Eec, the Directive on Hazardous waste 91/689/Ec and the Directive on packaging and packaging waste 94/62/Ec. This decree has been later integrated by some related decrees.

As stated by Directive 91/156/Eec, the decree n. 22/1997 defines the most important goals of the community strategy that is:

— to ensure the prevention or reduction of waste production and its harmfulness, in particular by the development of clean technology with a small use of natural resources and by the technical development and marketing of products so as to make no contribution (or the smallest possible contribution) by the nature of their manufacture, use or final disposal, to increasing the amount

or harmfulness of waste and pollution hazards;

— to ensure the reduction of final disposal of waste by means of recycling, re-use or any other process with a view of extracting secondary raw materials and the use of waste as a source of energy.

Of course the definition of waste, considered in the decree n. 22/1997, refers to the Directive 75/442/Eec that is: *waste shall mean any substance or object in the categories set out in Annex A of the decree 22/1997*[6] *and which the holder discards or intends or is required to discard.*

As regards the waste management permit for disposal and recovery operations/facilities (article 9 and 10 of Directive 91/156/Eec), the decree n. 22/1997 establishes the possibility to exempt from the obligation of a waste management permit. At present, the exemption is allowed for any recovery operation separately for non-hazardous waste and for hazardous waste. With reference to non-hazardous waste they are: any recovery operation listed in Annex IIB of Directive 91/156/Eec only for such waste included in decree 5 February 1998. The decree establishes some aspects to be followed with reference to recovery facilities for air emissions, technical requirements for waste storage, technical requirements for material and energy recovery, specific rules for waste sampling and characterisation and for the leaching test. With reference to hazardous waste, the operations allowed to the exemption of the waste management permit are: any recovery operation listed in Annex IIB of Directive 91/156/Eec only for such waste included in decree 161/2002. The decree establishes the recoverable waste quantity per plant on the basis of the type of waste and specific recovery operation; yearly processed quantity shall not exceed the maximum allowed quantity. It also establishes specific technical requirements for hazardous waste storage before recovery.

As far as the statistical information on waste is concerned, only in 1994 a law defined some rules in order to simplify and unify the environmental declarations related to activities producing environmental pressures. According to the legislator's intentions, a single questionnaire was planned to enclose declarations related to waste water, emissions, waste, and so on.

The law n. 70/1994 introduced a *Compulsory declaration* only for waste (Mud, Modello unico di dichiarazione ambientale).

6 This Annex A reports the categories of waste contained in Annex 1 of Directive 91/156/Eec.

The first version of Mud (defined in 1995) was submitted to some integration. In particular, a more definitive version was defined after the Ronchi's decree. With the decree 24 December 2002, integrated by decree 24 February 2003, the Compulsory declaration has been extended to emissions. In fact, the declaration required by the Ippc Directive 96/61/Ec (applied in Italy through the national decree 372/1999) - aimed at reducing polluting emission to air, soil and water - has to be presented by economic activities jointly with Mud declaration (for details see paragraph 5.2). The decree 22 December 2004 has integrated the Mud declaration with a new section devoted to end-of-life vehicles.

The Ronchi's decree confirms the *Compulsory waste declaration* previously introduced, but states some modifications for the obliged subjects and for the utilisation of the waste classification. In particular, while in 1995 and 1996 waste were classified according to the Italian waste classification, for years 1997-2001 waste are classified according to the European waste classification (Ewc). The decree 24 December 2002) states that starting from year 2002 waste is to be classified according to the LoW.

### *2.2.1 Waste covered by legislation*

The Ronchi's decree distinguishes between *municipal waste* and *special waste*, according to their origin, and between *hazardous* and *non-hazardous waste*, according to their hazardous characteristics.

The national definition of *municipal waste* includes the following waste codes:

a) domestic waste and bulky waste coming from residential places;
b) non-hazardous waste coming from places other than a), similar to municipal waste for quality and quantity;
c) waste of any source lying on public streets and public areas or on private streets and private areas subjected to public uses or on seas and lake beaches and river banks;
d) waste from street cleaning services;
e) plant-tissue waste coming from green areas, like gardens, parks and cemetery areas;
f) waste coming from exhumation and other waste coming from

cemeteries other than b), c) and e).

The following wastes are included in the category of special waste:

a) waste from agriculture and agro-industrial activities;
b) waste from construction and demolition and hazardous waste from excavation;
c) waste from industrial activities;
d) waste from craft activities;
e) waste from commercial activities;
f) waste from service activities;
g) waste from recovery and disposal, sludges from the preparation of water intended for human consumption and other water treatments, sludges from treatment of urban wastewater and from gas treatment;
h) waste from health care;
i) discarded equipment;
j) end-of-life motor vehicles and their components.

The distinction between *hazardous* and *non-hazardous* waste follows the related European legislations.

The decree n. 22/1997, and some following decrees, excludes from its scope the following waste:

— gaseous effluents emitted into the atmosphere;
— radioactive waste;
— waste coming from prospecting, quarrying and exploitation of quarries;
— animal carcasses and the following agriculture waste: faecal matter and other natural, non dangerous substances, used in farming and other materials of vegetal nature re-used in agricultural practices and soil generated in first washing operations;
— wastewaters, with the exception of waste in liquid form;
— decommissioned explosives;
— soil and rocks from excavation destinated to utilisation in refilling, with the exclusion of materials coming from polluted places and reclaimed land whose pollutants are higher than values defined by law;
— vegetal materials not contaminated by pollutants with values higher than those established by decree of Ministry of the Environment of 25 October 1999, n. 471, coming from draining, utilisable as such;

— waste from kitchen food preparation (residues of food, cooked or raw, not distributed, destinated to pet shelter as stated by law 14 August 1991, n. 281, as amended);
— petroleum coke used as fuel for production purpose;
— fuel from municipal waste and non-hazardous special waste.

*2.2.2 Administrative registers and authorities involved*

Some administrative registers are used in Italy for the selection of reporting units and control.

Waste management permits for disposal and recovery operations/facilities provide information for Regional register, managed by Regions. These registers include the following information for a given permit: quantity, origin, characteristics and the type of waste to be managed; the kind of disposal or recovery operations and limit values and requirements for emissions deriving from those operations. As regards establishments or undertakings not obliged to have a waste management permit which carry out recovery operations, provincial registers - managed by Provinces - are defined. These registers contained, for each waste recovery enterprise: the origin, characteristics, type and quantity of waste to be recovered, the kind of recovery operations and the type of outputs of such operations.

A Register of waste management enterprises for establishments or undertakings which collect or transport waste on a professional basis or which arrange for disposal or recovery of waste on behalf of others (dealers or brokers), where not subject to authorization (article 12 of Directive 91/156/Eec), is also defined.

Moreover, the decree n. 372/1998 reorganises the *National waste inventory* (firstly established by law in 1994), localised in the Italian Agency for environmental protection and technical services (Apat) at national level and in the Regional environment agencies (Arpa) at the regional one, which now are quite full operational. Pursuant to article 2 of decree n. 372/1998, the waste accounting system, yearly updated, is based on the data coming from the Compulsory waste declaration and from the permits from the competent authority (regional or local) as stated by articles 27 and 28 of decree n. 22/1997.

In order to monitor waste from its production to its final disposal, the

decree n. 22/1997 establishes the *National waste observatory* (Onr) that is a control and coordination authority. This authority has to identify the criteria for the reduction of waste production and to control waste management. It has also to control the specific programmes of *National packaging consortium* (Conai). The Conai consortium has to achieve recovery goals and to cooperate with the Public administration as regards separate collection of waste fractions. If the Public administration doesn't provide to the selected waste collection, with appropriate litter containers for packaging waste, Conai can directly collect these types of waste in the public area.

The decree n. 22/1997 establishes also a *National consortium for collection and treatment of oil and vegetal fats and carcasses* and a *National consortium for the recovery of goods containing polyethylene.*

The activity of *Recovery glass consortium* (Coreve), instituted in Italy in 1990, follows the statements of decree n. 22/1997 based on prevention through the reduction of packaging and packaging waste and of glass weight by the reduction of metal presence in packaging (for example lead).

Moreover, other *Consortium* deals respectively with paper (Comieco), plastic (Polieco), aluminium (Cial) and steal (Cna).

The *National consortium for recovery and recycling of paper packaging* (Comieco), instituted in 1997, has the aims to promote and support selected collection of paper waste and to develop more efficient collection and recovery systems. The *National consortium for aluminium packaging* (Cial) has been instituted in 1998. The *Steal national consortium* (Cna) can collect steal packaging in public areas. Also a *National consortium for lead batteries and lead waste* (Cobat) has been established in 1988. It has the aim to collect lead batteries and lead waste and to give them to recycling enterprises or to provide for an ecological disposal when recovery is not possible, nor economically convenient. All holders of discharged lead batteries have to deliver them to Cobat.

The *National used oil consortium* (Coou) has been instituted in 1982. Following the decree n. 22/1997 its aims are: 1) to ensure the used oil collection; 2) to deliver used oils to enterprises that realise their recycling; 3) to deliver used oil for other typologies of recovery, when recycling is not possible, nor economically convenient; 4) to ensure a good disposal - from the environmental point of view - of used oils when no recovery is possible.

CHAPTER THREE

# SECTORS UNDER STUDY: NACE A AND B

In order to compile data as required by Annex I and II of the WStatR with reference to Agriculture, hunting, forestry, and fishing sectors, at first, an analysis has to be carried out to better understand the actual area under study and the involved activities whose classification under one economic sector or another one, according to Nace, may be controversial.

This analysis would make easier the identification of the list of waste and/or by-products produced and managed in such activities.

## *3.1 Economic activities involved*

Referring to sectors[7] under study it is important to underline that:

- **for Sector A**
  - ***agriculture, hunting and related services (division 01)*** include both crop production (including flower production) and livestock breeding, classified respectively as sub-division 01.1 and 01.2 when conducted separately, whereas classification as sub-division 01.3 is applied when activities are conducted in a mixed form. When agricultural practices are conducted not by the farm itself but by external entities**,** such services are recorded under sub-division 01.4, together with activities related to management of urban parks and other recreational areas, as with interventions for landscape

Giampaola Bellini, Istat.

[7] The WStatR refers to Nace classification Rev. 1. Nevertheless the classification has been in the meantime reviewed, thus economic activities included in Nace A and B, in the present study, are listed according to the latest version available, that is Rev. 1.1.

management. Veterinary services are excluded. Processing activities of agriculture products are classified under agriculture when processing realised at farm level refers to products produced in the same farm. Otherwise, manufacture of food products and of tobacco products are classified respectively as division 15 and 16. The sub-division 01.5 includes hunting and wild animal catches finalised to breeding and replenishment of wild fauna. Related production of raw leather products is also included. Excluded activities are as follows: fur production processes, livestock breeding and leather production from material of slaughter house origin;

— ***forestry, utilisation of forest areas and related services (division 02)*** include utilisation of wooden forest product and other forestry activity as reforestation. Culture of plant for wood production, management of forest nursery, culture of Christmas trees cultivation is also included. Related services, included in this division, refer to activities undertaken for the utilisation of forest areas;

• **for Sector B**

— ***fishing, aquaculture and related services (division 05)*** include catching of fish and molluscs in sea, transitional and fresh water (sub-division 05.01), aquaculture in sea, transitional and fresh water (sub-division 05.02). First processing of fish is excluded in both subdivisions. Fishing for recreational purpose is also excluded.

### *3.2 Highlights on structural aspects of Nace A and B in Italy*

In order to have an overview of the economic activities responsible for generating waste and by-products, highlights on structural aspects of Nace A and B in Italy are given in the following.

#### *3.2.1 Nace A sector*

Data reported below refers to all holdings conducting a farming activity for crop production, livestock breeding and forestry purpose. Data coming from Agriculture census refer to all surveyed holdings, not taking into

account the threshold based on economic parameters and physical dimension, defined for reporting at european level.

Relevant information on structural aspects of Nace A is the one related to:

- holdings and related land and utilised agricultural area (Uaa);
- cultivated crops and agricultural practices (irrigation, machinery used for agricultural practices, and fertilisers and plant protection products uses);
- livestock breeding;
- forestry and forest products.

### HOLDINGS, LAND AND UTILISED AGRICULTURAL AREA

Referring to agriculture activities, the most complete data set available is the one realised through Agriculture census 2000, as it covers also holdings running exclusively forestry activity[8].

According to Agriculture census 2000, total holdings in Italy are 2,594,825; 91 percent of these are managed directly by holder with exclusively or prevalently household members.

In relation to owned land, holdings with land are 2,592,347 and the related area accounts for 19,605,519 hectares, whereas holdings with Uaa are 2,553,454 and the related Uaa equals 13,206,297 hectares.

The Uaa includes arable land (7,329,272 hectares), permanent crops (2,458,941 hectares), and permanent grassland (3,418,084 hectares). Referring to arable land, 55.0 percent is dedicated to cereals cultivation, referring to permanent crops, 43.2 percent and 27.5 percent are respectively cultivated with olive trees for olive oil production and vineyards for wine production.

Refering to irrigation, the irrigable[9] area is equal to 3,855,915 hectares, and the irrigated one is equal to 2,471,379 hectares. Irrigation methods applied - that might influence plastic material consumption and discharge - are aspersion, which accounts for 1,051,201 hectares, and micro-irrigation, extended on 366,038 hectares.

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8 These holdings are not included in the Farm structure survey sample.

9 Irrigable land is the surface that can be irrigated during summer period according to the irrigation equipment installed. Depending on cultivated crops, not all the irrigable surface requires irrigation, thus irrigated area might be minor or equal to the irrigable one.

### MACHINERY AND MECHANIZATION

Information on tractors and machines used at farm level is also collected through the Agriculture census. Nevertheless the actual number is only known for machines of individual properties. The information on the number of holdings using machine sharing and resorting to a private service is also available.

Referring to tractors, 1,393,698 machines are of individual property (of which 304,574 less than 10 years old), whereas holdings using shared machines are 54,535, and the ones using private services account for 768,434 units. Also for powered and engine-driven cultivator, machines of individual property prevail (1,348,857 - of which 290,643 less than 10 years old) on sharing (50,330 holdings) and on resorting to private services (262,194 holdings). Looking at combine harvester, only 34,480 are of individual property, whereas 6,228 holdings declare to use shared machines and 558,891 private services. Machines used for plant protection products (412,790 as property, 20,271 shared, 187,820 private services) and fertiliser spreading (280,944 as property, 16,871 shared, 186,339 private services) are still mostly of individual property.

Holdings whose mechanical agricultural practices are conducted by other entities (other farms, professional associations, service enterprises) are 1,229,628: 64,280 of them get the service done by professional associations, whereas 499,401 by service enterprises.

In year 2002, sold fertilisers account for 5,045,315 tonnes, 3,547,594 of them are mineral fertilisers.

In the same year, 167,323 tonnes of plant protection products were sold. Referring to classification by toxicity class, 6.9 percent is highly toxic or toxic, 11.6 percent is harmful, whereas the remaining 81.5 percent is non-hazardous.

### LIVESTOCK BREEDING

Livestock breeding is also a remarkable activity. Production refers to the following main species:

— cattle, accounting for 6,049,252 heads of which 3,189,346 in holdings with more than 100 livestock heads;

— pig, accounting for 8,645,659 heads of which 6,851,069 in holdings with more than 1,000 livestock heads;

— reared-bird, which account for 141,545,377 heads of which 44,784,506 laying hens (74 percent bred in holdings with more than 25,000 livestock heads), and 96,760,871 chickens (81 percent in holdings with more than 25,000 livestock heads);
— ovine, for 6,810,389 heads.

Furthermore buffaloes, for 181,951 units, and caprine animals, for 923,755 units, are bred.

FORESTRY AND WOOD TREE CULTIVATION

Referring to forestry, data are available on utilised wood cut area, which - at the reference year of 2000 - accounts for 103,545 hectares, representing the 1.5 percent of total forest area, and producing a total amount of 8,562,238 cubic meters of wood.

Wood tree cultivation is also quite common in certain regions of the country. The related cultivated area accounts for 158,907 hectares (of which 83,368 hectares are cultivated with poplar), as result of the extensive data collection realised through Agriculture census 2000.

Forest tree plants grown in nursery activity, managed by regions and delegated public institutions, in year 2000 are as follows: coniferous plants account for 9,942,000 units (of which 5,429,000 from seeds), whereas non-coniferous plants account for 15,675,000 units (of which 13,152,000 from seeds). The area dedicated to this activity equals 230 hectares; 2,132,000 coniferous plants and 4,965,000 non-coniferous ones have been sold.

### *3.2.2 Nace B sector*

Relevant information on structural aspects inside Nace B in Italy refers to fishing and aquaculture activities. Even if the role of this sector at national level is still limited, it is necessary to study the waste generation phenomenon in order to foresee a possible statistical action.

Available data for fishing activities come from surveys, which refer to the amount of caught fish, molluscs and crustaceous. Figures are collected separately on fishing activity run in the Mediterranean sea, in inland water and in the oceanic water.

Referring to the activity in the Mediterranean sea, in the reference year 2001, 16,636 were the licensed vessels (while for oceanic fishing activity only 22 are the authorised vessels). In total the production accounts for 308,540 tonnes of fish, molluscs and crustaceous; 165,275 tonnes of them are fish. Fishing, in inland water and in artificial basins, accounts for other 5,527 tonnes of product.

Aquaculture activity is conducted in coastal areas, mainly in seawater. Freshwater aquaculture is a rather limited activity, whose importance is growing recently.

Data released from last census on aquaculture (reference year 2002) refer to number of installations, installation characteristics, and amount and typology of production. The survey revealed that 711 enterprises run 742 active installations. Referring to the type of production, 71 of the total installations produces alevin (of which 54 in freshwater, especially for trout production), 417 are meant for fish production and 322 for molluscs. Settlements on land (374, of which 127 in transitional water and the rest on mixed areas) represent the majority of them, whereas 227 are in sea-water. With reference to intensity of production, 59 percent of them are classified as intensive and semi-intensive production system, 25 percent as extensive production system and the remaining 16 percent as mixed system.

Total fish production accounts for 50,499 tonnes, 72 percent of which grown in freshwater, whereas molluscs for 135,000 tonnes, represented mainly by mussels and clams.

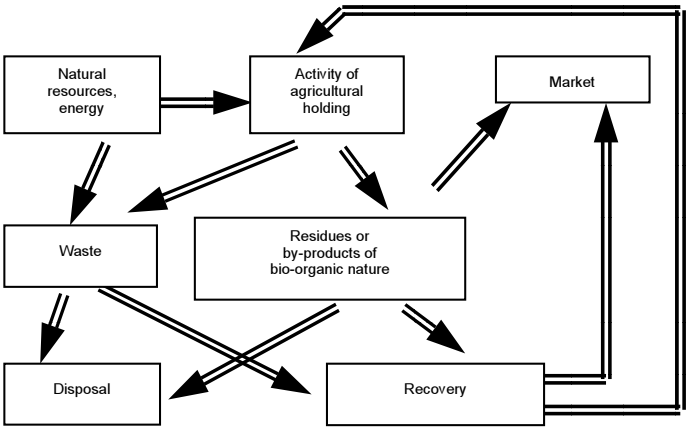
CHAPTER FOUR

# ISSUES RELATED TO THE DOMAIN OF WASTE STATISTICS REGULATION APPLICATION

Even if the WStatR is clear in its structure, during the adoption process in the European parliament and council it was decided to have pilot studies on new, difficult and political relevance areas. The agricultural sector, in particular, presents a lot of problems related to description and definition of which substances or objects have to be considered as *waste*. The main concern refers to the by-products/residues of bio-organic nature that are used in the productive process.

The graphic framework presented hereafter is intended to reflect the complexity of the matter and aims at supporting a correct consideration of the different aspects involved.

FIGURE 4.1 **Waste generated and managed in an agricultural holding**




Giampaola Bellini, Istat (paragraphs 4.1, 4.2, 4.3, 4.4); Mara Cammarrota, Istat (paragraphs 4, 4.5).

Starting from the activity of an agricultural holding with a given production delivered to the market, a distinction of waste generated is made between stream of *conventional waste* (reported in the scheme as *Waste*) that are designated to recovery or disposal and *residues or by-products of bio-organic nature* that can be recovered (inside or outside the holding) or disposed or re-used. Waste recovered can be after utilised in the production process. Moreover the agricultural holding can re-use the residues or by-products in its production process or deliver them directly to the market.

In the following paragraphs, besides a description of materials generated by Nace A and B sectors activities, some problems referring to waste allocation to the proper economic activity will be presented. A particular deepening is devoted to waste management practises. Some other statistical problems for the implementation of the WStatR will be also analysed.

### *4.1 General remarks on definition of waste*

A proper waste identification has as assumption a proper definition of waste, which generally is given by law. In relation to waste, law is not really clear. In fact, as already mentioned, waste shall mean “any substance or object which the holder discards or intends or is required to discard”. Thus these three conditions should be verified in order to define a material as waste or not.

The only unquestionable case is realised when the thing is discarded in a waste container. This is the only case where intentionality and discharge happen jointly and are out of question. In all other situations the case to case approach should be applied in order to attend the law and define whether the producer wants intentionally to get rid of the substance/thing because there is not need for using it anymore. In principle this can occur whether i) the object is not produced for the market, ii) it is produced for the market but doesn’t have the requested requirements, iii) its cycle of life is finished and cannot satisfy the needs it was produced for, or iv) it can still have the required requirements but cannot have the same function. This approach includes an assessment of the subjective and objective conditions which lead to get rid of things or substances. Nevertheless even if something is discarded/abandoned unintentionally it can be considered as waste.

Whether the substance/thing under investigation still has an economic value is not a sufficient parameter to decide if it has to be classified as waste or not. In this case the production residue cannot be directly excluded from the matter related to waste generation and management.

Furthermore the threshold between residues/by-product and waste can be related to the recovery which has to be certain and not eventual and without preliminary treatment processe to be realised in between production and recovery activity in the production process itself. If the recovery activity also brings economic value than the recovery activity will have more chance to happen (Judgment given by the Ec Court of justice, sect. VI, April 18th 2002).

Points arose above can give an idea of how can be controversial the classification as waste or not of a specific material. Furthermore, the case might become more complicated for residues and by-product of bio-organic nature. At present (Eurostat/Efta, 2004), materials of bio-organic nature have been defined as *potential waste*, and it has been stated that a review of available data calculation methodologies and of information on by-products destination available might be useful to solve the definition problems. Management of by-products at farm level is in fact a not well known phenomenon that might be changed as the organisation of the agriculture system is, in the last decades.

In the present study not a definite position on whether to consider specific bio-organic items as waste or not has been established, nevertheless their encoding and classification according to EWC-Stat and LoW is provided. It has been considered more profitable to provide a wide review on legislation in force on specific items - requiring reporting activity or regarding material management aspects -, in order to support decision making on considering some materials as waste or not. Legislation on management aspects can reveal that a material requires specific treatment or attention when re-used at farm level, on the other hand reporting activity deriving from legislative acts, might provide useful information on some issues which falls under the present study.

Where possible, highlights on substance relevance and destination are presented.

### *4.2 Waste generation*

Referring to waste generated by economic activities included in Nace A and B sectors, the result of the activity of identification and description of the items involved for the most relevant waste categories and materials is presented.

Referring to waste item relevance, the information arising from the activity of agricultural price indices sector in Istat[10] is taken into consideration. In fact referring to expenses incurred by farmers and in particular for the group *General expenses*, refuse disposal is one of the listed voices (other voices are: transport of goods, credit, insurance, fees, rents, postal services, water for irrigation). The Statistical offices of the Chamber of commerce that collects prices for Istat (indirect data collection) choose for their reference area the representative kind of product for the refuse disposal, voices for which the farmers sustain a cost in the area considered. Actually due to regional subsidies, the situation may vary from region to region and the waste typologies might be *hidden* by such public institution intervention.

Anyway it is interesting to look at the list referring to *Refuse disposal by type*, where voices are ordered from higher to lower frequency:

— Tyres
— Plant protection product containers
— Waste oil
— Oil filters
— Plastics waste
— Medicines
— Pesticide, insecticides waste
— Discarded batteries
— Mulching film

It arises that items belonging to the same waste category are considered separately. This is the case for waste related to plant protection products use (Plant protection product containers and Pesticides, insecticides

[10] Istat calculates and publishes the Input and Output agricultural price Indices, according to the methodology of the Ec Agricultural price statistics. Prices (except the deductible Value added tax) are recorded at points as close as possible to those of the transactions that the farmer actually undertakes. The list of groups and subgroups for which partial output and input indices are calculated was chosen considering the most representative products.

waste) and to plastics (Plastics waste and Mulching films). Medicines revealed to be quite frequently used and disposed.

Besides analysing waste relevance, encoding activity of waste items has been realised. In the following the relationship between EWC-Stat and LoW classifications, defined in the transposition table published in Regulation 574/2004/Ec, is analysed. Starting from typologies of materials, peculiar to the involved sectors, categories of list of waste and EWC-Stat are identified. A general description of the items identified, with reference to related legislation in force where necessary, is thus provided.

Items used for packaging have not been analysed, as this activity goes beyond the purpose of the present pilot study.

### *4.2.1 Waste generated in sector Nace A*

A peculiarity of agricultural farms is the production of biomasses and the use of bio-organic substances as inputs to obtain them. Consequently many residues and by-products have bio-organic nature, whose location under waste classification has to be analysed in relation, also, to treatment undertaken and final destination.

Referring to destination, different production processes are highly integrated (i.e. livestock breeding versus crop by-product production, manure of animal origin versus fertilisation of crop production), which means that residues and by-products of certain activities represent an input for others.

Besides substances of bio-organic nature, analysis has to include also other materials, such as plastic (used for irrigation purpose, for soil cover, to contain fodder, and etcetera), metals, waste generated in plant protection product use for crop production, discarded materials related to machinery use.

In the following materials are listed according to the order given by the EWC-Stat code.

*Used motor oils*

| EWC-Stat | | LoW |
|---|---|---|
| **01** | Chemical compound wastes | |
| **01.3** | Used oils | |
| **01.31** | Used motor oils | **13 02 05** Mineral based non chlorinated engine, gear and lubricating oils *(hazardous)*<br>**13 02 06** Synthetic engine, gear and lubricating oils *(hazardous)*<br>**13 02 07** Readily bio-degradable engine, gear and lubricating oil *(hazardous)* |

Different kind of oil can be consumed in machinery and equipment used in farming holdings. The related classification reported in the LoW is made referring to the nature of the oil substances. Thus the types of oil identified are the ones reported in the above mentioned list. All of them are classified as hazardous. For the WStatR reporting purpose only information on used motor oils as a whole is requested.

*Agrochemicals and Pesticides*

| EWC-Stat | | LoW |
|---|---|---|
| **02** | Chemical preparation waste | |
| **02.1** | Off-specification chemical wastes | |
| **02.11** | Agrochemical product waste | **02 01 08** Agrochemical waste containing dangerous substances *(hazardous)*<br>**02 01 09** Agrochemical waste other than those in 02 01 08 *(non-hazardous)* |

This item includes wastes from use of agrochemicals products, classified as non-hazardous and hazardous. The LoW also includes the item 20 01 19 *Pesticide waste* (classified as hazardous) when waste derives from *selected waste collection* activity. Referring to this item, it should be better clarified its relationship with farming activities and how to consider it for reporting activity.

For data collection purpose through 2003 Fss, the relation of agrochemicals waste - except fertilisers - to hazardous and non-hazardous categories has been realised using the toxicity to mammal classification of the marketed products. In fact the categories *very toxic*, *toxic* and *harmful* established by law (Dpr 24 May 1988, n. 223) to label traded plant protection products correspond to the hazardous category, the remaining are thus classified as non-hazardous. Such wastes include discarded products and related container, whose classifications as hazardous or not follow the rule of the contained substance.

It has to be stressed that legislation on hazardous substances changed over time at international and national level[11], and thus it should be clarified whether the relationship with labelling legislation is still valid.

*Veterinary medicines*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **02** | Chemical preparation waste | |
| **02.1** | Off-specification chemical wastes | |
| **02.12** | Unused medicines | **18 02 07** Cytotoxic and cytostatic medicines *(hazardous)*<br>**18 02 08** Medicines, other than those mentioned in 18 02 07 *(non-hazardous)* |

[11] At national level decree 14 Marzo 2003 n. 65 - and amending acts -, which replaced decree 223/1988, represents the reference acts on this matter at present. Decree 65/2003 is the result of the implementation process of Directives 1999/45/Ec and 2001/60/Ec on classification, packaging and labeling of hazardous products (including plant protection products).

Medicines waste in stockfarming is covered by this item, classified in two different LoW codes mainly referring to chemical compounds contained.

Legislation in force for veterinary medicines use is the national decree n. 336/99 implementing Directives 96/22/Ec and 96/23/Ec concerning the prohibition in stockfarming of certain substances use having a hormonal or thyrostatic action and of ß-agonists, in turn repealing Directives 81/602/Eec, 88/146/Eec and 88/299/Eec. As consequence of this surveillance activity, farmer has to register medicines used for animal cure and prevention. Medicines cannot be stored at farm level, except in cases authorised by the local vet authority. This means that very seldom medicines expire at farm level as confirmed by some sector experts, thus waste only would refer to medicines container or material entered in contact with chemical substances.

*Filter materials*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **3** | Other chemical wastes | |
| **03.1** | Chemical deposits and residues | |
| **03.14** | Spent filtration and absorbent materials | **15 02 02** Absorbents, filter materials including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by dangerous substances *(hazardous)*<br>**15 02 03** Absorbents, filter materials, wiping cloths, protective clothing other than those mentioned in 15 02 02 *(non-hazardous)* |

This item includes materials used for filtering purpose. In agriculture farming, different chemicals are spread on land for cultivation purpose. Filters discarded might be classified as reported in the list above as hazardous or not, depending on residues still contaminating the used filter.

*Infectious animal health care wastes*

| EWC-Stat | | LoW |
|---|---|---|
| **05** | Health care and biological waste (hazardous when the waste is infectious otherwise non-hazardous) | |
| **05.1** | Infectious health care wastes | |
| **05.12** | Animal infectious health care wastes | **18 02 02** Waste whose collection disposal is subject to special requirements in order to prevent infection ***(hazardous)*** |

Dead infectious animals are classified under this item.

Due to the eradication and prevention measures adopted a large amount of carcasses and other product of animal origin has been disposed in the last decades. The amount of carcasses disposed in landfill or incinerated is largely seasonal due to epidemic events taking place[12].

Figures on this item might be derived from local health authorities. As already mentioned in a previous paragraph, Regulation 1774/2002/Ec of the European parliament and council, which lays down health rules concerning animal by-products not intended for human consumption, provides the legal bases for register on deaths events.

Animals slaughtered for adoption of prevention measures might be classified as waste from stockfarming activity, or generated by Nace activity encoded as *85.2 Veterinary activities such as research, diagnosis, treatment or prevention of disease involving animals*. The suggestion is to include these figures as waste generated by the vet activity, instead of farming activity. The legislation in force on these issues supports this kind of approach. A brief review is reported below.

Main concern regarding livestock diseases arises with the cases of bovine spongiform encephalopathy (Bse) due to the possibility to transmit the disease to human being through the food chain. A wide and

[12] Lately several cases of infectious diseases have been recorded and as an example, in Italy 16 millions of poultry heads died or have been slaughtered for flu occurrence (years 1999-2000) in 413 disease centre, most of which where in highly intensive livestock breeding. Also for cows' disease, eradication measures have been adopted and 101 transmissible spongiform encephalopathy disease centres have been identified and 9.000 cow heads have been slaughtered and incinerated (years 2001-2003).

comprehensive legislation has thus been recently issued referring to monitoring and eradication of transmissible spongiform encephalopathy (Tse) activity, removal of specified risk materials and rules for importation of live animals and products of animal origin, as ruled in Regulation 999/2001/Ec of the European parliament and council (amended by Commission Regulation 1494/2002/Ec and by the Regulation 1139/2003/Ec). On the same topic also the Commission Regulation 270/2002/Ec rules, amending Regulation 999/2001/Ec of the European parliament and council - as regards specified risk material and epidemio-surveillance for Tse -, and Regulation 1326/2001/Ec - as regards animal feeding and the placing on the market of ovine and caprine animals and products -.

Particularly interesting for waste accounting purpose is the Regulation 1774/2002/Ec of the European parliament and council, which lays down health rules concerning animal by-products not intended for human consumption. Among others, animals suspected of being infected by Tse or in which the presence of Tse has been officially confirmed, and thus killed in the context of Tse eradication measures are included in category 1 (which is one of the three categories identified on the bases of the related health and environment risk). This Regulation provides rules on animal and public health for: (a) the collection, transport, storage, handling, processing and use or disposal of animal by-products, to prevent these products from presenting a risk to animal or public health; (b) the placing on the market and, in certain specific cases, the export and transit of animal by-products and derived pro ducts (see Annexes VII and VIII of the mentioned Regulation 1774/2002/Ec).

A health certificate and a full documentation to trace animal transfers shall accompany the mentioned material during collection, transportation and storage. Communication on such cases has to be done to regional health authorities and the resulting registers might be used as administrative source for waste accounting purpose. The legislation also identifies specific requirements for processing and storage plants of such by-products, whose approval have to be submitted to specific authorities.

Also poultry affected by flu falls under the above-mentioned Regulation 1774/2002/Ec.

*Metallic wastes*

| EWC-Stat | | LoW |
|---|---|---|
| **06** | Metallic waste | |
| **06.3** | Mixed metal wastes | |
| **06.32** | Other mixed metallic wastes | **02 01 10** Waste metal *(non-hazardous)* |

Waste of metallic nature might derive from metals in diverse forms used in holdings, such as nets used for fencing reason, wires - used in tree cultivation to sustain trees - and other metals. These materials were investigated through the 2003 Farm structure survey. Only non-hazardous metal is considered.

*End-of-life tyres*

| EWC-Stat | | LoW |
|---|---|---|
| **07** | Non-metallic wastes | |
| **07.3** | Rubber wastes | |
| **07.31** | Used tyres | **16 01 03** End-of-life tyres *(non-hazardous)* |

Rubber waste generated in farm holdings is mainly related to tyres, and to the end-of-life tyres. No doubts in end-of-life tyres definition arose in carrying on the project.

*Waste plastics*

| EWC-Stat | | LoW |
|---|---|---|
| **07** | Non-metallic wastes | |
| **07.4** | Plastic wastes | |
| **07.42** | Other plastic wastes | **02 01 04** Waste plastics (except packaging) *(non-hazardous)* |

Plastics are used in many fields as packaging, as films in agriculture, for construction, and etcetera. This is the reason why plastics are classified in many different waste categories. In this sector several materials of plastic nature can be used in farming. Excluding packaging, a list of things of plastic nature has been set up in a specific case study[13] including:

— sheet to cover greenhouses and tunnel (Pe, Peir, Eva);
— hard sheet for greenhouses;
— film for mulching (Pe);
— nonwoven fabric (Pp);
— geomembrane (Pvc, Hdpe, Pp) to proof;
— different kind of rope and strings to substain crops and trees (Pe, Pp);
— harvesting nets (for olives, and etcetera) (Pp);
— nets for trees protection (Hdpe);
— film for silage (Pe);
— tubes for different irrigation techniques (Pe, Pvc, Prfv).

Nevertheless, for the purpose of data collection through the 2003 Fss the definition adopted includes plastic used in soil cover - mulching - operation, to cover crops in order to anticipate or postpone vegetal life cycle, as part of irrigation equipment, used as forage wrapping.

*End-of-life vehicles*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **08** | Discarded equipment | |
| **08.1** | Discarded vehicles | |
| **08.12** | Other discarded vehicles | **16 01 04** End-of-life vehicles *(hazardous)*<br>**16 01 06** End-of-life vehicles, containing neither liquids nor other hazardous components *(non-hazardous)* |

[13] Apat, Onr. *Rapporto rifiuti 2003*. Roma. Apat, Onr, 2003.

This item includes all kind of end-of-life vehicles, including off-road machinery, and all "vehicles" used in farming activities (tractors, harvester machines, and etcetera). The containment of liquids or other dangerous components of waste can display one or more of the properties listed in order to classify a specific waste as dangerous.

*Batteries*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **08** | Discarded equipment | |
| **08.4** | Discarded machines and equipment components | |
| **08.41** | Batteries and accumulators waste | **16 06 01** Lead batteries *(hazardous)*<br>**16 06 02** Ni – Cd batteries *(hazardous)* |

Batteries are source of electrical energy obtained by the direct conversion of chemical energy. Different kind of batteries can be installed on machinery and equipment used in farming holdings. The related classification reported in the LoW distinguishes the materials referring to the nature of the metal contained in the battery that can be lead or Ni-Cd. Both types are considered hazardous.

*Oil filters*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **08** | Discarded equipment | |
| **08.4** | Discarded machines and equipment components | |
| **08.43** | Other discarded machines and equipment components | **16 01 07** Oil filters *(hazardous)* |

Different kind of filters can be installed on machinery and equipment used in farming holdings. In this item oil filters, considered hazardous, are included. For air filtering purpose, air filters in oil bath can be installed on vehicles and thus the question arises on how to classify this material. In fact this could be included here or encoded as 15 02 02 *Absorbents, filter materials including oil filters not otherwise specified, wiping cloths, protective clothing contaminated by dangerous substances (hazardous*). Nevertheless, given the relationship of code 16 01 07 to discarded equipment category, encoding air filters in oil bath as 16 01 07 is preferable.

### BIO-ORGANIC WASTE ORIGINATED FROM FARMING AND FORESTRY, AND FROM PRODUCT PROCESSING ACTIVITY

Classification as waste of residues and by-products of bio-organic nature generated in primary activity represents one of the most controversial and debated issues of the waste generation phenomenon, from the theoretical and methodological point of view. It is questionable whether to consider them as waste or not, since they might be re-used in farming activity as inputs.

Waste of bio-organic nature might be generated in product processing in farm. Also these materials might find their final destination in the farm itself.

In the following highlights on some items classified according to EWC-Stat as 09 *Animal and vegetal waste* and 09.1 *Waste of food preparation and products* are provided, including a deepening on waste generated in some processing activities of typical Mediterranean products, such as olive grinding and wine-making process. These activities are in fact conducted in a relevant percentage at farm level. The following substances are thus included: waste from olive grinding (wastewater from olive grinding, dry and wet olive residues) and from wine-making process. The typology of waste generated depends on the technology adopted in the grinding process: dry olive residues and wastewater are obtained if water is added in order to separate oil from the rest of the olive residues, otherwise only wet olive residues are obtained.

*Animal waste of food preparation and products*

| EWC-Stat | | LoW |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.1** | Waste of food preparation and products | |
| **09.11** | Animal waste of food preparation and products | **02 01 02** Animal-tissue waste *(non-hazardous)*<br>**02 02 01** Sludges from washing and cleaning *(non-hazardous)* |

Food preparation of animal products does not commonly occur at farm level, so that - referring to Nace A sector - only animal waste of products is accounted here.

**02 01 02 animal-tissue waste.** This item includes animals dead in livestock breeding activity. Only non infectious animals can be accounted[14] here.

**02 02 01 sludges from washing and cleaning**. This item might include sludges from washing of milking machinery. A doubt might arise on how to consider this activity as first phase of food preparation of animal origin or as a final phase of breeding activity, which would correspond to LoW classification 02 01 01 *Sludges from washing and cleaning* and accounted in EWC-Stat 09.12 *Vegetal waste of food preparation and products*.

[14] Figures on non-infectious animals dead in livestock breeding activity, can be derived from local health authorities. Necessity of distinguishing infectious animal from non-infectious for food chain purpose requires registering activity of such death events.

*Vegetal waste of food preparation and products*

| EWC-Stat | | LoW | |
|---|---|---|---|
| **09** | Animal and vegetal waste | | |
| **09.1** | Waste of food preparation and products | | |
| **09.12** | Vegetal waste of food preparation and products | **02 01 01** | Sludges from washing and cleaning *(non-hazardous)* |
| | | **02 01 03** | Plant-tissue waste *(non-hazardous)* |
| | | **02 03 01** | Sludges from washing, cleaning, peeling, centrifuging and separation *(non-hazardous)* |
| | | **02 03 99** | Wastes not otherwise specified *(non-hazardous)* |
| | | **02 07 01** | Wastes from washing, cleaning and mechanical reduction of raw materials *(non-hazardous)* |

This item includes all waste of vegetal nature that might be generated in primary activity production and in vegetal products processing, as reported in the above mentioned list. Referring to processing activity main attention was put on wastes and by-products generated in olive grinding and wine making processes.

A deepening is provided for the following materials.

**02 01 01 sludges from washing and cleaning.** See item 02 02 01 *Sludges from washing and cleaning*.

**02 01 03 plant-tissue waste**

— Straw and other vegetal by-products and residues are included in this item. This material might be generated in harvesting operation or trimming activity in fruit tree cultivation.

— Disposed crops contaminated by genetically modified organisms (Gmo) fall under this item. According to the current legislation cultivation of genetically modified (Gm) maize is forbidden in Italy - none Gm variety is listed in the national plant variety register -. After few cases of Gm maize contamination in northern italian regions in year 2003, concerns arose about maize treatment and destination procedure. An agreement was signed in the same year between the Ministry of Agriculture and forestry policies, some regions (Lombardia, Marche, Emilia-Romagna, Veneto), and the Italian seed company association (Ais), including Italian branches of the multinationals Pioneer, Monsanto and Verneuil Italy. Crops in field that would result to be contaminated by Gmo have to be withdrawn from the food market and used for energy production purpose, through the production of the bio-ethanol fuel or biomasses. Seed companies are in charge of buying maize from farmers at market prices and sell it to enterprise for its processing for energy production purposes. Any other utilisation, which would exclude anyway human and animal nutrition, has to be defined by specific Ministry authorisation. The Ais has to take care of product collection and storage. Agreement refers only to grains, whereas plant residues can be left on soil.
— It is still under discussion how to consider food disposal in case of food offer exceeding market demand.

**02 03 01 sludges from washing, cleaning, peeling, centrifuging and separation.** This item includes materials generated in washing, cleaning of vegetal product often carried out at farm – or cooperative - level for marketing purpose. Also wastewater and other residues generated in olive grinding process should be here accounted as wet olive residues.

**02 03 99 wastes not otherwise specified.** Dry olive residues might be classified under this item, since water content would make the difference with waste classified as sludges.

**02 07 01 wastes from washing, cleaning and mechanical reduction of raw materials.** Solid waste generated in wine making process, as marc and cream of tartar, can be classified under this item.

*Mixed waste of food preparation and products*

| EWC-Stat | | LoW |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.1** | Waste of food preparation and products | |
| **09.13** | Mixed waste of food preparation and products | **02 05 99** Wastes not otherwise specified *(non-hazardous)* |

This item includes all waste of vegetal nature that might be generated in primary activity production or in processing activity, as reported in the above mentioned list.

A deepening is provided on the following item:

**02 05 99 wastes not otherwise specified.** Whey generated in dairy product processing can be classified under this item. Referring to destination to which whey is subject, as revealed by a case study[15], a third of the total amount is used for swine feeding purpose, whereas the remaining is either treated or disposed directly.

*Green waste*

| EWC-Stat | | LoW |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.2** | Green wastes | |
| **09.21** | Green wastes | **02 01 07** Wastes from forestry *(non-hazardous)*<br>**20 02 01** Bio-degradable waste *(non-hazardous)* |

[15] Anpa, Onr. *Rapporto Rifiuti 2001*. Roma: Anpa, Onr, 2001.

**02 01 07 wastes from forestry.** Waste generated in forestry activity is mainly represented by vegetal residues, consisting in minor branches and leaves, which remain on the ground after cutting down the trees.

**20 02 01 bio-degradable waste.** This waste is related to vegetal material generated in management of grass and trees in public recreational areas. Since they might be mixed with other materials, such as waste generated in recreational human activity, they are usually disposed with household waste. A problem of calculation and allocation can thus arise for this item.

*Faeces, urine and manure*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.3** | Slurry and manure | |
| **09.31** | Slurry and manure | **02 01 06** Animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site *(non-hazardous)* |

Dejections, depending on stable characteristics, can assume different forms: liquid and solid part can be collected separately or flow into the same storage container. Where straw is present, especially in dairy cattle breeding, *dung manure* is the final composted product. All these materials can be spread on land, taking into account their characteristics. Composting process allow to obtain a final material with little negative side effects when distributed on land. On the contrary, spreading of slurry requires following a number of care rules.

As stated in the LoW, effluents treated on-site are not considered waste.

Deeper analyses should clarify whether *treatment on-site* refers to a complete treatment, including re-use on-site, which for dejections would mean spreading the substance on agricultural land, or is limited to a

treatment which makes re-use feasible.

Legislation on use and management of dejection in agriculture is aimed at minimising pollution problem and exalting positive effects on soil fertility. In fact distribution on soil of dejection can contribute to soil fertilisation when applied at a proper plant growth phase and in appropriate weather conditions, but - since emissions in air and water might arise - specific use conditions have to be taken into consideration. Main laws on this matter are the national decree 152/99 which is aimed at preventing water pollution, in this case mainly from nitrates, and the Nitrates Directive. Legislation, Nitrates Directive and the Annex n. 7 of the national decree 152/99, thus establish the maximum nitrogen load allowed per hectare in areas vulnerable to nitrogen, which is 170 kilograms starting from year 2003. Maximum nitrogen application rates per crop are also defined within the code of good agricultural practices, implemented as required by the Nitrates Directive. Furthermore dejection management and spreading can cause the emission of gas containing nitrogen as methane and ammonia, for which a monitoring activity is required[16] by the Integrated pollution prevention and control Directive 96/61/Ec (applied in Italy through the national decree 372/99).

### *4.2.2 Waste generated in sector Nace B*

Nace B sector includes fishing activity and aquaculture. In the following some highlights on the phenomenon of waste generation are given for both economic activities.

#### FISHING ACTIVITY

Referring to fishing activities waste might be classified as follows.

[16] Declaring activity is mandatory for some poultry and swine intensive stockfarms. In Italy, poultry heads bred in such intensive conditions are 98,324,937, which represents 69 percent of total heads, whereas referring to swine, 43 percent heads are bred in intensive stockfarms.

*End-of-life vessels*

| EWC-Stat | | LoW |
|---|---|---|
| **08** | Discarded equipment | |
| **08.1** | Discarded vehicles | |
| **08.12** | Other discarded vehicles | **16 01 04** End-of-life vehicles *(hazardous)* |

Here are included wastes related to discarded vessels, trawlers and fishing boats. A specific legislation is available on disposal of end-of-life vessels.

*Discarded fish*

| EWC-Stat | | LoW |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.1** | Waste of food preparation and products | |
| **09.11** | Animal waste of food preparation and products | **02 01 02** Animal-tissue waste *(non-hazardous)* |

This item includes fish rejected in water.

During fishing operation, some of the fish might be discarded in water. In fact the captured fish is not always eatable of marketable – according to legislation in force -, and, as consequence, a certain amount (named discard or reject) is discarded in water. This material is generated especially in trawl' fishing operation. There are cases of Institutions studying how to calculate the discard amount, which is generally expressed as percentage of the total fished amount. Of course such coefficients depend greatly on fish specie target and on area of fishing.

*Discarded net*

Nets and other components - such as floats - in fishing nets are made out of synthetic fibres such as polyamide, polyethylene, polyvinyl chloride, and etcetera[17]. Furthermore some other components are made out of metallic materials such as lead, steel, and etcetera.

Here might be included all kind of nets no more useful for fishing and thus discarded.

Classification can be controversial: the net part can be classified as 02 01 04 *Waste plastics* and the metallic part as 02 01 10 *Waste metal*; than encoding according to EWC-Stat would follow the transposition table published in Regulation 574/2004/Ec.

Nevertheless if disposal is realised for the fishing net as a whole - as it is likely to be - than being a material of mixed nature the classification could be as 02 01 99 *Wastes not otherwise specified (non-hazardous)*. Also in this case doubts would arise for encoding this material as 02 01 99 for its relationship with EWC-Stat code 09.13 *Mixed waste of food preparation and products* according to Regulation 574/2004/Ec.

Referring to management of nets, fishermen adopt the practice of reusing and repairing used nets, sometime to discard in seawater or to burn them. Not a specific legislation is active in this sector, except for net used for swordfish capture. In fact due to the European council Decision 97/292/Ec incentives are given to switch from swordfish catches to another kind of fishing activities (or for the abandonment of the fishing activity itself). Thus the disposal of the particular nets used for swordfish fishing is regulated.

*Mixed waste generated during navigation*

| EWC-Stat | | LoW |
|---|---|---|
| **09** | Animal and vegetal waste | |
| **09.1** | Waste of food preparation and products | |
| **09.13** | Mixed waste of food preparation and products | **02 01 99** Wastes not otherwise specified *(non-hazardous)* |

[17] Icram. *Classificazione e descrizione degli attrezzi da pesca in uso nelle marinerie italiane con particolare riferimento al loro impatto ambientale*. A cura di M. Ferretti, E. Tarulli, S. Palladino. Roma: Icram, 2002.

Mixed waste generated during navigation can be related to primary fishing activity, to first fish conservation and processing activities, to human activity on board. For encoding purpose it can be classified as 02 01 99 *Wastes not otherwise specified (non-hazardous)*.

Legislation on waste generated by vessels and discarded in the harbour is available in order to improve its safe management (Dl n. 182, 24 giugno 2003, implementing Directive 2000/59/Ec on vessel waste collection in harbours).

Other substances that can be discharged from a vessel are objects and materials resulting from incidental catches, mainly deriving from human activities or of human origin. None legislation regulating the phenomenon is available at the moment, even if there is debate on the necessity of addressing such issues. In fact diverse materials are fished and rejected in water at the moment and there is a suggestion to make mandatory taking them back to land in order to properly dispose such materials. Problems arise mainly for the peculiar nature of some of them that can even be human residues, unexploded weapons, other.

### AQUACULTURE ACTIVITY

Aquaculture activity can also generate waste. A specific pilot project[18] on aquaculture was carried out by Central institute for research applied to the sea (Icram) and Apat to implement Eco-management and audit scheme (Emas) regulation in aquaculture. The study revealed which are the critical points that need to be monitored in terms of environmental protection and that can be useful for this pilot project purpose in identifying relevant waste generated in this activity.

Emas defines a general framework which enterprises can apply to, on voluntary basis, to certify and control their own environmental management (and performances).

Quantity of waste produced by LoW code has to be registered in installations where Emas procedure is applied. Basic declaration, according to the law, has to contain information on structural installation characteristics, waste produced and related treatment applied, general environmental management adopted.

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18 Anpa, Icram. *Linee guida per l'applicazione del regolamento Emas al settore della piscicoltura. Manuali e linee guida 15/2002*. Roma: Anpa, Icram, 2002.

The former regulation on Emas (Regulation 1836/93/Ec) was only applied to manufactures, thus aquaculture has been only recently covered. Guidelines have been implemented and environmental critical points in enterprise management have been highlighted for this sector. Main typologies of enterprises includes i) off-shore cages, ii) aquaculture in natural or artificial basins (often supplied with transitional water) and iii) in tanks. Common factor is the use of an area on land where offices and magazines for storage and first fish selection and packaging are settled, and machines used to move products. Aquaculture in tanks tends to be more intensive, since food is supplied from outside. Removal of dead fish is quite often run daily.

Waste identified in the study carried on by Icram and Apat revealed waste types as follows.

*Used motor oils*

| **EWC-Stat** | **LoW** |
|---|---|
| **01** Chemical compound wastes | |
| **01.3** Used oils | |
| **01.31** Used motor oils | **13 02 05** Mineral based non chlorinated engine, gear and lubricating oils *(hazardous)*<br>**13 02 06** Synthetic engine, gear and lubricating oils *(hazardous)*<br>**13 02 07** Readily bio-degradable engine, gear and lubricating oil *(hazardous)* |

Different kind of oil can be consumed in machinery and equipment used in aquaculture. The related classification reported in the LoW is made referring to the nature of the oil substances. Thus the types of oil identified are the ones reported in the above mentioned list. All of them are classified as hazardous. For the WStatR reporting purpose only information on used motor oils as a whole is requested.

*Food container of paper nature*

| EWC-Stat | LoW |
|---|---|
| **07** Non-metallic wastes | |
| **07.2** Paper and cardboard waste | |
| **07.23** Other paper and cardboard waste | **20 01 01** Paper and cardboard |

Under this item fish food containers of paper nature are considered. Separate waste collection might occur for this material as a specific *Consortium* with this purpose is active.

*Waste plastics*

| EWC-Stat | LoW |
|---|---|
| **07** Non-metallic wastes | |
| **07.4** Plastic wastes | |
| **07.42** Other plastic wastes | **02 01 04** Waste plastics (except packaging) *(non-hazardous)* |

Material of plastic nature is included in this item.
In aquaculture plastic films are used mainly to cover tanks.

*Dead fish tissue*

| EWC-Stat | LoW |
|---|---|
| **09** Animal and vegetal waste | |
| **09.1** Waste of food preparation and products | |
| **09.11** Animal waste of food preparation and products | **02 01 02** Animal-tissue waste *(non-hazardous)* |

Here dead fish tissues are included.

Death might occur in water during breeding activity (LoW code 02 01 02).

Doubts arise on whether to account dead fish discarded during fish selection activity (LoW code 02 02 02 *Animal-tissue waste (non-hazardous)*), for not having the required market characteristics, here or not, since fish processing activity is exluded from Nace B sector.

Dead unmarketable fish might fall under category II or III of the Regulation 1774/2002/Ec of the European parliament and council, which lays down health rules concerning animal by-products not intended for human consumption. Dead fishes are considered high risk material according to the national decree 508/92 implementing the Directive 90/667/Ec, whose disposal has to be realised in authorised plants.

The only problem that can be foreseen in dead fish classification is whether it has to be considered as hazardous or not. If the fish tissue waste has to be considered hazardous, it is not available a code in LoW with this peculiarity, in fact the available codes referring to EWC-Stat is 09.11 *Animal waste of food preparation and products* are non-hazardous.

The LoW classification reported above, in fact, doesn't consider a hazardous section for the animal tissue waste category.

*Sludges deriving from washing activities*

| **EWC-Stat** | **LoW** |
|---|---|
| **09** Animal and vegetal waste | |
| **09.1** Waste of food preparation and products | |
| **09.11** Animal waste of food preparation and products | **02 02 01** Sludges from washing and cleaning *(non-hazardous)* |

This item includes sludges deriving from washing activities (water) of places of fish selection and packaging. In fact as mentioned before, enterprises always uses magazines for storage and first fish selection and packaging.

*Discarded net*

Nets and other components - such as floats - in fishing nets are made out of synthetic fibres such as polyamide, polyethylene, polyvinyl chloride, and etcetera. Furthermore other components are made out of metallic materials such as lead, steel, and etcetera.

Here might be included all kind of nets no more useful for fishing and thus discarded.

Classification can be controversial: the net part can be classified as 02 01 04 *Waste plastic* and the metallic part as 02 01 10 *Waste metal*; than encoding according to EWC-Stat would follow the transposition table published in Regulation 574/2004/Ec.

Nevertheless if disposal is realised for the fishing net as a whole - as it is likely to be - than being a material of mixed nature the classification could be as 02 01 99 *Wastes not otherwise specified (non-hazardous)*. Also in this case doubts would arise for encoding this material as 02 01 99 for its relationship with EWC-Stat code 09.13 *Mixed waste of food preparation and products* according to transposition table published in Regulation 574/2004/Ec.

*Dredging deriving from removing of sediments from artificial basins and tanks*

| **EWC-Stat** | | **LoW** |
|---|---|---|
| **11** | Common sludges | |
| **11.3** | Unpolluted dredging spoils | |
| **11.31** | Unpolluted dredging spoils | **17 05 06** Dredging spoil[19] other than those mentioned in 17 05 05 *(non-hazardous)* |

This item includes materials removed from artificial basin or tanks where fish is bred.

[19] In the Italian version of Regulation 574/2004/Ec the “spoil” word is translated with “terra” (“soil” in English). Maybe this is not the most appropriate translation, *detrito* would probably be a more appropriate word.

Referring to aquaculture, an important issue is related to the removal of sediments. The phenomenon of residues settling can vary a lot depending on condition of water flow. In fact, in installations where water flow is continuous and abundant, floating solids can be transported by out-coming water and settle down with lower rate. The out-coming water monitoring activity falls under the rules laid down by the national decree 152/99 (and following amending acts). Discharge quality can be improved by lagoon basins or tanks and filtering systems where solid particles can sediment, increasing sediment waste amount as a consequence. Sediments contain food residues, dejections, residues of distributed medicines and food additives.

The problem of sediments mainly arises with installations in freshwater and when fish is bred in tanks where the production system is intensive. These materials can accumulate and be discharged periodically. According to sector experts, in Italy the situation might become critical in the next future since the operation has not been considered necessary so far due to the life time of the settlements itself. Aquaculture in fact mainly arose in the 70ies and 80ies and existing tanks are reaching their saturation level.

Technical solutions to apply may vary. A dredging plant or flocculant substances can be used. Sludges are analysed to verify the possibility to spread them on agricultural land as such or possibly after biological treatment as composting. Other possible uses or destinations are as fuel for energy production or landfill. The Directive on the biological treatment of bio-degradable waste[20] under discussion at the European Commission level might in the next future give some highlights on management of these materials.

*Other waste*

*Discarded equipments* are mentioned in the list. *Fish packaging* - usually made out of polystyrene - is used and discarded, but as it refers to packaging its analysis goes beyond the purpose of this pilot study.

[20] Draft discussion document for the ad hoc meeting on bio-waste and sludges. 15-16 January 2004. Dgenv.A2. Brussels, 10 December 2003.

### *4.3 Waste allocation to the related economic activity: some problems*

As required by the WStatR, Ms in their reporting activity have to keep separated figures on waste deriving from Nace A and B sectors.

The possibility to calculate and allocate properly the involved waste depends largely from the availability of integrated Business register archive, from the nature of the basic data used in the estimation approach or from the survey used to collect directly the required information.

In Italy farms are not encountered in an integrated Business register archive so that where mixed activities - farming and vegetal and animal product processing, farming and forestry - are conducted, they are encoded as Nace A for Agriculture national accounts purpose, without any regards to the activity prevailing in economical terms. Thus the decision of referring the waste generated to the main activity, in the Italian case, would bring to figures whose comparison with Ms having a different classification would be misleading

Referring to basic data availability for waste account purpose, agriculture sector is the one with the most comprehensive information available, whereas for forestry and fishing we can register lack of data on some phenomena. Agriculture activity is monitored through several surveys run by the National statistical institute or through the activities run by the Ministry of Agriculture and forestry policies. The arising figures refer to any kind of agricultural activity, without any reference to the fact that farmer conducts this activity as main and primary or as secondary activity.

Depending on the parameters considered, yearly statistics are available on sample survey basis or on census basis, whereas Agriculture census on holdings activity is conducted every 10 years.

Referring to forestry the situation is different since mixed agriculture/forestry farms are usually included in the population universe surveyed, whereas exclusively forestry farms are surveyed only for Agriculture census purpose every 10 years. Statistics with yearly bases only are available for certain forestry parameters such as surface per typology and different territorial level, and for some specific activities such as areas of cutting. On the other hand information on culture of trees for wooden products (i.e. poplar culture) is not available if the activity is not conducted jointly with agricultural farming. The forestry sector, so, might have

problems of lack of data depending on the approach used in data compilation to meet regulation requirements that might provide an underestimation of waste generated.

Similar situations arise for fishing, where statistics on fishing quantities are available, but they refer to the delivery centres and not to the fishing units. On the other hand, statistics for aquaculture sector arise from a census on yearly basis where all the active units are surveyed.

The problem of misleading accounting of waste in relation to a sector, might arise in cases where agriculture activity and fishing activity are carried out in the same holding. Waste for which these kinds of problems of allocation can arise, are mainly discarded equipment and machinery, since they can be used for both economic activities. Through 2003 Fss questionnaire, information was collected on whether the investigated holding was conducting aquaculture activity at the same time, but unfortunately not direct linkage with the aquaculture unit archives is available at the moment to understand the size of this activity.

Main concern arises in Italy for accounting waste generated through product processing realised inside the farm. In fact, several processing activities might take place in agriculture holdings, from first vegetal product processing as cleaning and selection activity to make product ready for the market, to other processing activities such as wine making, dairy production and olive grinding for oil production. In Italy, mainly wine making and olive grinding for oil production activities are accounted as agriculture (43 percent of processed grapes and 91.5 percent of grounded olives) in economical terms for National account purpose. Thus, data comparison between Ms could be misleading.

Problems arise also in trying to keep separated figures of waste generated in forestry activity and in household. In fact bio-degradable waste (code 20 02 01) generated in maintenance of recreational green area - referring to national legislation in force - falls in municipal waste in terms of classification. Furthermore related figures at the moment cannot be distinguished from municipal waste since data are provided only in an aggregated form.

Other specific problems might arise for allocation of some waste to the proper economic activity. This situation has been presented in the previous paragraph 4.2.1 on waste generated from Nace A activity, as for the case of infectious animal health care waste.

### *4.4 Waste management practices*

According to Annex II of the WStatR, statistics shall be compiled on waste treated, per treatment method, also per Nace A (Agriculture, hunting and forestry) and B (Fishing*)* groups.

Referring to agricultural activities, several modalities to recover and dispose substances are adopted at farm level. The most common typologies of recovery and disposal operations, according also to the list stated by the WStatR, are:

— *purification*, and particularly *composting*;
— *incineration* - for energy production, on land;
— *disposal in water bodies*;
— *land treatment*.

In the following the definitions used for purification, composting, incineration and disposal in water bodies for data collection purpose through 2003 Fss are provided. A deepening on land treatment operation is given with reference also to legislation in force.

*Purification* refers to chemical, physical and biological treatments applied to modify chemical, physical and biological parameter values in order to make possible the re-use of the considered substance. A specific and common way to recover material of bio-organic nature in agriculture is composting. *Composting* refers to the process of breaking down the complex organic materials by micro-organisms. Managing the temperature of the composting process is also possible to eliminate unwanted micro-organism so that the final compost can be used on land for plant nutrition and for soil fertility improvement. Substances that can be used in composting are vegetal residues from crops and from vegetal product processing, manure, selected organic waste from household.

*Incineration* involves burning of material, operation that can be carried out on land or in places where it's possible to recover energy or to obtain indoor heating.

Referring to *disposal in water bodies*, we considered included disposal in both fresh and sea water.

Another kind of treatment very common in farming activity is *land treatment*. The distribution on agricultural land can refer to residues or by-products of bio-organic nature generated in the same sector - from primary

and product processing activities - and waste generated from other economic sectors (Dlgs. 27 January 1992 n. 99), typically sewage sludge (from treatment of wastewater generated by municipalities or by industrial settlements).

As agricultural soil can be the final destination of several bio-degradable wastes a particular attention has to be given to this phenomenon. A comprehensive legislation is active on the subject and some new legislative acts are in the implementation phase.

Depending on the final effect of the bio-waste on soil characteristics, land treatment can result in benefit to agriculture or in ecological improvement and thus be classified as R10 *Land treatment resulting in benefit to agriculture or ecological improvement* or just have the effect of the bio-degradation of the spread material and thus be classified as D2 *Land treatment, e.g. biodegradation of liquid or sludgy discards in soils, and etcetera*.

Attention should thus be paid to consider a certain bio-waste as beneficial or not to soil.

In fact, through continuous cropping, agriculture activity increases the need of nutrient and of organic matter. Sludge and bio-waste can serve this purpose. Indeed, sewage sludge is a nutrient supplier, while compost is also a provider of well-stabilised organic matter with soil improving properties, due to its humus building capacity, affecting soil characteristics as water retention capacity, physical reduced erodibility, and etcetera. Nevertheless the application of sludge and bio-waste can pose certain environmental problems mainly related to: excessive supply of nutrients, introduction of pollutants, such as heavy metals and organic compounds, spreading of human, animal and/or plant pathogens. For some bio-waste legislation is already in force, nevertheless a more broad framework might soon arise from the ongoing discussion started with the Commission Communication *Toward a Thematic Strategy on Soil Protection* [Com(2002)179] that would bring revision of the Sewage sludge Directive 86/278/Eec – on the protection of the environment and in particular of the soil when sewage sludge is used on agricultural soil - and a proposal for a Directive on the biological treatment of bio-degradable waste.

At national level, legislative acts ruling on material spreading on land were issued for water pollution prevention purpose. Mainly concerns are on prevention of water pollution from nitrates of agriculture origin. Main act

is the national decree 11 May 1999, n. 152 *Constraint to Prevent Water Pollution*, implementing Directive 91/271/Eec concerning treatment of urban wastewater and Directive 91/676/Eec on prevention of water pollution from nitrates of agriculture origin. The latter provides the identification of areas vulnerable to nitrates, defining also the good practice code[21] (Dm n. 86, 19 April 1999). The maximum material amount that can be spread on agricultural land is defined in relation with the nitrogen content. In fact legislation - Nitrates Directive and the Annex n. 7 of the national decree 152/99 -, establishes the maximum nitrogen load allowed per hectare in areas vulnerable to nitrogen, which is 170 kilograms starting from year 2003. Furthermore the maximum nitrogen application per crop is defined within the code of good agricultural practices, implemented as required by the Nitrates Directive.

Referring to bio-organic material generated in vegetal product processing, such as wet and dry residues from olive grinding process limit of spreading on land are defined by a national law (decree 11 November 1996, n. 574): 50 cubic meters per hectare for residues generated by oil mill with conventional grinding and 80 cubic meters per hectare by oil mill with continuous cycle. A communication to the local mayor is required with a technical documentation showing suitability of the soil to such treatment.

Furthermore, utilisation of sewage sludge from wastewater treatment of domestic, urban, or industrial origin is ruled at national level by the decree n. 99 of 27 January 1992 which represents the implementation of the Directive 86/278/Eec, whereas management issues (transportation, storage, treatment) are ruled by the decree n. 22/1997.

Article 3 of the mentioned decree (n. 99/1992) allows utilisation on agricultural soil of sewage sludges only if these three conditions occur:

— a treatment has been undertaken;

— they are able to bring nutrients and/or have an effect on soil properties;

21 This code includes several practices such as the identification of the less problematic spreading periods, the modality to proceed with the distribution on slopes, or in difficult soil condition, the proper capacity of manure storage infrastructure, the best distribution techniques in order to prevent water contamination. Different parameters related to weather conditions (mainly rainfall periods), crop rotation plans and crop cover techniques, fertilisation plan, soil characteristics have to be taken into account in order to reduce nitrate leaching and water contamination.

— they don't contain substances toxic and harmful and/or persistent, and/or bio-accumulatives in such concentrations that might result harmful for soil, crops, animals, humans and for the environment in general.

Thus several practices have to be adopted at farm level in order to consider the bio-waste spreading on land as appropriate in agronomic, environmental and healthy terms. If these conditions are met, then spreading on land can be considered bringing benefits to agriculture and improvement to ecological conditions and could be classified in R10 otherwise a D2 case should be accounted for. This implies that it is a case to case choice to identify a R10 or D2 treatment practice and this would require ancillary information that might be collected through statistical surveys.

The main classification issues arising here are related to the nature of "disposal" or "recovery" of some wastes, when spread on land.

The question arises on how to consider the distribution on agricultural land of the following substances:

— sludge from treated wastewater;

— wastewater and dry and wet residues generated in olive grinding process;

— slurry from pigs bred on conventional way, containing heavy metals.

In these cases, more than others, it is necessary to understand if the act of spreading on land is linked to a benefit (R10) or if it is ending with the operation of treatment in itself (D2).

None of the treatment included in list stated in Directive 75/442/Eec openly refers to products re-used to feed livestock. This issue should be further analysed.

An example can be given from by-products generated in milk processing activities. In fact the by-product *whey* is normally used to feed pigs, in areas where this kind of livestock breeding is widespread. At least at national level a case study was carried on by Apat[22] and it revealed that a third is used as animal food, another third is processed and the remaining is disposed. At present focusing only on typology of treatments proposed, question arises on how to classify materials of organic nature used in animal feeding. Since digestion is a biological process, it could be classified as R3 *Recycling/reclamation of organic substances which are not used as solvents*.

[22] Anpa, Onr. *I rifiuti del comparto agroalimentare - Studio di settore.* Roma: Anpa, Onr, 2001. (Collana Rapporti 11/2001).

For data collection purpose through Fss the item *Other treatment* has been used to account also for the re-use of organic materials as animal fodder.

### *4.5 Other statistical problems for the implementation of the Waste statistics Regulation*

The implementation of the WStatR in Italy with reference to Nace A and B sectors presents some problems with reference to the statistical units to consider and to the identification of threshold of 10 employees stated by article 3 of the Regulation.

#### *4.5.1 The agricultural holding as statistical unit for Waste statistics Regulation*

As requested by Council Regulation n. 2186/93 Ms are requested to set up one or more harmonised registers for statistical purposes. Following this regulation, in Italy a Statistical archive of undertakings and institutions (Asia) has been created. Asia undertakings covers activities from Sections C to O, excluding L, of Nace Rev. 1. Section L is covered by the archive Asia institutions that is currently being created. The register does not cover not-profit activities which will be included in the complementary register of Asia institutions.

Asia represents the national statistical record of enterprises and local units. The items of information held for each unit consist of its Asia number, name, address, legal form, principal economic activity classification, and recorded values for turnover, employees and wages and salaries. All enterprises are covered regardless of their size. The main sources of information for updating are: Chambers of commerce (Camere di commercio); Fiscal company register (Anagrafe tributaria); Social security institution (Inps - Istituto nazionale per la previdenza sociale); National electricity company (Ente nazionale energia elettrica spa); Telecom spa; Central bank of Italy (Banca d'Italia); Structural business statistics survey; Short-term statistical surveys Intrastat survey.

Istat is actually involved in the establishment of a Business register for agricultural holdings (Asaia), starting from data coming from Agriculture census. Nevertheless, the list of agricultural holdings is defined according to Agriculture census 2000.

A particular stressing is necessary for the *agricultural holding* that doesn't meet with the statistical units requested by WStatR that can be local units or kind-of-activity units. An agricultural holding is defined as a *local kind-of-activity unit* (local Kau), as defined in Council Regulation 696/93/Eec on the statistical units for the observation and analysis of the production system in the Community.

### *4.5.2 Consequences for the adoption of minimum threshold value for size of enterprises*

The WStatR excludes from surveys enterprises of less than 10 employees unless they contribute significantly to the generation of waste.

In Italy, some problems occur in the application of this criterion since the number of employees is not immediately available for agricultural sector. In fact, the Agriculture census, in the section devoted to labour, requests some information with reference to holder, household members and agricultural workers other than members of the holder's household. For this last category, permanent and temporary workers are considered, making a distinction between managers, clerks and workmen.

For all categories the number of days worked during the agricultural year is requested. In the Fss the yearly days worked is requested too. Furthermore the Fss requests also the daily mean hours.

As an agricultural holding is characterised by a lot of temporary workers and seasonal workers, as in a lot of case the holder and household members usually have another work besides the one realised in the farm, some problems occur in the calculation of the *real* employees.

Starting from working days it is possible to calculate years/men equivalent data. It is important to establish or not the equivalence of these two measures from the legal point of view.

Table 4.1 below is based on data from the Agriculture census and shows some information related to labour force, typology of management and working days in agricultural holdings.

The 91 percent of agricultural holdings is managed directly by holder with household members, with a percentage of working days that accounts for 85 percent; moreover, around 50 percent of agricultural holdings are characterised by less than 50 working days.

Data presented in the table shows that the Italian agricultural sector mainly comprises holdings with few workers and so since the WStatR states the exclusion of enterprises with less than 10 employees, there would be a considerable deficiency in the coverage of the statistics.

**TABLE 4.1 Agricultural holdings and working days by typology of management and class of working days - Year 2000**

| TYPOLOGY OF MANAGEMENT CLASS OF WORKING DAYS | Absolute value | | Percentage | |
|---|---|---|---|---|
| | Agricultural holdings | Working days | Agricultural holdings | Working days |
| TYPOLOGY OF MANAGEMENT | | | | |
| Direct management by holder: | 2,459,589 | 309,139,565 | 94.8 | 92.7 |
| *With exclusively household members* | *2,109,508* | *236,030,121* | *81.3* | *70.8* |
| *With prevalent household members* | *250,773* | *47,386,173* | *9.7* | *14.2* |
| *With prevalent workers other than household members:* | *99,308* | *25,723,271* | *3.8* | *7.7* |
| Management with wage-earners | 133,004 | 24,076,045 | 5.1 | 7.2 |
| Other management | 2,232 | 332,218 | 0.1 | 0.1 |
| **TOTAL** | **2,594,825** | **333,547,828** | **100.0** | **100.0** |
| CLASS OF WORKING DAYS | | | | |
| Less than 50 | 1,281,884 | 25,853,134 | 49.4 | 7.8 |
| 50 – 100 | 461,277 | 30,340,662 | 17.8 | 9.1 |
| 100 – 200 | 353,201 | 46,881,335 | 13.6 | 14.1 |
| 200 – 300 | 164,384 | 38,285,961 | 6.3 | 11.5 |
| 300 – 500 | 194,995 | 70,863,620 | 7.5 | 21.2 |
| 500 – 1000 | 113,229 | 74,793,189 | 4.4 | 22.4 |
| 1000 – 2500 | 23,152 | 31,077,219 | 0.9 | 9.3 |
| More than 2500 | 2,703 | 15,452,708 | 0.1 | 4.6 |
| **TOTAL** | **2,594,825** | **333,547,828** | **100.0** | **100.0** |

*Source*: Istat, Agriculture census 2000

This problem arises however also for the other economic sectors as Italy around 95 percent of enterprises have less than 10 employees, and almost two third of this group has 1 or 2 employees. It is clear that a single enterprise could not contribute significantly to the *generation of waste* but in the whole these enterprises surely contribute to it. So in the formulation of minimum requirements, it is necessary to consider the different

economic structure of a single country and statistical estimates of the waste quantities of the excluded enterprises is necessary before the application of this exclusion criterion.

CHAPTER FIVE

# STATISTICAL TOOLS FOR DATA COMPILATION

Tools for data compilation mainly consist of exploitation of available approaches. Existing data sources as the surveys on agricultural holdings, and as the one rising from Mud declaration activity were considered. Furthermore, estimation methodologies that arise from National accounts activity, Material flow accounts, sector studies supported and published by Apat, and from an approach based on data collected through 2003 Fss are described.

## *5.1 Potential data sources: surveys on farm structure*

Considering the importance of farm in generation and management of several substances and the complexity of the farming system, and for the purpose of present project, Istat experienced a data collection approach through the integration of Fss questionnaire.

Questions added in 2003 Fss were oriented to collect information on wastes and by-products generated and managed at farm level. The exploitation of this tool can be useful to directly collect data on waste generation and management phenomenon. Referring to by-product management at farm level, farms use to spread on land material of bio-organic nature produced in the farm or originated in other economic activities. Information on this phenomenon was also collected.

In order to evaluate classification as waste of bio-organic materials generated at farm level also information collected through Agriculture census is brought to the discussion in order to support decision making activity on such issue.

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Giampaola Bellini, Istat (paragraphs 5, 5.1, 5.1.1, 5.1.1.2, 5.1.1.3 (part), 5.3, 5.3.1, 5.3.2, and 5.3.3); Mara Cammarrota, Istat (paragraph 5.2); Marco Ballin, Istat (paragraphs 5.1.1.1, 5.1.1.3 (part), and 5.3.4); Antonio Macrì, Istat (paragraph 5.3.2.1); Aldo Femia, Istat (paragraph 5.3.2.2).

Some data results are provided and described in the following.

### *5.1.1 Farm structure survey*

In the following the sample survey design, the questions added in the Fss questionnaire, and the related response rates analysis are presented. A deepening on results related to plastic waste generation, referring to estimation modelling activity, is presented in paragraph 5.3.4.

#### *5.1.1.1 Sample survey design*

The list of units used to plan the Fss and the sample design is the set of all farms enumerated by Agriculture census 2000. It consists of about 2.6 millions units. This list includes the *reference population*, that is the set of *agricultural holdings* according to the definition used for data comparison at european level. Holdings in the reference population have the following characteristics:

— utilized agricultural area for farming equals 1 hectare or more;
— whether the utilized agricultural area for farming is less than 1 hectare, they have to produce a certain proportion for sale or their production has to exceed certain physical threshold.

Table 5.1 contains, for each region, the number of units enumerated by the Italian Agriculture census in year 2000 and the number classified in the reference population.

The sampling design is a stratified one with a *take all stratum* containing the biggest farms. The sample size is 55,030. About 53,000 units have been selected from the reference population and about 2,000 units have been selected from the set of other units contained in the population list.

The units' stratification has been carried out in three stages.

In the first phase it has been defined the take all stratum using: 273 hectares as threshold for *Utilised agricultural area* (Uaa), 446 as threshold for *Live stock unit* (Lsu) and a threshold in terms of *European size unit*[23] (Esu) for some principal type of farming. These thresholds are listed in table 5.2.

[23] 1 European size unit = 1.200,00 euro of total gross standard margin.

**TABLE 5.1 Agricultural holdings in the Census list and in the reference population**

| REGIONS | Number of farms enumerated by Agriculture census | Agricultural holdings in the reference population |
|---|---|---|
| Piemonte | 120,965 | 105,676 |
| Valle d'Aosta | 6,595 | 6,125 |
| Lombardia | 74,867 | 71,257 |
| Trentino-Alto Adige | 61,253 | 53,383 |
| *Bolzano* | *26,559* | *23,362* |
| *Trento* | *34,694* | *30,021* |
| Veneto | 191,085 | 177,000 |
| Friuli-Venezia Giulia | 34,963 | 32,981 |
| Liguria | 44,266 | 29,992 |
| Emilia-Romagna | 107,888 | 103,702 |
| Toscana | 139,872 | 107,290 |
| Umbria | 57,153 | 46,076 |
| Marche | 66,563 | 60,439 |
| Lazio | 214,666 | 162,111 |
| Abruzzo | 82,833 | 67,117 |
| Molise | 33,973 | 28,890 |
| Campania | 248,932 | 212,146 |
| Puglia | 352,510 | 288,087 |
| Basilicata | 81,922 | 68,470 |
| Calabria | 196,484 | 145,813 |
| Sicilia | 365,346 | 295,637 |
| Sardegna | 112,689 | 91,532 |
| **ITALY** | **2,594,825** | **2,153,724** |

**TABLE 5.2 Esu thresholds for take all stratum for some principal types of farming**

| PRINCIPAL TYPES OF FARMING | Thresholds |
|---|---|
| Specialist dairying | 404 |
| Specialist cereals, oilseeds and protein crops | 141 |
| Various permanent crops combined | 103 |
| Specialist olives | 70 |
| General field cropping | 144 |
| Specialist fruit and citrus fruit | 115 |
| Mixed cropping | 110 |
| Specialist horticulture | 267 |
| Specialist vineyards | 81 |
| Other farms | 400 |

In the second stage the reference population has been stratified using: localization of the headquarters of the farms, classes of Uaa, classes of Lsu, classes of Esu and the typology of the agricultural holdings.

In the third phase, the remaining units of the population list (smallest units) have been stratified using the region code.

The sample size and its allocation have been defined using a threshold for the expected coefficient of variation (Cv) for some variables of regional and national interest (Table 5.3).

**TABLE 5.3 Upper thresholds for the expected Cv used to determine the stratification, the sample size and the allocation of the sample units among the strata**

| REGIONS | Cereals | Industrial plants | Fresh Vegetables | Flowers | Vineyards | Olives plantations | Citrus plants | Fruits plants | Bovines | Pigs | Sheep and Goats | Esu | Uaa | Lsu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Piemonte | 5.0 | - | - | - | 5.0 | - | - | - | 5.0 | - | - | 5.0 | 6.0 | 6.0 |
| Valle d'Aosta | - | - | - | - | - | - | - | - | 5.0 | - | - | 5.0 | 6.0 | 6.0 |
| Lombardia | 5.0 | - | - | - | - | - | - | - | 5.0 | 5.0 | - | 5.0 | 6.0 | 6.0 |
| Trentino-Alto Adige | - | - | - | - | - | - | - | 5.0 | - | - | - | 5.0 | 6.0 | 6.0 |
| *Bolzano* | - | - | - | - | - | - | - | *5.0* | - | - | - | *5.0* | *6.0* | *6.0* |
| *Trento* | - | - | - | - | - | - | - | *5.0* | - | - | - | *5.0* | *6.0* | *6.0* |
| Veneto | 5.0 | - | - | - | 5.0 | - | - | - | - | 5.0 | - | 5.0 | 6.0 | 6.0 |
| Friuli-Venezia Giulia | 5.0 | - | - | - | - | - | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Liguria | - | - | - | 5.0 | - | - | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Emilia-Romagna | 5.0 | - | - | - | 5.0 | - | - | 5.0 | 5.0 | 5.0 | - | 5.0 | 6.0 | 6.0 |
| Toscana | 5.0 | - | - | - | 5.0 | - | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Umbria | - | - | - | - | - | 5.0 | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Marche | - | - | - | - | - | - | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Lazio | 5.0 | - | 5.0 | - | 5.0 | 5.0 | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Abruzzo | - | - | - | - | - | 5.0 | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Molise | - | - | - | - | - | 5.0 | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Campania | 5.0 | - | 5.0 | - | - | 5.0 | - | 5.0 | - | - | - | 5.0 | 6.0 | 6.0 |
| Puglia | 5.0 | - | 5.0 | | 5.0 | 5.0 | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Basilicata | 5.0 | - | - | - | - | - | - | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Calabria | 5.0 | - | - | - | - | 5.0 | 5.0 | - | - | - | - | 5.0 | 6.0 | 6.0 |
| Sicilia | 5.0 | - | 5.0 | - | 5.0 | 5.0 | 5.0 | - | - | - | 5.0 | 5.0 | 6.0 | 6.0 |
| Sardegna | 5.0 | - | - | - | - | - | - | - | - | - | 5.0 | 5.0 | 6.0 | 6.0 |
| **ITALY** | **1.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **3.0** | **1.0** | **2.0** | **2.0** | **1.5** | **1.5** | **3.0** |

The resulting distribution of the sample among regions is quoted in the following table (Table 5.4).

**TABLE 5.4 Size of total sample size, take some strata, take all stratum and strata for smallest farms by region**

| REGIONS | Sample size | | | |
|---|---|---|---|---|
| | Total sample size | Take some stratum | Take all stratum | Other small units |
| Piemonte | 3,700 | 2,963 | 597 | 140 |
| Valle d'Aosta | 430 | 358 | 51 | 21 |
| Lombardia | 5,300 | 3,363 | 1,762 | 175 |
| *Bolzano* | *700* | *527* | *160* | *13* |
| *Trento* | *700* | *554* | *113* | *33* |
| Veneto | 4,000 | 2,938 | 935 | 127 |
| Friuli-Venezia Giulia | 1,300 | 1,086 | 176 | 38 |
| Liguria | 1,350 | 1,302 | 25 | 23 |
| Emilia-Romagna | 3,250 | 2,337 | 780 | 133 |
| Toscana | 3,000 | 2,508 | 325 | 167 |
| Umbria | 1,500 | 1,186 | 177 | 137 |
| Marche | 1,350 | 1,020 | 168 | 162 |
| Lazio | 3,850 | 3,402 | 308 | 140 |
| Abruzzo | 1,350 | 1,046 | 176 | 128 |
| Molise | 1,250 | 1,127 | 56 | 67 |
| Campania | 3,300 | 2,851 | 312 | 137 |
| Puglia | 6,700 | 6,385 | 210 | 105 |
| Basilicata | 1,100 | 850 | 115 | 135 |
| Calabria | 3,000 | 2,688 | 158 | 154 |
| Sicilia | 5,150 | 4,846 | 165 | 139 |
| Sardegna | 2,750 | 2,404 | 203 | 143 |
| **ITALY** | **55,030** | **45,741** | **6,972** | **2,317** |

### *5.1.1.2 Integration of the 2003 Farm structure survey questionnaire*

Following the importance of farm in waste/by-product production and recovery/disposal activities, additional questions have been introduced in the Fss 2003 questionnaire.

Criteria about the possibility and the way to add questions were given mainly by the correlation of additional questions to phenomena analysed by the Fss, the necessity to know the existence - or not - of different typology of waste and of some management practices, the valuation about ability of farmer to assess and value originated and managed waste, in order to have positive results with least costs.

In particular the added questions refer to waste/by-product generation in farm (question 59) and treatment practices adopted at farm level (question 60) (Scheme 5.1).

**SCHEME 5.1** **New questions introduced in "Section X – Waste generation and treatment in farm" of Fss 2003**

**59. GENERATION OF BY-PRODUCTS AND WASTE**

**59.1 Fill in, whether farm generates listed waste:** ***(more than one answer is allowed)***

| WASTE TYPOLOGY | | Quantity |
|---|---|---|
| a) Metal ***(00 kg)*** ..... | 01 | |
| b) Plastic ***(kg)*** ..... | 02 | |
| c) Pesticide waste ***(kg)*** | | |
| - hazardous ..... | 03 | |
| - non-hazardous..... | 04 | |

**59.2 Fill in, indicating which kind of waste is generated, whether olive processing for oil production is conducted in farm:**

a) Wet olive residues..... 01 ☐

b) Dry olive residues and related waste water..... 02 ☐

**59.3 Is grape processing for wine production conducted in farm?** ..... 1 [Y] 2 [N]

**60. TREATMENT OF BY-PRODUCTS AND AGRICULTURAL WASTE**

**60.1 Does the farm treat by-products and/or agricultural waste?**..... 1 [Y] 2 N

**Does the farm treat also materials coming from other farms?**..... 1 [Y] 2 N

**60.2 Fill in, for typology of treatment and of material conducted in farm:** ***(more than one answer is allowed)***

| BY-PRODUCTS AND AGRICULTURAL WASTE | Purification | Incineration | | Land treatment | Disposal in water bodies | Composting | Other treatment |
|---|---|---|---|---|---|---|---|
| | | For energy | On soil | | | | |
| a) Vegetals..... | XXX | 2 ☐ | 3 ☐ | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |
| b) Wastewater from olive grinding..... | 1 ☐ | XXX | XXX | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |
| c) Dry olive residues..... | XXX | 2 ☐ | 3 ☐ | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |
| d) Wet olive residues..... | 1 ☐ | XXX | XXX | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |
| e) From grape processing.... | XXX | 2 ☐ | 3 ☐ | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |
| f) Other ..... | 1 ☐ | 2 ☐ | 3 ☐ | 4 ☐ | 5 ☐ | 6 ☐ | 7 ☐ |

For all substances considered under generation perspective (*metal*, *plastic*, *pesticide waste*, *waste from olive grinding and wine-making process*), farmers were asked to fill in the questionnaire whether the farm generates the specific substance, except for *metal*, *plastic* and *pesticide waste*, for which the amount produced was requested in hundred of kilograms for *metal*, and in kilograms per *plastic* and *pesticide waste*.

Referring to treatment used at farm level, a selection on substances and modality of recovery and disposal has been realised. The following substances are thus included: by-product of vegetal production, waste from olive grinding (wastewater from olive grinding, dry and wet olive residues) and wine-making process, plus the item *other*. Typologies of treatment are *purification*, *incineration - for energy production*, *on land -*, *land treatment*, *disposal in water bodies*, *composting*, *other treatment*.

### *5.1.1.3 Some result analysis: overall response rates*

Results on response rate for question 59.1 (waste generation occurring at farm level) that is number of farms indicating at least one waste quantity and, specifically, the amount of plastic generated, are presented in Table 5.5. It has to be stressed that any calculation refers to the sample farms previously described (paragraph 5.1.1.1), including the ones under the thresholds used for data comparison at european level. Results might differ from the official statistics released by Istat, due to the use of provisional sample weights slightly different to the definitive ones.

Figures reveal that the response rate at national level (number of farms giving at least one answer with a value higher than zero on sample size) is slightly higher than 49 percent (it should be noted that the related size in terms of European size units (Esu) represents almost 62 percent of the investigated farms). The highest response rate is recorded for Emilia-Romagna region (81 percent of the surveyed holdings), followed by Veneto (78 percent) and Lombardia (75 percent). Valle d'Aosta (0.3 percent) showed the lowest response rate, while southern regions, recorded response rates lower than the national average, with the exception of Campania (about 58 percent).

Referring to the low response rate, the interviewers referred that one of the main difficulties in giving the answers was the quantification of the waste.

In some regions farmers put up some resistance in answering this question.

The heterogeneity of the response rate and the difficulties encountered in answering the specific questions could affect the geographical comparability of the results of any statistical analysis, thus, in paragraph 5.3.4, an approach based on a model fitted at national level and on Fss results to obtain regional estimates is proposed.

TABLE 5.5 **Number of farms surveyed by Fss, response rate on sample base to question 59.1 on waste generation and fraction of agriculture activity - measured in terms of Esu - represented by respondents computed on regional population estimates - Year 2003**

| REGIONS | Farms surveyed by Fss (a) | Response rate to Q. 59.1 | | % of Esu represented by respondents |
|---|---|---|---|---|
| | | Total | Only Plastic | |
| Piemonte | 2,995 | 54.50 | 37.5 | 64.50 |
| Valle d'Aosta | 355 | 0.30 | 0.3 | 0.85 |
| Lombardia | 4,779 | 75.45 | 62.9 | 86.60 |
| *Bolzano* | *633* | *42.50* | *33.9* | *55.25* |
| *Trento* | *647* | *50.40* | *15.9* | *65.00* |
| Veneto | 3,552 | 77.55 | 63.7 | 84.90 |
| Friuli-Venezia Giulia | 1,033 | 66.80 | 56.1 | 81.60 |
| Liguria | 1,022 | 49.60 | 20.8 | 66.05 |
| Emilia-Romagna | 2,905 | 80.70 | 59.9 | 88.75 |
| Toscana | 2,514 | 58.25 | 46.6 | 67.50 |
| Umbria | 1,383 | 57.10 | 48.0 | 70.70 |
| Marche | 1,234 | 38.25 | 29.7 | 50.30 |
| Lazio | 3,112 | 42.85 | 37.1 | 47.50 |
| Abruzzo | 1,246 | 45.10 | 40.8 | 58.30 |
| Molise | 1,136 | 15.30 | 13.9 | 17.25 |
| Campania | 2,692 | 58.05 | 38.4 | 63.30 |
| Puglia | 5672 | 29.25 | 20.5 | 32.35 |
| Basilicata | 957 | 21.75 | 7.6 | 35.80 |
| Calabria | 2,524 | 12.30 | 8.8 | 17.30 |
| Sicilia | 4,041 | 34.35 | 29.5 | 39.40 |
| Sardegna | 2,444 | 39.95 | 36.3 | 46.35 |
| **ITALY** | **46,876** | **49.15** | **37.9** | **61.80** |

*Source:* Istat, Farm structure survey 2003
(a) Farms resulting respondents and actives in Fss.

Main concern arises in Italy for accounting waste generated by the oil olive grinding process. Despite National accounts point of view, which accounts 91.5 percent of grounded olives in the agricultural sector, survey has obtained a low rate of response to question 59.2 on farms processing olives for oil production purpose. The response rate in table 5.6 has been

computed conditionally to farms with olives plantations. At national level only 1.3 percent of farms with olives plantations stated to process olives. At regional level, Friuli-Venezia Giulia presents the highest rate (8.35 percent) in terms of responses obtained and of olive plantations represented by respondents (69.3 percent); nevertheless these anomalous figures are due to the fact that olive plantation is an unusual farming activity in this region. Basilicata region follows in the list, in this case the response rate equals 4.3 percent and respondents represent the 4.7 percent of the total olives plantations.

The interviewers referred that the low rate of response to question 59.2 was mainly due to the fact that the olive grinding process is usually carried out by mills. Therefore the waste generated by olives grinding directly by farms should be considered as a small amount compared to the one generated by mills.

Results, referring to question 59.3 on whether wine making process is

TABLE 5.6 **Number of surveyed farms with olives plantations, response rate on sample base to question 59.2 and weight of respondents in terms of olive plantations computed on regional population estimates – Year 2003**

| REGIONS | Number of sample farms with olive plantations | Response rate to Q 59.2 (a) | % of regional olive plantations represented by respondents |
|---|---|---|---|
| Piemonte | 2 | 0.00 | 0.00 |
| Valle d'Aosta | 0 | 0.00 | 0.00 |
| Lombardia | 51 | 1.95 | 0.35 |
| *Bolzano* | *1* | *0.00* | *0.00* |
| *Trento* | *21* | *0.00* | *0.00* |
| Veneto | 111 | 1.80 | 0.30 |
| Friuli-V.Giulia | 12 | 8.35 | 69.30 |
| Liguria | 354 | 0.30 | 0.00 |
| Emilia-Romagna | 172 | 1.15 | 2.20 |
| Toscana | 1,453 | 2.70 | 7.70 |
| Umbria | 805 | 1.50 | 3.50 |
| Marche | 456 | 0.00 | 0.00 |
| Lazio | 1,309 | 0.25 | 0.05 |
| Abruzzo | 776 | 0.65 | 0.90 |
| Molise | 723 | 0.40 | 0.70 |
| Campania | 1,097 | 1.20 | 2.50 |
| Puglia | 3,548 | 0.85 | 2.70 |
| Basilicata | 421 | 4.30 | 4.75 |
| Calabria | 1,782 | 3.15 | 6.55 |
| Sicilia | 1,983 | 0.60 | 1.55 |
| Sardegna | 714 | 0.70 | 0.55 |
| **ITALY** | **15,791** | **1.30** | **3.25** |

*Source:* Istat, Farm structure survey 2003
(a) Conditionally on having olives plantations.

carried out at farm level, show that this process is more widespread than the olive grinding process (Table 5.7). In fact, the response rate of *Yes* (computed on the set of surveyed farms having vineyards) amounts at 43 percent representing about 31 percent of the total vineyards area. The highest rate of *Yes* has been obtained in Molise region (84.0 percent) where these farms represent 60 percent of the regional vineyards.

Results suggest that waste generated by this activity in the agricultural sector is a non negligible part of the total waste generated in wine making process, but a deepening for the quantification of waste due to grape processing specifically run in this sector is necessary. Therefore, the problem of exploiting the relationship between this type of waste and the quantity of grape processed by the farms has been considered for 2005 Fss questionnaire.

TABLE 5.7 **Number of surveyed farms with vineyards, response rate on sample size to question 59.3 and weight of respondents in terms of vineyards computed on regional population estimates - Year 2003**

| REGIONS | Number of sample farms with vineyards | Rate of *Yes* on Q 59.3 among farms with vineyards (a) | % of regional vineyards represented by respondents |
|---|---|---|---|
| Piemonte | 680 | 35.00 | 37.95 |
| Valle d'Aosta | 90 | 43.35 | 59.05 |
| Lombardia | 461 | 51.40 | 58.75 |
| *Bolzano* | *123* | *17.05* | *19.10* |
| *Trento* | *203* | *13.80* | *13.05* |
| Veneto | 1,192 | 36.35 | 37.90 |
| Friuli-V. Giulia | 393 | 55.20 | 54.85 |
| Liguria | 142 | 51.40 | 34.75 |
| Emilia-Romagna | 1,036 | 34.45 | 32.55 |
| Toscana | 1,096 | 60.30 | 63.50 |
| Umbria | 590 | 47.45 | 45.60 |
| Marche | 480 | 41.90 | 29.85 |
| Lazio | 725 | 49.10 | 32.25 |
| Abruzzo | 411 | 51.60 | 37.25 |
| Molise | 419 | 84.00 | 60.70 |
| Campania | 859 | 79.30 | 67.50 |
| Puglia | 1,427 | 15.40 | 9.35 |
| Basilicata | 185 | 60.55 | 51.50 |
| Calabria | 356 | 61.50 | 51.55 |
| Sicilia | 894 | 7.60 | 2.90 |
| Sardegna | 633 | 62.10 | 52.10 |
| **ITALY** | **12,395** | **43.55** | **30.95** |

*Source:* Istat, Farm structure survey 2003
(a) Conditionally on having vineyards.

Figures presented in tables 5.8 and 5.9 refer to question 60 on management - at farm level - of waste and by-product per kind of material and on management of waste and by-product generated by other farms.

The figures, computed conditionally on the set of surveyed farms treating waste reported in the first column of table 5.8, show that the rate of *Yes* response to the question 60.1 (on whether farms would adopt waste and by-product management practices at farm level) ranges between 6.1 percent (Valle d'Aosta) and 66.65 percent (Emilia-Romagna), whereas national average reaches 24.4 percent value. Regions where farms practicing waste management are the majority (more than 50 percent of total surveyed farms) are Liguria, Emilia-Romagna and Abruzzo.

The habit of managing also waste and by-product generated in other farms is very little spread at national level (1.45 percent), only for Bolzano province the value is higher than 10 percent.

It is possible to observe a weak relationship between figures in column 1 and 2. In fact, higher rate of *Yes* in column 2 (treatment of materials coming from outside) are linked to lower rate of *Yes* in column 1.

Looking at the response rate to the questions 60.2 on management of different kind of materials (vegetal residues, waste water from olive grinding process, dry and wet olive residues, residues from wine making process, other material of bio-organic nature), the materials with highest number of marks are vegetal residues and residues from wine making process (Table 5.8). These results are consistent with the results on questions 59.2 and 59.3. In fact, only few farms declare they treat waste generated by olive grinding process, while it is more common the treatment of waste generated by wine making process. Furthermore, table 5.8 shows that the treatment of the vegetal residues is a very common practice among farms that declare treating by-product and waste (81.7 percent at national level) according to modalities of practices listed.

Investigation of management of by-products and waste of bio-organic nature phenomenon was considered necessary to better understand destination at farm level of such products, in order to identify what material or which amount per material can be considered as waste (Table 5.9). In the following data analysis was performed on sample size base. Recovery in farm, in several forms, seems to be the most adopted

**TABLE 5.8** **Response rate on sample size to questions on waste and by-product management per kind of material -Year 2003**

| REGIONS | Waste and by-product treated in farm Rate of *Yes* | Response rate among farms treating waste and by-product | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Waste and by-product originated in other farms and treated in farm Rate of *Yes* | Vegetal residues | Waste water from olive grinding process | Dry olive residues | Wet olive residues | Residues from wine making process | Other material |
| Piemonte | 13.95 | 2.65 | 68.35 | 0.55 | 0.00 | 0.25 | 21.35 | 15.55 |
| Valle d'Aosta | 6.10 | 5.55 | 0.00 | 0.00 | 0.00 | 5.55 | 72.20 | 0.00 |
| Lombardia | 20.80 | 1.50 | 93.40 | 0.00 | 0.00 | 0.00 | 11.75 | 1.95 |
| *Bolzano* | *6.80* | *11.65* | *44.20* | *0.00* | *0.00* | *0.00* | *25.60* | *32.55* |
| *Trento* | *2.15* | *0.00* | *71.45* | *0.00* | *0.00* | *0.00* | *21.45* | *14.30* |
| Veneto | 25.45 | 2.70 | 82.45 | 0.10 | 0.10 | 0.00 | 17.65 | 1.70 |
| Friuli - Venezia Giulia | 32.40 | 1.20 | 92.35 | 0.30 | 0.30 | 0.30 | 17.15 | 40.35 |
| Liguria | 65.85 | 0.15 | 99.15 | 0.00 | 0.00 | 0.00 | 5.35 | 0.15 |
| Emilia - Romagna | 66.65 | 1.20 | 96.40 | 0.05 | 0.00 | 0.00 | 13.20 | 1.50 |
| Toscana | 25.90 | 1.45 | 72.80 | 3.20 | 1.90 | 2.90 | 41.45 | 2.70 |
| Umbria | 24.45 | 0.65 | 50.00 | 1.60 | 1.60 | 3.25 | 62.00 | 9.75 |
| Marche | 15.00 | 1.60 | 63.25 | 0.55 | 0.00 | 0.55 | 41.60 | 4.85 |
| Lazio | 20.55 | 0.95 | 70.60 | 0.30 | 0.00 | 0.50 | 30.05 | 6.80 |
| Abruzzo | 54.75 | 1.05 | 91.80 | 0.75 | 0.45 | 0.00 | 38.05 | 5.00 |
| Molise | 29.50 | 1.80 | 71.55 | 0.30 | 0.60 | 0.00 | 54.80 | 0.30 |
| Campania | 30.40 | 0.80 | 69.75 | 0.65 | 0.15 | 0.00 | 41.65 | 2.30 |
| Puglia | 9.05 | 2.75 | 85.80 | 1.75 | 1.25 | 0.50 | 12.95 | 0.75 |
| Basilicata | 11.75 | 6.25 | 71.45 | 2.70 | 1.80 | 0.90 | 34.80 | 0.00 |
| Calabria | 11.55 | 1.40 | 37.25 | 10.85 | 7.55 | 5.65 | 48.10 | 9.90 |
| Sicilia | 23.55 | 0.55 | 95.15 | 0.55 | 0.15 | 0.55 | 1.55 | 10.25 |
| Sardegna | 12.85 | 1.00 | 28.90 | 1.00 | 1.65 | 1.00 | 60.80 | 17.95 |
| **ITALY** | **24.40** | **1.45** | **81.70** | **0.80** | **0.50** | **0.55** | **24.75** | **5.50** |

*Source:* Istat, Farm structure survey 2003

practice and among these *land treatment* is the most widespread one for any kind of material. Nevertheless burning on soil of crop residues and of trimming operation residues is still a wide spread practice. Referring to vegetal material, incineration for energy and composting are quite common treatments adopted. As reported in paragraph 5.3.2.1, the total amount of some by-products can be estimated applying technical coefficient, as performed by Environmental national accounts in Material flow balance, whereas the calculation of the quantities of material managed per kind of management would require a different approach.

Referring to land treatment, it is important to underline that a comprehensive legislation exists on such matter (paragraph 4.4). In fact the application on soil of some material of bio-organic nature can pose certain environmental problems mainly related to: excessive supply of nutrients, introduction of pollutants, such as heavy metals and organic compounds, spreading of human, animal and/or plant pathogens.

Referring to the purification treatment, figures reveal that some farms have a treatment plant for wastewater generated in the olive grinding process and for wet olive residues.

Referring to management of vegetal residues (Table 5.9), in more detail, farms choose in most of the cases (6,223 cases) spreading on land, but some (2,759 cases) still use burning practice on land to get rid of this kind of residue, followed by the ones burning residues for energy production (622 cases) and composting them (560 cases). The *other treatment* category, adopted in 369 holdings, might include animal

TABLE 5.9 **Respondents on sample size level to question on by-product and waste management type – Year 2003**

| BY-PRODUCTS AND WASTES | Purification | Incineration for energy | Incineration on soil | Land treatment | Disposal in water bodies | Compo-sting | Other treatment |
|---|---|---|---|---|---|---|---|
| Vegetal residue | - | 622 | 2,759 | 6,223 | 15 | 560 | 369 |
| Waste water from olive grinding | 14 | - | - | 78 | 1 | 2 | 9 |
| Dry olive residue | - | 3 | 4 | 29 | - | 6 | 17 |
| Wet olive residue | 3 | - | - | 46 | - | 3 | 10 |
| From grape processing | - | 11 | 127 | 2,263 | 18 | 96 | 225 |
| Other | 33 | 8 | 115 | 212 | 4 | 44 | 298 |

*Source:* Istat, Farm structure survey 2003

feeding as final destination. Discharge in water bodies (15 cases) - as vegetal residues management modalities - is the least common case.

Spreading on land of vegetal residues, being the most common way to treat this kind of material, has been analysed with its relationship with farm characteristics.

Management practices show to be slightly changing with farm size (Table 5.10) if focusing on vegetal residues material, in fact spreading on land is more practiced in farms with Uaa larger than 5 hectares than in smaller ones, whereas burning on land is more often adopted in small-medium farms (less than 5 hectares) than in larger farms, maybe because it is easier in such case to control fire on land. Burning for energy in farms is more common in farms with Uaa less than 10 hectares, whereas disposal in water bodies is higher in farms with Uaa less than 5 hectares.

TABLE 5.10 **Response rate on sample size to question on vegetal residues management computed by Uaa classes - Year 2003** *(area in hectares)*

| UAA CLASSES | Answers given | Incineration for energy | Incineration on soil | Land treatment | Disposal in water bodies | Composting | Other treatment |
|---|---|---|---|---|---|---|---|
| | n. | % | % | % | % | % | % |
| Less than 1 | 1,593 | 7.6 | 39.5 | 42.6 | 0.3 | 8.6 | 1.4 |
| 1 – 5 | 2,827 | 7.7 | 33.3 | 49.0 | 0.2 | 7.7 | 2.2 |
| 5 – 10 | 1,390 | 7.5 | 24.5 | 59.9 | 0.1 | 4.5 | 3.5 |
| 10 – 20 | 1,490 | 5.2 | 21.9 | 64.5 | 0.1 | 3.3 | 5.0 |
| 20 – 30 | 771 | 4.3 | 20.6 | 68.0 | 0.1 | 3.2 | 3.8 |
| 30 – 50 | 842 | 3.6 | 17.3 | 70.8 | 0.0 | 3.1 | 5.2 |
| 50 – 100 | 769 | 2.1 | 12.5 | 77.5 | 0.0 | 2.2 | 5.7 |
| More than 100 | 866 | 2.5 | 14.0 | 75.2 | 0.0 | 3.0 | 5.3 |
| **TOTAL** | **10,548** | **5.9** | **26.2** | **59.0** | **0.1** | **5.3** | **3.5** |

*Source:* Istat, Farm structure survey 2003

In 2003 also treatment facilities installations existing at farm level were investigated. The survey revealed (Table 5.11) that, in stockfarms with treatment facilities operating on dejection storage installations for bio-organic materials (which account for 9,703 respondents holdings), it is common to have none treatment facility (87.7 percent holdings over total stockfarms with storage installations) and more than one kind of storage installations for bio-organic material (37.8 percent holdings over total

stockfarms). Furthermore physical treatment is the most widespread technique (7.9 percent of stockfarms), whereas dejections are stored mainly as solid manure (35.8 percent of holdings) - when the storage facility is of only one type -.

**TABLE 5.11 Farms with dejection storage installations and treatment facilities computed on sample size base - Year 2003** *(%)*

| TREATMENT FACILITY | With only one storage type | | | | With more than one storage type | TOTAL |
|---|---|---|---|---|---|---|
| | Solid manure | Slurry manure | Liquid manure other than slurry | Other material | | |
| None | 34.4 | 18.3 | 2.2 | 2.2 | 30.6 | **87.7** |
| Depuration | 0.3 | 0.4 | 0.0 | 0.0 | 0.2 | **0.9** |
| Aeration | 0.1 | 0.9 | 0.1 | 0.0 | 0.4 | **1.5** |
| Physical treatment | 0.9 | 1.5 | 0.1 | 0.0 | 5.5 | **7.9** |
| More than one | 0.2 | 0.6 | 0.0 | 0.0 | 1.1 | **2.0** |
| **TOTAL** | **35.8** | **21.7** | **2.4** | **2.3** | **37.8** | **100.0** |

*Source:* Istat, Farm structure survey 2003

### *5.1.2 Agriculture census*

Surveys conducted at farm level can collect figures on some specific phenomena or information on behaviour and practices adopted by farmers.

Agriculture census 2000 questionnaire was integrated with question on issues of environmental relevance. Among others a specific question was posed on actual destination of residues of bio-organic nature, inluding - among others - vegetal residues and manure (Table 5.12). The different possible uses identified in this question were: sale, land treatment and composting, and other destination. At national level the response rate is 25 percent of the total farms investigated. Nevertheless a wide variability among regions occurred ranging from 56 percent of Friuli-Venezia Giulia (followed by Veneto with 55 percent, and Lombardia with 49 percent) and 11 percent recorded for Puglia and Calabria (followed by Sardegna 12 percent, and Sicilia 14 percent).

Among these farms, 11 percent chooses more than one modality to use or dispose the bio-organic residues, the rest declared to use only one modality. The most common of them revealed to be the land treatment operation, chosen by 71 percent of the farms; sale is a habit for 2 percent of the farms. A further investigation should clarify what is the actual destination when *other destination* is declared, which accounts for 16 percent of the total farms giving an answer.

**TABLE 5.12 Holdings recovering or disposing bio-organic residues per kind of treatment – Year 2000**

| REGIONS | Total surveyed holdings | Holdings applying only one treatment | | | Holdings applying more than one treatment |
|---|---|---|---|---|---|
| | | Sale | Land treatment and composting | Other treatment | |
| Piemonte | 120,965 | 1,379 | 31,794 | 2,169 | 7,100 |
| Valle d'Aosta | 6,595 | 4 | 1,473 | 381 | 359 |
| Lombardia | 74,867 | 862 | 27,803 | 914 | 6,983 |
| Trentino - Alto Adige | 61,253 | 144 | 11,713 | 801 | 1,499 |
| Veneto | 191,085 | 1,680 | 86,015 | 2,548 | 14,599 |
| Friuli - Venezia Giulia | 34,963 | 200 | 16,667 | 248 | 2,533 |
| Liguria | 44,266 | 60 | 10,668 | 1,973 | 1,528 |
| Emilia - Romagna | 107,888 | 3,386 | 34,418 | 5,437 | 9,702 |
| Toscana | 139,872 | 413 | 23,350 | 8,562 | 3,120 |
| Umbria | 57,153 | 80 | 8,016 | 2,072 | 1,005 |
| Marche | 66,563 | 1,561 | 21,259 | 963 | 2,113 |
| Lazio | 214,666 | 509 | 20,792 | 8,172 | 2,429 |
| Abruzzo | 82,833 | 213 | 16,447 | 7,614 | 2,658 |
| Molise | 33,973 | 42 | 6,676 | 1,696 | 994 |
| Campania | 248,932 | 567 | 63,734 | 3,914 | 3,768 |
| Puglia | 352,510 | 463 | 19,914 | 15,863 | 2,274 |
| Basilicata | 81,922 | 165 | 9,382 | 2,107 | 390 |
| Calabria | 196,484 | 285 | 18,863 | 2,508 | 713 |
| Sicilia | 365,346 | 1,323 | 16,375 | 29,555 | 3,820 |
| Sardegna | 112,689 | 740 | 6,761 | 4,684 | 1,195 |
| **ITALY** | **2,594,825** | **14,076** | **452,120** | **102,181** | **68,782** |

*Source:* Istat, Agriculture census 2000

### *5.2 An existing data source: the Compulsory waste declaration*

Since 1996 the Italian administrative source on waste by means of the *Compulsory waste declaration* (Mud) collects data related to municipal waste and waste produced by economic activities.

Every year, all Italian municipalities and local units producing and/or managing waste (defined in article 11 of decree n. 22/97) have to fill in the above mentioned questionnaire and send it to the Chamber of commerce of their competent area. The questionnaires, containing information related to the previous calendar year, must arrive not later than the 30$^{th}$ of April of each year. The construction and demolition waste are excluded from this declaration, following article 11 of decree n. 22/97. Anyway data about construction and demolition waste are computed by a specific study of Apat.

The subjects obliged for the Mud reporting, as established by the article 11, comma 3 of legislative decree 22/97, are:

— whoever performs, professionally, waste collection and waste transport activities;
— waste traders and intermediaries;
— whoever performs recovery and/or disposal operations;
— companies and agencies that produce hazardous waste;
— companies and agencies that produce non-hazardous waste (as specified in article 7, comma 3 of the decree 22/97) deriving from: industrial activities, craft sector activities, waste recovery and disposal activities, sludge from the purification and other water treatments, sludge from the wastewater treatment and from emission abatement.

From this obligation are excluded:

— farmers (according to the article 2135 of Civil code) with an annual business volume not larger than 7,800.00 euro;
— concerning the non-hazardous waste production, small craft enterprises (according to the article 2083 of the Civil code) with three employees at most.

The producers of non-hazardous waste (according to the article 7, comma 3, of the legislative decree 22/97), related to the following categories are excluded too:

— agricultural waste;

— construction and demolition waste;
— waste generated by trade activities;
— waste generated by service activities;
— waste generated by hospital and health care activities;
— obsolete machinery and mechanical components;
— end-of-life vehicles, trailers and similar;
— refuse derived fuel.

For economic activities, statistical units are Local unit and data are available for sections, divisions, groups and classes of Nace Rev. 1.

The Mud questionnaire is composed of different sheets that the different obliged subjects have to fill in.

There is a first part that all obliged subjects (municipalities and local units) have to fill in. This first part includes *general information* like: tax number; name and address (for local unit or municipalities); Nace code for local unit (the Nace code refers to the prevalent activities in a certain local unit) and number of employees for local unit.

For economic activities producing waste, following the *general information* section, a particular *waste section* is provided.

For every waste, according to LoW starting from 2002, the subjects have to declare the quantity of waste which has been produced inside the local unit or received by others. Moreover the quantity of waste sent for recovery or disposal has to be reported. The subjects have also to declare if the recovery or disposal activities are carried out in the local unit itself.

If this source is used, we'll have information about waste generation from the waste collection side (as regards household waste), from waste treatment side (as treatment facilities have to fill in the questionnaire with reference to amount of waste received) and from the waste generation side (as local unit have to report the amount of waste produced). All these information are available by Nace codes and waste categories.

Referring to agriculture sector, we have to stress that some local units are not required to fill in the questionnaire. This is the case for agricultural farmers with a turnover lower than 7,800.00 euro. Moreover, agricultural farmers with a turnover larger than 7,800.00 euro have to fill the questionnaire only if they produce hazardous waste. Anyway the analysis of data coming from Mud shows that these agricultural farmers declare any kind of generated waste.

Referring to fishing, also port authorities are required to fill in the questionnaire with reference to ship-generated waste and delivered to port reception facilities (following Directive 2000/59/Ec).

Starting from 1997, in the yearly *Rapporto rifiuti* (Apat, Onr) an aggregate value for the total waste produced by the Agriculture, forestry and fishing sectors is provided. The total amount (hazardous and non-hazardous) of waste declared in Nace A and Nace B, in 1999, 2000 and 2001, is of 328,000, 347,000 and 432,000 tonnes respectively. The hazardous waste represents around the 2 percent of the total amount. Anyway the lack of accuracy of these data is certain due to the coverage of Mud for agricultural farms. As these data are very partial, this administrative source seems to be not useful to fulfil the requirements of WStatR.

Another source of information, that might become available in the next future is the emission inventory that became mandatory through the Ippc Directive (96/61/Ec - applied in Italy through the national decree 372/99) in order to reduce polluting gas emission to air, soil and water. Data about emissions are collected through the Mud starting from reference year 2002[24].

Information required refers to structural installation characteristics and to treatments adopted to reduce pollution risk at enterprise level. Enterprises can be classified as Ippc installations if they run one of the economic activities listed in Annex I of Directive 96/61/Ec.

Referring to Nace A sector, intensive stock farming of swine or poultry can be classified as Ippc activity, depending on size of stock bred whether they overcome the following identified thresholds on size of stock bred:

a) 40,000 stable posts for poultry;
b) 2,000 stable posts for swine production (weight more than 30 kilograms);

[24] The Dpcm 24 December 2002 is divided in two sections: the first one is devoted to waste, while the second one is about emissions. The declaration form related to emissions has been prepared jointly by Apat and the Research centre for animal production. Information required to fill in this form were defined according to the variables necessary to run an algorithm (Fabbri et al., 2004) to calculate ammonia and methane emission in different steps of manure management, by application of the best available technologies in intensive livestock farming. Starting from phosphate, nitrogen and organic matter excreted by animals, feeding strategies, designs of floors and manure management in the different housing system, on-farm treatments, type of storage, applying manure methods are taken into account to calculate mentioned emissions. Livestock heads per category and specie, structural housing characteristics, stored dejection volume, and several other basic parameters are thus necessary inputs of the calculation. This algorithm has been tested in several conditions and will be used electronically for the declaring farmer form.

c) 750 stable posts for sows.

Other economic activities related to Nace A and B sector can fall under this classification as slaughtering activity, treatment and processing for food product production, treatment and processing of milk and treatment plants to process carcasses and other animal residues. Specific thresholds have been identified for each activity.

The emission declaration includes four different sets of information:

— I part: identification of the settlement and of emission source activity;
— II part: emission to air;
— III part: emission to water (only for disposal in surface water after in-site depuration);
— IV part: emission to water after off-site depuration (not obligatory).

All this information will be recorded first at national level and than at european level in the European pollutant emission register.

The communication has to be sent by stockfarms classified as Ippc installation, and declaration of emission to air is mandatory when the superior air emission limit of 100 tonnes per year for methane and 10 tonnes per year for ammonia is overcome (even if only one pollutant results to be above the limit).

Thus it is evident that basic information that might become available from this declaration can help in figures calculation for WStatR purpose or to deepen studies on manure management. Nevertheless, this aspect of Mud can be evaluated only in the next future, with the analysis of the first results.

### *5.3 Estimation methodologies*

Inside official statistics, different Istat sectors work on and get estimates of materials that are included in the present study. National accounts activities are related to the assessment of coefficients necessary to estimate some economic activities (olive grinding process, wine making process…), while the Environmental national accounts activities are related to the set up of material flow balances.

Apat also for its institutional role promoted several sector studies on waste and by-product generated in agriculture.

In the following some estimation approaches will be described. Also coefficient grids are provided even if it would be necessary to deepen on the procedures implemented to estimate them.

In general terms, it would be a good statistical practice to verify through other statistical tools such as data collection the used estimation methodologies, so that estimators can be checked elsewhere.

Furthermore, an approach of waste generation estimation is presented for plastic waste, based on data collected through Farm structure survey.

### *5.3.1 National accounts activity*

From National accounts activity some elements can be drawn in order to understand how residuals can be estimated. A simple mathematical estimation procedure can be applied utilising a coefficient, which expresses the amount of the residue generated per unit of weight of the product.

Coefficients are available for calculation of some cereals straws (wheat, rye, barley, oats, and rice). The amount of straw produced is calculated by applying the coefficient reported to the harvested product. This material, depending on demand at local level**,** is used for animal feeding, for stable, in composting processes.

Referring to product processing activity, oil olive grinding and wine making can be relevant in terms of generation of waste.

A coefficient is applied by National accounts to quantify the actual amount of olive residues from grinded olives figures. This value may vary among years depending largely on pedo-climatic conditions. Basic data are available through an Istat survey on olive oil production. Figures are compiled by technicians that estimate at local level (provinces, corresponding to Nuts III level) the amount of grinded olives. Some ancillary data as olive residues processed by manufactures might be used for data validation in the estimation procedure of olive residues. The amount of olive residue produced is calculated by applying the coefficient to the grinded olives. It has to be underlined that not all the total oil produced is appropriate (good) for human nutrition, in fact a certain amount needs to be processed since its acidity grade overcomes the threshold value of 4 percent, thus processing is required to obtain edible oil.

The other case analysed is related to wine making process. Similar procedure is applied for the calculation of marc and cream of tartar, which are wastes generated in wine making process. The coefficients applied to total amount of grape designated to processing are known. Basic data on processed grapes are available through an Istat survey on wine production. Figures are compiled by technicians that estimate at local level (provinces, Nuts III level) the amount of grapes designated to processing for wine making purpose.

### *5.3.2 Material flow accounts*

Two relevant activities are carried out in the framework of Material flow accounting (Mfa) activities in Istat: calculation of unused quantities of harvested biomass and of manure generated by livestock.

#### *5.3.2.1 Unused quantities of harvested biomass*

Along with useful (marketed) products, plants biomass is harvested or otherwise intentionally moved by man, which is not intended for further transformation, but left on the soil or otherwise disposed of. The quantities of this unused biomass harvest are estimated on the basis of a set of coefficients[25], calculated *ad hoc* for the needs of the pilot development of complete material balances and indicators, according to Eurostat guidelines.

As far as agriculture is concerned, the unused materials extracted consist in the parts of plants which are not harvested, but remain on the ground and are ploughed back into the soil, in order to restore its organic material endowment, which is directly correlated to agronomic fertility.

No data on actual weight of unused flows are directly available. It was therefore necessary to device an estimation procedure. For both, agriculture and forestry activities, the estimate has followed a two-steps procedure, with the use of two groups of coefficients. The coefficients of the first

[25] Macrì A. in Femia (2003). As far as the overlapping with the previous set of coefficients on straw production used on National accounts activity is concerned, operations for the harmonisation are currently underway.

group transform in dry weight the used materials removed (the quantities included in Direct material input - Dmi), which are reported in statistics on harvested products in terms of total weight at the time of harvest; the ones in second group allow to calculate, starting from harvested products' dry matter thus calculated, the connected flows of unused materials, again in terms of dry matter.

The choice of accounting these flows in terms of dry matter was imposed by the fact that the data available in literature usually concern dry matter contents of used and unused parts of the plants when they are ready to be harvested. In many cases it was possible to derive from these data the ratios which have been applied to account for unused materials starting from used ones. Transforming dry weight of unused materials into actual weight was not considered a viable option because of the degree of uncertainty that this operation would introduce in the procedure and for the lack of appropriate parameters in most cases as well. Also a direct estimation of actual values (weight) of unused material flows resulted not feasible, again for the lack of an adequate number of data and parameters.

For these materials a specific coefficient has been determined for each product/crop; the estimation of these coefficients has been relatively easy; indeed, data on water content of agricultural products at the time of harvest are calculated on the basis of repeated laboratory tests and released by various institutions (universities, research centres, and etcetera).

The list of coefficients presented in the table below is a combination of two sets of coefficient (Table 5.13):

- the first one referring to dry matter content of harvested product expressed as percentage where each one represents a "reasonable" average resulting from series of different data issued by different sources (publications, technical, agronomic or nutritional handbooks);
- the second one giving dry matter ratios between agronomic residue and agricultural product (e.g. straw/grain). The estimation of this second group of coefficients relies on values published in technical manuals. In some cases, these values, taken as basic reference, have been weighted with data released by various institutions (universities, research centres, and etcetera) and related to agronomic productivity in the major national agricultural areas: in this way the coefficients can take into account also the existing differences between the major cultivars adopted in the different climatic regions of

Italy (e.g. high/low size cultivars). It was thus possible in these cases to quantify the residues to be accounted for each unit of useful product, so these values mostly represent a weighted average value of the discarded by-products generated by all crops included in the same category.

The coefficients relating to fruit trees' residues take into account only the residues resulting from harvesting operation, since in this case the part of the plant which has not been harvested is not physically separated from the soil and therefore does not represent a crop residue but a productive capacity for the year to come.

For some items such as wheat, barley and oat, the assumption was made that only half of the total vegetal residue is left on soil, while the rest is used in livestock breeding activities or composted, which means that the related coefficients presented in the table represent half of the actual residue/product ratio.

Ancillary information coming from other sources might be used for improving the estimation of the percentage left on soil.

Similar estimation procedure is used for forestry. Forestry unused flows consist in minor branches and leaves remaining on the ground after cutting down the trees.

For wood felled and removed from forests and outside forests the coefficients used by Un and Fao to account for forests' biomasses, as reported in the global Forest resources assessment 2000 were adopted for Mfa purpose. These coefficients express wood biomass in terms of dry matter per cubic meter; when applied to wood removals statistics they allow to take into account wood biomass contained in the trunk and in the major branches of the tree. Distinct coefficients have been adopted for coniferous and non-coniferous species.

The coefficients relating to the ratio *residues/wood removals* have been estimated on the basis of losses' modal value of the years between 1991 and 2000 and have been issued distinctly for coniferous (percentage of harvested product dry matter 0.42; unused/used 0.09) and non-coniferous species (percentage of harvested product dry matter 0.56; unused/used 0.04). They result from the time series of residues provided by Istat's survey on wood removals. These coefficients allow, when applied to dry weights of removed wood, to account for processing losses resulting from felling and removing operations.

**TABLE 5.13 Unused dry matter/used harvest as such coefficients** *(weight/weight)*

| CROPS | Coeffi-cients | CROPS | Coeffi-cients | CROPS | Coeffi-cients |
|---|---|---|---|---|---|
| HERBACEOUS CROPS | | e) VEGETABLE CROPS | | ……. | |
| | | *e.1) in open air* | | *e.2)In greenhouses* | |
| a) CEREALS | | Fresh broad bean | 0.22 | Beet | 0.00 |
| | | Fresh bean | 0.38 | Fennel | 0.01 |
| Wheat | 0.67 | Fresh pea | 0.22 | Endive | 0.00 |
| Rye | 1.65 | Garlic | 0.00 | Lettuce | 0.00 |
| Barley | 0.63 | Beetroot | 0.24 | Chicory | 0.00 |
| Oats | 0.54 | Carrot | 0.02 | Parsly | 0.00 |
| Rice | 1.22 | Onion | 0.02 | Sedano | 0.00 |
| Maize (grain) | 1.45 | Leek | 0.02 | Spinach | 0.00 |
| Sorghum | 1.66 | Turnip | 0.05 | Valerian | 0.00 |
| Triticale | 1.96 | Radish | 0.01 | Cucumber | 0.05 |
| | | Asparagus | 0.01 | Watermelon | 0.01 |
| b) LEGOMINOUS CROPS (FOR GRAIN) | | Beet | 0.00 | Strawberry | 0.01 |
| | | Hartychock | 0.00 | Eggplant | 0.04 |
| | | Cabbages | 0.01 | Pepper | 0.04 |
| Broad bean | 0.94 | Cauliflower | 0.01 | Tomato | 0.03 |
| Bean | 1.17 | Lettuce | 0.00 | Melon | 0.02 |
| Pea | 1.45 | Chicory | 0.00 | Squash | 0.03 |
| Chick – pea | 1.60 | Parsley | 0.00 | | |
| Lentil | 1.87 | Spinach | 0.00 | FORAGE | |
| Lupin | 1.87 | Cucumber | 0.04 | For forage | 0.00 |
| | | | | For seed (Lucern, Sainfoin, | |
| Vetch | 1.87 | Cucumber (for pickles) | 0.03 | *Trifolium sps, etc.)* | 0.90 |
| | | Watermelon | 0.01 | | |
| c) TUBER CROPS | 0.31 | Strawberry | 0.03 | AGRICULTURAL TREES | |
| | | Eggplant | 0.04 | a) VINE | 0.01 |
| d) CROPS FOR INDUSTRIAL PROCESSING | | Pepper | 0.04 | | |
| Sugar beet | 0.07 | Tomato | 0.03 | b) OLIVE | 0.03 |
| Tobacco | 0.04 | Melon | 0.02 | | |
| Flax | 0.00 | (Squash) | 0.03 | c) CITRUS TREES | 0.01 |
| Cotton | 3.20 | Mushrooms | 0.00 | | |
| Peanut | 1.49 | | | d) FRUIT TREES | |
| Colza | 1.37 | *e.2)In greenhouses* | | Apricot, Cherry, | |
| Sunflower | 1.65 | Fresh bean | 0.38 | Peach, Nectarine, | |
| Mustard | 1.47 | Fresh pea | 0.22 | Plum, Apple, Pear, | |
| Sesame | 2.37 | Beetroot | 0.20 | Fig | 0.01 |
| | | | | Kiwi, Indian fig, | |
| Soya – bean | 1.42 | Carrot | 0.02 | Pistachio | 0.00 |
| | | Radish | 0.01 | Pomegranate | 0.01 |
| | | Asparagus | 0.00 | Almond | 0.05 |
| | | Basil | 0.00 | Hazelnut | 0.05 |

### *5.3.2.2 Manure*

The manure generated in livestock breeding has been estimated by using a selection of available manure production coefficients (Table 5.14), drawn from a review of case studies[26].

**TABLE 5.14 Quantity of liquid and solid manure generated per live weight unit and animal specie and category**

| ANIMAL SPECIES AND CATEGORY | Liquid manure | Solid manure | Animal average weights |
|---|---|---|---|
| | *l/100 kg l.w.*day* | *kg d.m./100 kg l.w.*day* | *[kg]* |
| CATTLE (buffaloes included) | | | |
| Dairy cattle | 8.2 | 1,10 | 650 |
| Other cattle | | | 399 |
| LESS THAN 1 YEAR | | | |
| Calf | 5.0 | 0.50 | 125 |
| Other | 5.6 | 0.82 | 270 |
| 1 - 2 YEARS | 6.8 | 0.82 | 400 |
| MORE THAN 2 YEARS | 8.2 | 1.05 | 650 |
| Buffaloes | | | |
| Dairy buffaloes | 8.2 | 1.05 | 650 |
| Other buffaloes | 5.6 | 0.74 | 300 |
| SWINE (all categories included) | | | |
| SOW | 12.5 | 0.53 | 160 |
| Less than 20 kg | 2.5 | 0.73 | 15 |
| Other | | | |
| 20 - 50 kg | 7.0 | 0.35 | 50 |
| Fattening | 11.0 | 0.44 | 100 |
| Boar | 8.0 | 0.53 | 160 |
| OVINE ANIMAL | | | |
| Sheep | 4.0 | 0.44 | 50 |
| Other | 1.2 | 0.13 | 15 |
| CAPRINE ANIMAL | 3.5 | 0.38 | 43 |
| EQUINE ANIMAL | 13 | 1.18 | 528 |
| POULTRY | | | |
| Broilers | 4 | 1.08 | 1.0 |
| Laying hens | 6 | 1.50 | 2.0 |
| Other poultry | 3 | 0.59 | 3.9 |
| RABBIT | 7.5 | 1.50 | 1.6 |

[26] Anpa, Ctn - Rif. *I rifiuti del comparto agricolo*. Roma: Anpa, 2000.

This estimated features as output item in a material flow balance of Italian livestock breeding activities, developed in order to asses the extent to which the available different data referred to inputs and output match, and identify areas of major need for improvement.

The results obtained on inflow and outflow roughly matches, validating the estimation activity, even if improvements in the data about some of the phenomena under observation might be necessary. The coefficients, reported in the table, refer to the quantities of liquid and/or solid manure generated per live weight unit, according to animal species and category; also reported is the average weight by kind of animal applied to the surveyed number of animals in order to obtain total live weight by kind of animal.

### *5.3.3 Sector studies for waste estimation*

The data base arising from Mud declaration has limits for waste generated and managed in Agriculture, forestry and fishing economic sectors that oblige to verify a different data compilation strategy. Apat activity on this issue has been a basic reference, for the purpose of this study. Apat provided a document on implemented estimation methodologies in order to quantify by-products and waste generated in agriculture, valuating existing data bases and registers.

First report on sector studies carried out referring to the mentioned economic sectors was published jointly with *Rapporto rifiuti 2001*[27], in Annex A3, and an updated version is in progress. Information presented here comes from different Apat publications[28].

Studies carried out focus on the materials considered to be the most relevant either for their nature (the hazardous ones) or for the amount generated, or - lastly - for their specificity to the economic sector considered. Thus the materials involved are:

— waste generated for utilisation of vehicles (used motor oils, end-of-life batteries, oil filters and air filters in oil bath, end-of-life tyres, end-of-life vehicles and their dismantling parts);

27 Anpa, Onr. *Rapporto rifiuti 2001*. Roma: Anpa, Onr, 2001.

28 Anpa, Ctn - Rif. *I rifiuti del comparto agricolo*. Roma: Anpa, 2000; Anpa, Onr. *I rifiuti del comparto agroalimentare - Studio di settore.* Roma: Anpa, Onr, 2001. (Collana Rapporti 11/2001); Apat, Onr. *Rapporto rifiuti 2003*. Roma: Apat, Onr, 2003; Apat. *Metodologie di stima per la quantificazione dei rifiuti prodotti dal settore agricolo*. Roma: Apat, 2004.

— waste generated from utilisation of inputs such as plant protection products, fertilisers, seeds, focusing on container discharged because empty or containing expired substances;
— plastics waste (different from packaging), mainly plastic films and other polyethylene materials;
— vegetal residues.

Methodology applied to quantify the generated waste involves the calculation of the final discharged amount of material starting from the amount of good used in the process, and taking into account the dispersion factors and the modifications undergoing due to the use itself. In other cases the methodology involves the simple estimation of coefficients that can be applied to the products or to the factors used in the productive process (i.e. the cultivated area). Once defined such coefficients and knowing basic statistic data on production or on agricultural land, it is possible to calculate the waste generated for the territorial level for which the data are available.

In the following a rough description of the waste calculation methodologies in use is given per waste category.

### WASTE GENERATED USING MACHINERY FOR AGRICULTURE

Basic data on mechanisation in agriculture used for the calculation are available at the Ministry of Agriculture and forestry policies and National union of firms building machinery for agriculture (Unacoma). Most recent available data refer to year 1998, so that for the following years an estimation based on the annual vehicles registered has been adopted. Nevertheless for most of the vehicles used in agriculture registration is not mandatory, so that quantification can be affected by errors. In fact registration for vehicles is mandatory only for machinery using fuel with reduced taxes (registered by specific regional offices - ex Uma) or running on roads (registered by Ministry of Infrastructure and transports). For other kind of vehicles only estimation based on sale data and on the amount presumably discharged is possible.

For used oils, discharged filters and end-of-life tyres - even if separated collection takes place - figures generated by collectors are not suitable to estimate the amount of waste generated from a specific sector.

*Vehicles and equipment*

As regards agriculture machinery, it has to be stressed that even if they are not usable in fields anymore in many cases they are not discharged from farms, thus representing only a potential but not an actual waste. These figures are not estimated. For those not registered - usually the ones without engine -, their estimation can be done only from other figures available, and information collected through last Agriculture census on machinery used for fertilisers and plant protection products spreading can be used as ancillary data.

Two different approaches are described for machinery with engine and without engine.

The estimation methodology applied to the ones with engine is based on the assumption that the fleet park is stable - only substitutions of machinery take place - and that the discharge rate is constant, at least in the short period. Thus starting from vehicles discharge occurred in year 1998, it is possible to calculate the vehicles discharged in 2003, knowing the fleet park registered for year 2003.

The total discharged weight can be thus calculated using the Agrimach data base (run by the Center of research on animal production - Crpa) containing information on specific machinery weight.

The estimation of discharged machineries without engine is more complex due to lack of an official register. The methodology implemented starts from figures on total sold machineries, from which the ones with engines are subtracted.

Thus the discharged amount is considered to be equal to the one sold on market.

*Discharged lead batteries*

The estimation procedure applied takes into consideration the number of circulating machinery with electric start having installed lead battery. In fact, despite the fact that both lead and Ni-Cd batteries can theoretically be used for such purpose, only lead batteries are installed on such machineries. The battery lifetime is estimated in three years time. Furthermore, technical information on installed battery characteristics coming from building firms is utilised.

Thus, the information on circulating machineries with electric start, the battery weight per category and their lifetime are the basic parameters used to estimate the total discharged amount.

*Used motor oils*

Methodology applied to calculate used motor oil is here described. The estimation procedure refers to oil used as a whole not distinguishing between different oil typologies.

Basic assumption is that one cubic decimetre of diesel engine power, develops - on average - 16 kilowatts of power and 2.5 cubic decimetres of oil are necessary. Thus 0.141 cubic decimetres of oil are used for each kilowatt.

The total amount of used oil is obtained multiplying the total power of machineries with engine for the mentioned coefficient (0.141 cubic decimetres of oil per kilowatt), considering that oil change takes place every 150 hours and that, on average, machineries are supposed to be in use for 200 hours per year.

Oil used for transmission and hydraulic power lift is calculated considering that each cubic decimetre of power requires from 10 to 15 cubic decimetres of oil.

As regards the fleet park taken into consideration for total oil amount calculation, only tractors and combine harvester are included, as are the ones with hydraulic installations. In this case oil change is considered to be done every 1,200 hours and the machinery is used - on average - for 200 hours per year.

*Lubricating oil filters*

Estimation procedure is based on the assumption that filters are changed every three oil changes, which corresponds to 450 hours of machinery use.

*Air filters in oil bath*

Air filters technology changed during time. Lately air filters function in

oil bath. Data arising from Agriculture census (year 2000) permit to distinguish from vehicles aged more or less than 10 years. The ones with more than 10 years are assumed to use only dry air filters, whereas the ones with less than 10 years are assumed to install air filters in oil bath in 50 percent of the cases.

*End-of-life tyres*

Estimation of end-of-life tyres is done taking into account numbers and typology of tyres installed, tyres weight, tyres lifetime and amount of rubber consumed during tyre life (considered to be 30 percent of the original tyre weight).

Number of installed tyres is calculated on the basis of figures on fleet park (reference year 1998) to which trailers, estimated from registered vehicles, are added. Machineries are classified for driving power and, where information is available, for kind of traction (*drive*). In relation to machinery category, the typology of installed tyres is identified and knowing specific tyre weight, it is possible to quantify the total weight installed - excluding categories of machinery for which none information is available.

Referring to the relevance of these figures, the sector study revealed that tyres used in agriculture account for less than 5 percent of the total tyre weight discharged.

PLANT PROTECTION PRODUCT WASTE

The methodology includes the calculation of total amount of discharged plant protection product containers on the basis of containers sold on market, knowing container typology and related weight.

The assumption is that the container of the sold product becomes a waste during the same year and that there is little unused product, so that empty plant protection product container is a good proxy of the plant protection product waste generated.

Specific case studies conducted at local level (mainly regions or provinces) tried to develop a different approach to estimate discarded container figures. This procedure involves estimation of coefficient per hectare and specific cultivated crops. Nevertheless, the estimation has not been tempted at national level.

Referring to container characteristics, the sector study revealed that most of the containers (around 70 percent) are made of hard material whereas the remaining is soft. Almost 85 percent of the hard material is of plastic nature, the remaining is mainly mixed materials, both for hard and soft containers. On large majority (80 percent), the dimension of packages ranges from 250 grams to 1 kilogram weight. Furthermore, during the late nineties, the total amount of container discharged drastically reduced (by 35 percent from 1995 to 1999) due to the fact that chemicals were produced in a dry formula and that containers were hydro-soluble.

Agreements between agriculture professional association and selected collectors at regional level have been established lately. Situation might differ among regions. Main aim is to define containers management rules, in order to reduce contamination and pollution risk. One of the rules for correct management is to wash used containers in order to collect them separately and dispose as non-hazardous material.

### VETERINARY MEDICINES WASTE

Actual availability of data at farm or health institution level has not been assessed; nevertheless a case study in estimation procedure has been implemented. Figures on container of medicines used in stockfarming may vary a lot among species and kind of stockfarm. For dairy cattle, the generation of such material accounts on average for 700 grams per tonne of live weight per year, whereas in fattening cattle farming this value falls down to 57 grams per tonne of live weight per year.

### PLASTICS WASTE

Plastics waste estimation procedure is based on the marketed product (material of plastic nature used in farming activity) or on separated material collection. Figures on sold product arise from plastic material producers, whereas the ones on collection from the plastic collector *National plastic consortium*. These figures have to be integrated with data on fertilisers container also estimated on the base of the amount of marketed fertilisers.

The assumption is that the plastic discharged is equal to the amount sold every year.

### VEGETAL RESIDUES FROM CROP CULTIVATION

Since not direct statistical data are available on vegetal residues, estimation procedures have to be implemented. The residue calculation is done multiplying the harvested product for a coefficient, per single crop. The coefficient represents the amount of residue generated per unit of harvested product. These residues are usually left on soil, or used in stockfarms or in a different sector. The identification of these coefficients represents the critical step of the procedure since they can vary largely with crop variety, cultivation practices, pedo-climatic conditions, harvesting techniques, plant disease problems, and etcetera.

### PLANT-TISSUE WASTE

Besides plant residues generated in harvesting process, plant-tissue waste is also generated during trimming activity. Actual wood produced when tree life cycle is finished is generally used at farm level for energy production purpose, whereas brushwood and other small wood materials, generated with trimming operations, are usually burned on field borders.

Estimation methodologies to quantify such materials are available. The simplest method implies multiplying the product obtained by a coefficient, which expresses the amount of residue produced per unit of the plant product.

For grapes and olive trees a linear relationship to quantify wood from trimming operations was found:

$$\textit{Brushwood (t/ha)} = \textit{harvested product} * a + b$$

for grapes a = 0.113 and b = 2.0, whereas for olive trees these values change among regions, depending on several factors.

For other crops different coefficients are listed.

### WASTE GENERATED IN DAIRY PROCESSING ACTIVITY: WHEY

Whey generated in milk processing is directly related to cheese obtained. Whether *ricotta* cheese is not produced than whey is 6 times the amount of cheese produced, whereas when *ricotta* cheese is processed the ratio lowers to 5.

WASTE IN WINE MAKING PROCESS

Marcs are calculated as 18 percent of the wine produced in weight. Other solid residues from filtering operations consist of 6 percent of the amount of wine produced.

### *5.3.4 A proposal for an approach based on Farm structure survey data*

Data collected through Fss on some waste generation and management have been used to run an exercise to estimate plastic waste generation. In the following a proposal aimed at showing the strength and the weakness offered by the data collection method is presented. A similar approach can be used for the other types of waste observed by the survey (metal and pesticide waste).

It has to be stressed that any calculation refers to the sample farms previously described (paragraph 5.1.1.1), including the ones under the thresholds used for data comparison at european level. Results might differ from the official statistics released by Istat, due to the use of provisional sample weights slightly different to the definitive ones.

This approach can be summarized as follow:

— firstly a regression tree analysis is carried out to split the set of all respondents to question 59.1 into groups homogeneous with respect to plastic waste generation. The groups are defined on the base of a set of predictors selected among some structural characteristic of holdings observed by Fss;
— secondly, in each group and using the answer to question 59.1 the mean of plastic waste generation is estimated;
— finally, the amount of plastic produced in each region is obtained joining the means of the groups and the related population size (at regional level) estimated using Fss results.

The analysis of the plastic waste generation by farms has been carried out by Chaid methodology[29] and using as potential predictors some of the main structural variables collected by Fss.

[29] Electronic text book “statsoft” (http://www.statsoft.com/textbook/stchaid.html).

The acronym Chaid stands for *Chi*-squared automatic interaction detector. This name derives from the basic algorithm that is used to construct (non-binary) trees. When the dependent variable is continuous (as in the case of plastic waste generation) the result is called *regression tree*.

Chaid is based on an algorithm that can be summarized as follow:

— split any continuous predictors in classes with an approximately equal number of observations. For categorical predictors, the categories (classes) are *naturally* defined;
— cycle through the predictors to determine for each predictor the pair of categories that is least significantly different with respect to the dependent variable; for regression problems it computes a *F* test. If the test for a given pair of categories is not statistically significant, then it will merge the respective predictors categories and repeat this step (i.e., find the next pair of categories, which now may include previously merged categories);
— choose the split of the predictor variable with the smallest adjusted (Bonferroni) *p*-value, i.e., the predictor variable that will yield the most significant split; if the smallest adjusted *p*-value for any predictor is greater than a given *alpha*-to-split value, then no further splits will be performed, and the respective node is a terminal node;
— continue this process until no further splits can be performed (given the *alpha*-to-merge and *alpha*-to-split values).

The set of potential predictors used for this exploratory analysis contained:

— utilized agricultural area (hectares);
— general types of farming (8 classes accordingly with first digit of typology classification);
— fresh vegetables in open field (hectares);
— fresh vegetables under glass or other accessible protective cover (hectares);
— flowers outdoor (hectares);
— flowers under glass or other accessible protective cover (hectares);
— total arable land (hectares);
— vineyards (hectares);
— olive plantations (hectares);
— citrus plantations (hectares);

— fresh fruit and berry species of temperate climate zones (hectares);
— kiwi (hectares);
— nurseries (square meters);
— total permanent crops (hectares);
— total protected - under glass or other accessible protective cover - area (hectares);
— bovines (heads number);
— pigs (heads number);
— poultry (heads number);
— mulch area (hectares);
— irrigated area (hectares);
— area irrigated by dripping method (hectares);
— European size unit (Esu) (1 unit=1200,00 euro of total gross standard margin).

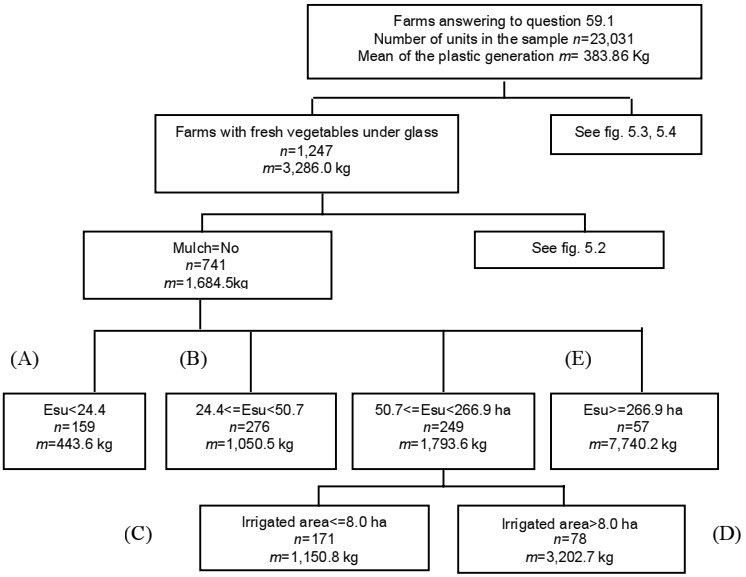
The result of the regression tree analysis is drawn in figures 5.1-5.4. It should be noted that Chaid identifies groups of farms on the basis of some characteristics linked to the plastic material used in farming activity. Structural characteristics refer to the presence in farm of the following: fresh vegetables under glass or other accessible protective cover, mulch area, irrigation, nurseries. Esu is also a parameter which affects plastic waste generation. It has to be underlined that mulch area is a variable not included in the standard Fss questionnaire, but introduced on voluntary basis in the national survey for its environmental relevance.

Referring to things of plastic nature, the list set up in a specific case study by Anpa and Onr[30] includes:

— sheet to cover greenhouses and tunnel;
— hard sheet for greenhouses;
— film for mulching;
— non-woven fabric;
— geo-membrane to proof;
— different kind of rope and strings to sustain crops and trees;
— harvesting nets (for olives, and etcetera);
— nets for trees protection;
— film for silage;
— tubes for different irrigation techniques.

[30] Apat, Onr. *Rapporto rifiuti 2003*. Roma: Apat, Onr, 2003.

**FIGURE 5.1** **Branch of the regression tree including farms characterized by: fresh vegetables under glass or other accessible protective cover and without mulch area – Year 2003** *(between brackets the code of terminal nodes)*




The results of previous figures are summarized in the following table 5.15. It should be noted that a better model could be easily obtained changing some parameters chosen in fitting the tree (number of levels below the root, number of units in each parent and child node, *alpha* level for *F* test, and etcetera). For example allowing 6 levels of the tree (instead of the 5 used in the present data analysis), Chaid find out that final group (Q) of figure 5.3 could be split using Esu and vineyards.

Nevertheless the present model gives some hints on the potentiality of the method. Assuming that it fits adequately the data we can see that the total plastic waste generated by the 2,224,860 farms is 92,714 tonnes. It should be reminded that such quantity is related to agriculture, and not to forests, selviculture and fishing activities; materials linked to activities not pertaining to agriculture, as agroindustrial activities, are excluded.

FIGURE 5.2 **Branch of the regression tree including farms characterized by: fresh vegetables under glass or other accessible protective cover and with mulch area – Year 2003** *(between brackets the code of terminal nodes)*

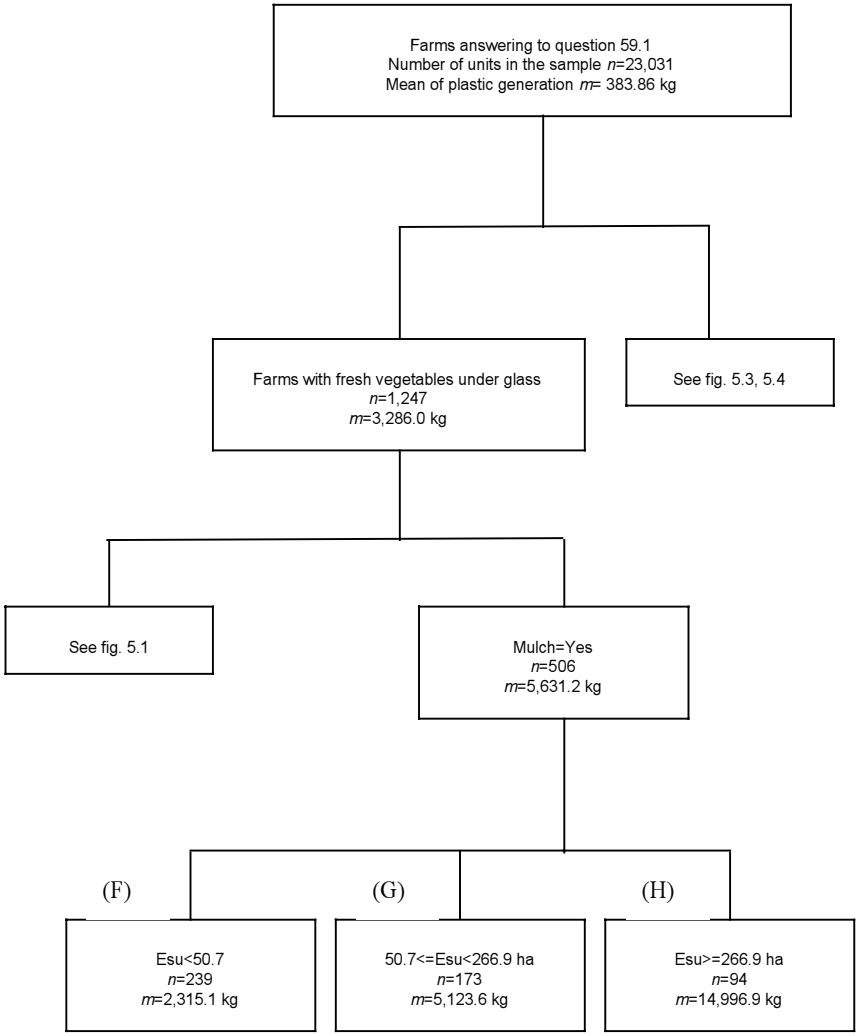


**FIGURE 5.3 Branch of the regression tree including farms without fresh vegetables under glass or other accessible protective cover and without mulch area – Year 2003**
*(between brackets the codes of terminal nodes)*

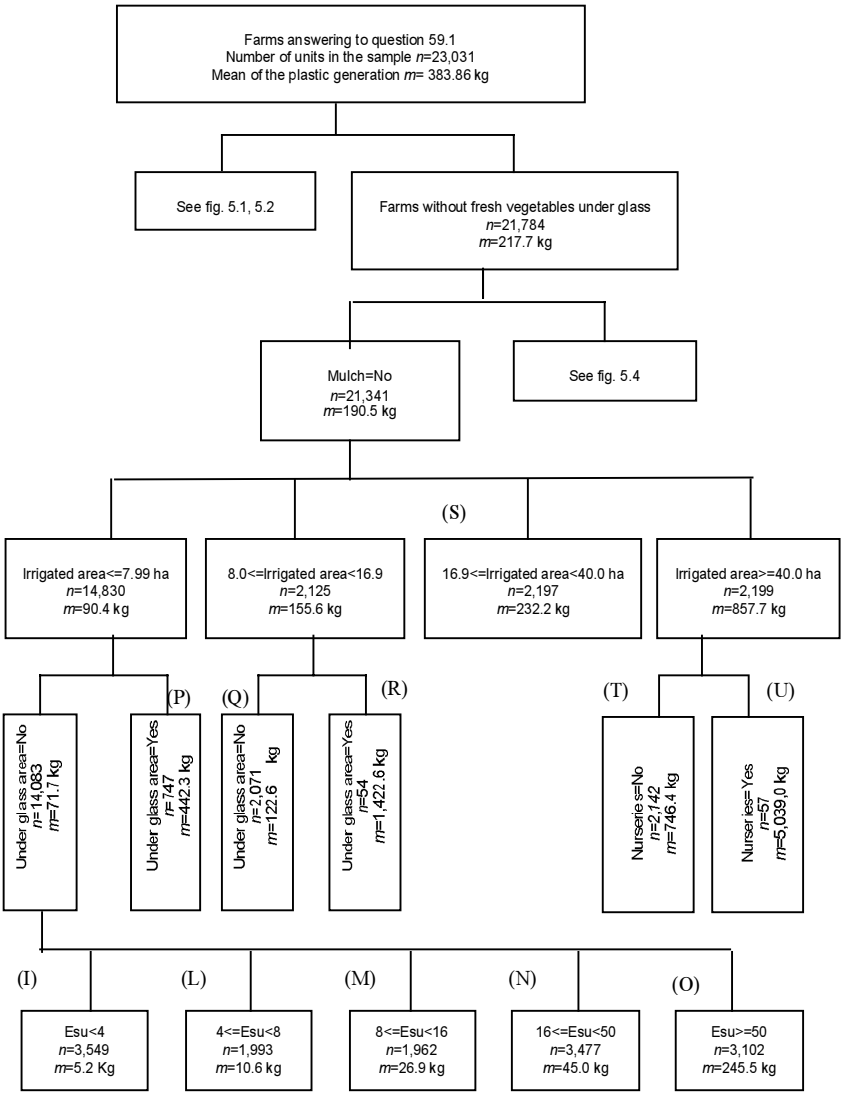
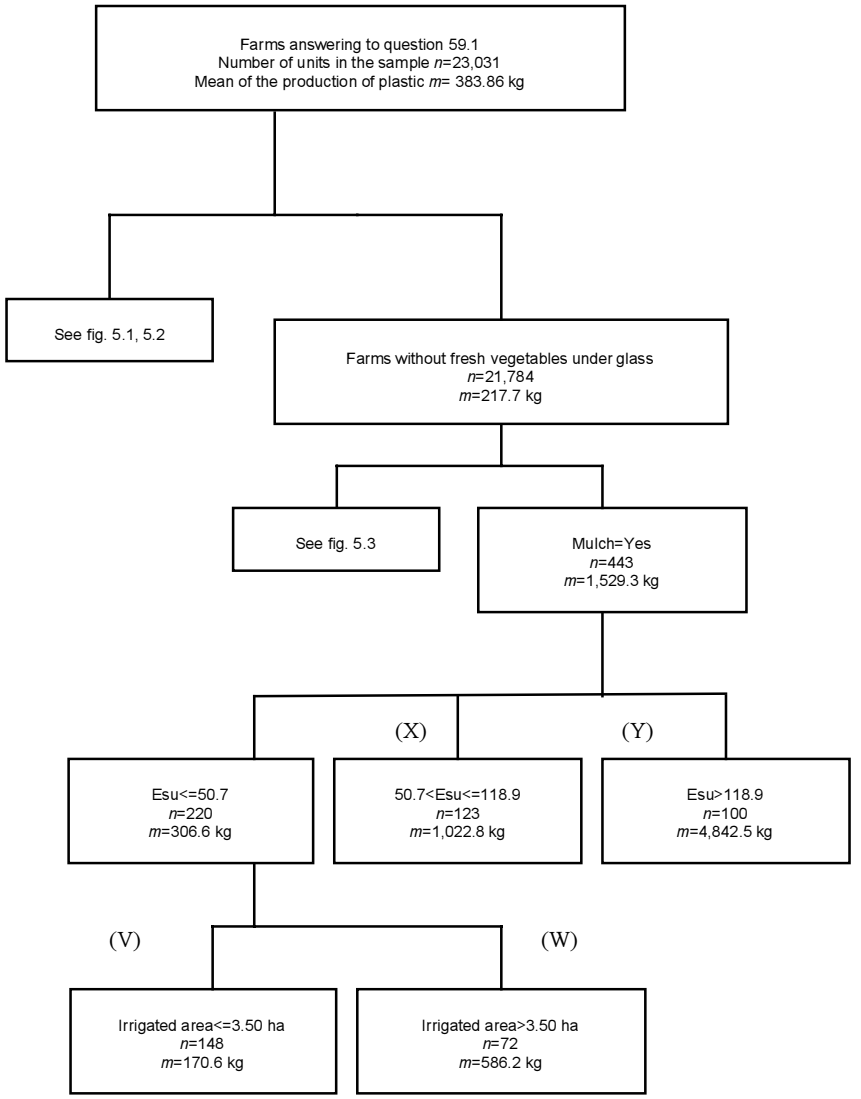


**FIGURE 5.4 Branch of the regression tree including farms without fresh vegetables under glass or other accessible protective cover and with mulch area – Year 2003**
*(between brackets the code of terminal nodes)*



The mean of plastic waste, generated by groups, ranges from a minimum of 5.25 kilograms - group (I) - to a maximum of 15 tonnes - group (H). The five higher estimated means of plastic waste generated by farms grouped on the base of some relevant characteristics related to plastic waste generation are:

- 14,997 kilograms for group (H) – Figure 5.2 – including farms characterised by fresh vegetables under glass or other accessible protective cover, with mulch, and Esu equal or higher than 266.9;
- 7,740 kilograms for group (E) – Figure 5.1 – including farms characterised by fresh vegetables under glass, without mulch, and Esu equal or higher than 266.9;
- 5,124 kilograms for group (G) – Figure 5.2 – characterised by fresh vegetables under glass or other accessible protective cover, with mulch and Esu lower than 266.9 and higher than 50.7;
- 5,039 kilograms for group (U) – Figure 5.3 – characterised by fresh vegetables under glass or other accessible protective cover, without mulch, with irrigated area equal or higher than 40 hectares and with nuseries;
- 4,842 kilograms for group (Y) – Figure 5.4 – characterised by farms without fresh vegetables under glass, with mulch, and with Esu higher than 118.9.

Farms belonging to group (I) show the lowest estimated mean and have diametrically opposite characteristics to those of group (H) (without fresh vegetables under glass, without mulch, with irrigated area lower than 8 hectares, without under glass area and with Esu lower than 4).

What becomes evident with these results is that the generated average of plastic waste is strongly dependent the presence or absence of protected cultivation, on Esu dimension (positive correlation), on the presence of mulch and on the size of irrigated areas.

The column of distribution of farms and plastic waste among groups shows:

- most of farms are concentrated in two groups, (I) and (L – including farms without fresh vegetables under glass, without mulch, with irrigated area lower than 8 hectares, without under glass area and with Esu between 4, included, and 8) that cover more than 80 percent of the total number of farms and 11.63 percent of the total plastic waste generated;

— the most influential group is the group (F) accounting for 17.22 percent of the total plastic waste. The farms inside this group includes 0.31 percent of the total number of farms, which are characterized by fresh vegetables under glass or other accessible protective cover, mulched area and dimension lower than 50.7 Esu;
— the group with the highest mean (H) contributes with 2.93 percent of the total generated plastic and represents the 0.01 percent on national total farms.

Table 5.16 is concerned with a regional analysis. It should be noted that northern regions and provinces (Piemonte, Valle d'Aosta, Lombardia, Bolzano, Trento, Veneto, Friuli-Venezia Giulia, Liguria and Emilia-Romagna) add to 22.75 percent of the farms but they generate more than 40 percent of the total plastic waste. The region with the major share in terms of plastic waste generation is Sicilia where are located about 14 percent of total farms generating about 16 percent of the total plastic waste. The influence of this region is confirmed by data contained in table 5.17. This table contains the distribution of the main predictors among regions.

**TABLE 5.15** **Mean by farm groups of plastic waste generation, Cv, number of farms , distribution of the farms among groups, total plastic waste generation, distribution of the total plastic waste among groups – Year 2003**

| CODE OF THE GROUP | Mean of plastic generation (kg) | Cv of the mean | Number of farms (a) | Distribution of the farms | Total generated plastic waste (t) | Distribution of plastic generation |
|---|---|---|---|---|---|---|
| (A) | 443.58 | 19.45 | 9,780 | 0.44 | 4,338.5 | 4.68 |
| (B) | 1,050.45 | 20.35 | 2,458 | 0.11 | 2,581.5 | 2.78 |
| (C) | 1,150.80 | 16.15 | 979 | 0.04 | 1,126.5 | 1.22 |
| (D) | 3,202.68 | 23.85 | 565 | 0.03 | 1,811.0 | 1.95 |
| (E) | 7,740.16 | 26.35 | 89 | 0.00 | 686.0 | 0.74 |
| (F) | 2,315.08 | 15.75 | 6,898 | 0.31 | 15,968.5 | 17.22 |
| (G) | 5,123.64 | 13.25 | 1,219 | 0.05 | 6,244.0 | 6.73 |
| (H) | 14,996.94 | 11.00 | 181 | 0.01 | 2,720.5 | 2.93 |
| (I) | 5.25 | 9.90 | 1,523,994 | 68.50 | 7,993.5 | 8.62 |
| (L) | 10.61 | 9.45 | 262,570 | 11.80 | 2,786.5 | 3.01 |
| (M) | 26.86 | 29.15 | 171,609 | 7.71 | 4,609.0 | 4.97 |
| (N) | 45.02 | 11.40 | 123,343 | 5.54 | 5,552.5 | 5.99 |
| (O) | 245.47 | 13.95 | 27,571 | 1.24 | 6,768.0 | 7.30 |
| (P) | 442.32 | 18.05 | 11,018 | 0.50 | 4,873.5 | 5.26 |
| (Q) | 122.59 | 15.70 | 36,888 | 1.66 | 4,522.0 | 4.88 |
| (R) | 1,422.61 | 32.25 | 364 | 0.02 | 518.0 | 0.56 |
| (S) | 232.22 | 13.15 | 24,579 | 1.10 | 5,708.0 | 6.16 |
| (T) | 746.41 | 7.85 | 10,034 | 0.45 | 7,489.5 | 8.08 |
| (U) | 5,039.04 | 35.40 | 156 | 0.01 | 786.5 | 0.85 |
| (V) | 170.57 | 18.25 | 7,201 | 0.32 | 1,228.0 | 1.32 |
| (W) | 586.21 | 25.70 | 1,641 | 0.07 | 962.0 | 1.04 |
| (X) | 1,022.81 | 29.05 | 1,284 | 0.06 | 1,313.0 | 1.42 |
| (Y) | 4,842.46 | 25.85 | 439 | 0.02 | 2,127.5 | 2.29 |
| **TOTAL** | | | **2,224,860** | **100.00** | **92,714.0** | **100.00** |

*Source:* Istat, Farm structure survey 2003

(a) Fss estimate.

## TABLE 5.16 Estimate of plastic waste generation by region - Year 2003

| REGIONS | Estimate of total plastic waste generation | Number of farms | % of plastic | % of farms |
|---|---|---|---|---|
| Piemonte | 6,761.5 | 84,214 | 7.29 | 3.79 |
| Valle d'Aosta | 126.5 | 5,373 | 0.14 | 0.24 |
| Lombardia | 8,312.0 | 62,841 | 8.97 | 2.82 |
| *Bolzano* | *1,094.0* | *21,887* | *1.18* | *0.98* |
| *Trento* | *1,443.0* | *27,407* | *1.56* | *1.23* |
| Veneto | 9,026.5 | 151,759 | 9.74 | 6.82 |
| Friuli-Venezia Giulia | 2,027.5 | 25,834 | 2.19 | 1.16 |
| Liguria | 1,999.5 | 37,967 | 2.16 | 1.71 |
| Emilia-Romagna | 8,045.5 | 88,995 | 8.68 | 4.00 |
| Toscana | 4,770.5 | 106,624 | 5.15 | 4.79 |
| Umbria | 984.0 | 51,487 | 1.06 | 2.31 |
| Marche | 1,349.5 | 59,719 | 1.46 | 2.68 |
| Lazio | 6,016.5 | 171,904 | 6.49 | 7.73 |
| Abruzzo | 1,385.0 | 74,818 | 1.49 | 3.36 |
| Molise | 557.0 | 30,261 | 0.60 | 1.36 |
| Campania | 7,419.0 | 198,114 | 8.00 | 8.90 |
| Puglia | 6,236.5 | 342,464 | 6.73 | 15.39 |
| Basilicata | 2,877.5 | 75,869 | 3.10 | 3.41 |
| Calabria | 2,867.0 | 178,903 | 3.09 | 8.04 |
| Sicilia | 15,386.5 | 332,618 | 16.60 | 14.95 |
| Sardegna | 4,028.5 | 95,802 | 4.35 | 4.31 |
| **ITALY** | **92,714.0** | **2,224,860** | **100.00** | **100.00** |

*Source*: Istat, Farm structure survey 2003

**TABLE 5.17** **Distribution of structural characteristics among regions – Year 2003**

| REGIONS | Farms with fresh vegetables under glass | Fresh vegetables under glass (000 ha) | Farms with mulch area | Mulch area (000 ha) | Farms with irrigated area | Irrigated area (000 ha) | Farms with nursery | Nurseries (000 $m^2$) | Esu (000) |
|---|---|---|---|---|---|---|---|---|---|
| Piemonte | 1,430 | 8.96 | 1,023 | 18.46 | 30,504 | 3,480.98 | 1,431 | 872.13 | 1,297.97 |
| Valle d'Aosta | - | - | - | - | 4,049 | 191.37 | - | - | 26.03 |
| Lombardia | 755 | 19.51 | 564 | 18.07 | 32,714 | 5,839.17 | 1,342 | 828.86 | 2,302.84 |
| *Bolzano* | *25* | *0.14* | *446* | *11.77* | *11,545* | *389.82* | *158* | *13.68* | *364.18* |
| *Trento* | *214* | *1.75* | *1,608* | *18.07* | *14,102* | *220.02* | *452* | *10.56* | *295.76* |
| Veneto | 1,683 | 26.90 | 1,711 | 32.58 | 49,840 | 3,127.70 | 2,278 | 1,409.41 | 1,737.05 |
| Friuli-Venezia Giulia | 82 | 0.33 | 437 | 10.44 | 8,861 | 706.71 | 305 | 151.16 | 391.54 |
| Liguria | 418 | 0.94 | 451 | 4.31 | 28,532 | 97.86 | 2,833 | 806.34 | 260.15 |
| Emilia-R. | 1,353 | 20.41 | 1,973 | 42.77 | 34,036 | 3,083.17 | 1,194 | 477.33 | 2,149.60 |
| Toscana | 1,137 | 4.40 | 1,323 | 48.44 | 19,971 | 473.66 | 2,747 | 825.28 | 992.05 |
| Umbria | 86 | 0.83 | 171 | 3.14 | 6,695 | 285.47 | 179 | 64.32 | 317.57 |
| Marche | 45 | 0.54 | 234 | 1.58 | 8,668 | 242.24 | 324 | 57.69 | 477.11 |
| Lazio | 3,879 | 33.66 | 1,173 | 20.87 | 30,313 | 902.42 | 3,990 | 4,092.67 | 892.79 |
| Abruzzo | 287 | 0.83 | 74 | 3.20 | 14,042 | 314.76 | 507 | 143.44 | 446.61 |
| Molise | 45 | 1.46 | - | - | 3,478 | 168.22 | 17 | 3.30 | 189.83 |
| Campania | 2,403 | 39.43 | 739 | 27.51 | 62,313 | 1,029.11 | 3,755 | 4,904.96 | 1,211.62 |
| Puglia | 807 | 13.69 | 412 | 2.80 | 76,522 | 3,073.32 | 797 | 536.80 | 1,890.11 |
| Basilicata | 618 | 5.67 | 1,452 | 57.08 | 23,316 | 552.61 | 786 | 546.96 | 414.03 |
| Calabria | 288 | 7.84 | 230 | 7.99 | 46,989 | 809.79 | 233 | 546.13 | 829.56 |
| Sicilia | 5,523 | 76.17 | 3,952 | 60.76 | 89,955 | 1,793.17 | 6,278 | 6,970.04 | 1,475.60 |
| Sardegna | 10.90 | 7.53 | 890 | 10.38 | 29,587 | 682.06 | 1,182 | 711.02 | 634.89 |
| **ITALY** | **22,169** | **270.98** | **18,863** | **400.22** | **626,032** | **27,463.64** | **30,787** | **23,972.09** | **18,597.00** |

*Source*: Istat, Farm structure survey 2003

# CONCLUSIONS

The general objective of the pilot studies for the implementation of WStatR is to develop for Ms data collection systems which fulfil the needs of the Community. The WStatR sets out four areas where pilot studies should be undertaken before regular data collection is established. These pilots concern the following areas: Statistics on waste generated in Agriculture, forestry and fishing, Statistics on the import and export of waste, Statistics on packaging waste and Statistics on preparatory waste treatment operations.

In late 2003 and beginning of 2004, at european level 15 projects started to investigate the waste generation and management flows and the respective data collection possibilities related to Agriculture, forestry and fishing sectors, and 10 studies started on Import and export of waste area of study.

The present publication describes the tasks followed by Istat in carrying out a pilot study devoted to waste generated and managed in Agriculture, forestry and fishing sectors. As Istat participates actively inside the Eurostat working group *Statistics of the environment* – subgroup *Waste*, the updating occurred during year 2005 in the implementation of the WStatR is reported too.

The first step, in carrying out the pilot study, was devoted in defining the domain of the different aspects involved; furthermore, suggestions for the waste categories to be included under these economic activities are presented. In more detail, with reference to Agriculture and forestry sector, conventional waste mainly generated for use of machineries (used motor oils, filters, end-of-life tyres, end-of-life vehicles, batteries, oil filters), of

fertilisers, of chemical substances for crops protection and for veterinary purpose, and of materials of metallic and plastic nature (as film for mulching, sheet to cover greenhouses and tunnel, hard sheet for greenhouses, harvesting nets, tubes for irrigation) are analysed. Furthermore, issues related to bio-organic residues and by-products including animal, vegetal and mixed waste of food preparation and products, green waste and faeces, urine and manure are faced. In Fishing sector, the study analysed the following items: end-of-life vessels, used motor oils, discarded net, mixed waste generated during navigation, waste plastics, sludge deriving from washing activities, dredging deriving from removing of sediments from artificial basins and tanks.

Highlights for each waste considered are presented with reference to definition, data source and calculation methodology available. For some items, however more clarity in juridical terms is necessary. For example, in case of some production residues, a law should clarify if they are conventional waste or if they represent waste only in particular conditions, depending on treatment adopted, or different issues.

A proposal for classifying waste generated in Agriculture, forestry and fishing sectors according to the EWC-Stat Rev. 3 and underlying LoW is presented. The concern about the classification of some materials as waste becomes more complicated for residues and by-products of bio-organic nature. A review of available data calculation methodologies and of information on by-products destination available might be useful to solve the definition problems. Management of by-products at farm level is in fact a not well known phenomenon that might be changed as the organisation of the agriculture system is, in the last decades.

In order to support decision making on considering some materials as waste or not, the present study provides a wide review on legislation in force on specific items - requiring reporting activity or regarding material management aspects. Legislation on management aspects can reveal that certain materials require specific treatment or attention when re-used at farm level, on the other hand reporting activity deriving from legislative acts, might provide useful information on some issues which falls under the present study. Particularly, attention was given to slurry manure generated in intensive stockfarms where poultry and swine are bred.

As regards other emerging statistical problems during the present

study, it is outlined that the definition of the agricultural holding doesn't meet with the statistical units requested by WStatR, as an agricultural holding represents a local kind-of-activity unit (local Kau), as defined in Council Regulation 696/93/Eec on the statistical units for the observation and analysis of the production system in the Community. Moreover, some problems occur in the adoption of minimum threshold value for size of enterprises stated by WStatR, since in Italy the number of employees is not immediately available. The analysis of some related variables showed however that the Italian agricultural sector mainly comprises holdings with few workers and so since the WStatR states the exclusion of enterprises with less than 10 employees, there would be a considerable deficiency in the coverage of the statistics. Thus, in the formulation of minimum requirements, it is necessary to consider the different economic structure of a single country and a statistical estimate of the waste quantities of the excluded enterprises is necessary before the application of this exclusion criterion is set up.

As regards the fulfilment of WStatR requirements, due to the wide range of typologies of waste generated and managed in Nace A and B sectors, a jointly utilization of official statistical information, administrative source data and data coming from other research institutes is foreseen. Possible tools for data compilation, comprising existing data sources, methods used in National accounts system and some specific studies compiled by research institutes are described. Moreover, considering the importance of farm in generation and management of several substances and the complexity of the farming system, additional questions introduced in the Fss 2003 are proposed.

The integration of Fss 2003 shows that for some types of waste the direct data collection is a relatively easy way to obtain information; however it can not be suitable for any kind of waste. In any case a sample survey can be a useful tool to define the main variables to use inside a model for estimation purpose or to validate data coming from estimation models or other gathering methods.

The analysis of overall responses to additional questions introduced in the Fss 2003 showed that the response rate on some specific waste generation in Italy was about 49 percent. This response rate was considered quite unsatisfactory, thus an estimate approach based on

modelling is applied on collected data on plastic waste generated by farms. The analysis of the generation of plastic by farms has been carried out by applying Chaid methodology, using as potential predictors some of the structural variables collected by Fss. After the identification of homogenous groups, the plastic waste mean has been estimated for each group and then the total amount of plastic produced has been obtained joining the means of the groups and their population size estimated using Fss results. Analysis was run at regional level. This approach enhances the accuracy of estimates as more variables, which can help in determining plastic waste generation, are considered. It is important also to stress that using the European size unit variable can help to estimate with more accuracy a mean value but estimates based simply on number of farms can lead to overestimate these values.

Even if the model could be easily improved, the above mentioned results show that the sample survey can be a very useful tool above all in identifying influential groups of farms for waste generation and in showing that generation of waste can be very different depending on the level of some relevant structural variables.

The survey, integrated also on some wastes and by-products - generated both in primary production and farm product processing activity - management aspects, revealed that grape processing activity is quite common and further deepening is being faced in proceeding with 2005 Farm structure survey in order to quantify the amount of related waste generated. Furthermore, among management methods adopted at farm level to treat by-products and residues of bio-organic nature, the most common one resulted to be the spreading on land.

Analysis undergone of waste generation and management in Agriculture, forestry and fishing sectors revealed that data sources and methodologies are available in Italy to meet in most of the cases WStatR requirements. At this point main concern is on whether to consider residues and by-products of bio-organic nature as waste or not. At present discussion is still on-going and materials of bio-organic nature have been defined as *potential* waste. Since main recovery activity is the spreading on land and legislation in force is well developed, it is possible to reach opposite conclusions: either that the sector is already well monitored and not more statistics are necessary or that the long list of precautions to take would suggest that misuse of such materials can easlily happen and that the WStatR should cover these items.

# ANNEX A

**Definitions regarding some waste issues, from Council Directive 75/442/Eec of 15 July 1975 on waste (as amended)**

(a) 'waste' shall mean any substance or object mentioned in the categories set out in the waste nomenclature which the holder discards or intends or is required to discard;
(b) 'producer' shall mean anyone whose activities produce waste ('original producer') and/or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste;
(c) 'holder' shall mean the producer of the waste or the natural or legal person who is in possession of it;
(d) 'management' shall mean the collection, transport, recovery and disposal of waste, including the supervision of such operations and after-care of disposal sites;
(e) 'disposal' shall mean any of the operations provided for in the Annex IIA of the Directive (see the following *disposal operations* list);
(f) 'recovery' shall mean any of the operations provided for in the Annex IIB (see the following *recovery operations* list).

**Disposal operations**

D1 Deposit into or onto land (e.g. landfill, etc.)
D2 Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.)
D3 Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.)
D4 Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.)
D5 Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
D6 Release into a water body except seas/oceans
D7 Release into seas/oceans including sea-bed insertion
D8 Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by

means of any of the operations numbered D 1 to D 12

D9 Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.)

D10 Incineration on land

D11 Incineration at sea

D12 Permanent storage (e.g. emplacement of containers in a mine, etc.)

D13 Blending or mixing prior to submission to any of the operations numbered D 1 to D 12

D14 Repackaging prior to submission to any of the operations numbered D 1 to D 13

D15 Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where it is produced)

***Recovery operations***

R1 Use principally as a fuel or other means to generate energy

R2 Solvent reclamation/regeneration

R3 Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transfor mation processes)

R4 Recycling/reclamation of metals and metal compounds

R5 Recycling/reclamation of other inorganic materials

R6 Regeneration of acids or bases

R7 Recovery of components used for pollution abatement

R8 Recovery of components from catalysts

R9 Oil re-refining or other reuses of oil

R10 Land treatment resulting in benefit to agriculture or ecological improvement

R11 Use of wastes obtained from any of the operations numbered R 1 to R 10

R12 Exchange of wastes for submission to any of the operations

numbered R 1 to R 11

R13 Storage of wastes pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where it is produced)

# ANNEX B

**Definitions of hazardous and non-hazardous waste**
**(from Council Directive 91/689/Eec of 12 December 1991 on hazardous waste)**

Hazardous waste: wastes having one or more of the properties listed in Annex III of the mentioned Directive. The properties include the fact of being: i) explosive, ii) oxidizing, iii) flammable, iv) irritant, v) harmful, vi) toxic, vii) carcinogenic, viii) corrosive, ix) infectious, x) teratogenic, xi) mutagenic, xii) able of releasing toxic or very toxic gases in contact with water, air or an acid, xiii) capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above, and xiv) ecotoxic.

Non-hazardous waste: any other waste not presenting properties as defined for hazardous waste.

# ANNEX C

**Description of waste nomenclatures**

European List of waste (LoW): this list (formerly named the European Waste Catalogue) has a direct link with the EU's waste definition and it is a process oriented waste nomenclature. The List of wastes is established with Commission Decision 2000/532/Ec of 3 May 2000 replacing Decision 94/3/Ec establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/Eec on waste and Council Decision 94/904/Ec establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/Eec on hazardous waste.

The List of Waste has been amended by the following Commission Decisions: 2001/118/Ec, 2001/119/Ec and 2001/573/Ec.

European waste statistical nomenclature (EWC-Stat): this waste nomenclature is mainly substance oriented, and defined for statistical purpose. EWC-Stat is an aggregation of the LoW. A Transposition table forming the entries in the List of waste to the aggregation of EWC-Stat (Rev.3) is available in the Annex III of the WStatR (as amended).

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17. Waste statistics on agriculture, forestry and fishing sectors

## Waste statistics on agriculture, forestry and fishing sectors

*This publication reports the results of the pilot study on waste generation and management in Agriculture, forestry and fishing sectors, financed by Eurostat, in order to implement the Regulation 2150/2002/Ec of the European parliament and council on Waste statistics. The pilot study was carried out by Istat with two different projects: one on methodological aspects and the other one on data collection. An analysis of the economic activities involved and related waste together with a review of available and exploitable data sources and methodologies for waste statistics calculation has been performed. Furthermore a deepening on the discussion ongoing at international and national level on some specific statistical issues related to the implementation of Regulation 2150/2002/Ec is reported. As regards data collection tools, a proposal for some data collection through an environmental section devoted to waste generation and management integrated in the Farm structure survey 2003 questionnaire is presented.*

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