

Application of Relational Database in Listing Pesticides used in Greece according to their Hazards in Human Health and the Environment

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Abstract. Pesticide use raises a number of environmental concerns. Recent EU legislation has been approved banning the use of highly toxic pesticides and measures were agreed to improve the general safety of pesticides across all EU member states including Greece. In addition the problem of illegal and usually hazardous pesticides has to be faced. Nevertheless end-users, farmers and consumers should be informed of the hazards for public health and environmental risks. Information technology, the Internet and wireless technologies are gradually adopted by farmers. This paper presents the development of a database listing pesticides used in Greece highlighting the following factors: the legitimacy of the pesticide registration, the dangers of the pesticide to human's health and finally the dangers of the pesticide on the environment.

Keywords: Relational databases, pesticides, environmental hazards, health hazards.

1 Introduction

The rapid development and global spread of modern Information and Communication Technology (ICT) allows the developing world to leapfrog the infrastructural constraints to access and utilize information vital to agricultural research and development (Gelb et al., 2004, Santana et al., 2007, McLaren et al., 2009).

Information concerning the use and hazards of pesticide is crucial in pest management of crops in order to achieve a high quality agricultural production and ensure both farmers and public health as well as minimize environmental risk. The use of Pesticides has increased 50-fold since 1950 and currently there are thousands of synthetic pesticide products made up of more than 1000 different chemicals and combinations thereof (Miller, 2002). The growing awareness of the risks related to the intensive use of pesticides has led to a more crucial attitude by the society towards agriculture. At the same time, there is a change in consumer concerns that had put more weight on issues such as environmental friendliness in agricultural production and food safety (Saba and Messina, 2003).

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In: M. Salamasis, A. Matopoulos (eds.): Proceedings of the International Conference on Information and Communication Technologies

for Sustainable Agri-production and Environment (HAICTA 2011), Skiathos, 8-11 September, 2011.

Therefore pesticides use raises a number of environmental concerns. It is estimated that a huge amount of sprayed insecticides and herbicides reach a destination other than their target species, including non-target species, air, water and soil (Greek Ministry of Rural Development and Food, 2010).

In Europe, recent EU legislation has been approved banning the use of highly toxic pesticides including those that are carcinogenic, mutagenic or toxic to reproduction, those that are endocrine-disrupting, and those that are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB). Measures were approved to improve the general safety of pesticides across all EU member states (Regulation (EC) 1107/2009). New ways for pest control are requested to reduce human and environmental exposure to hazardous chemicals, and potentially lower overall costs of pesticide application material and labor.

Nowadays, among other issues, Information Management is becoming an increasingly challenging task for farmers (Gelb et al, 2004), especially in terms of the amount of data, the complexity of processes in precision farming, the demanding function of data acquisition, the choice of information technology, the use of Internet or other wireless technologies such as mobile phones (Steinberger et al, 2009). Also another challenging factor is the format of data, which can be accessed by the involved stakeholders, at anytime without knotty requirements, in user-friendly and comprehensible forms.

This paper presents the development of a Database platform regarding pesticides used in Greece, which aims to highlight the following factors: the legitimacy of the pesticide registration, the hazards of pesticide, and the dangers of the pesticide to human's health and finally the dangers of the pesticide on the environment and ecosystem.

2 Materials and Methodology

2.1 Pesticides

During the past few years, Greece, like most other countries, has faced the problem of counterfeit/ illegal Plant Protection Products (PPPs) or, as they are often called, pesticides. Pesticides are used to protect crops before and after harvest from infestation by pests and plant diseases.

In most countries, pesticides must be approved for sale and use by a government agency. The problem of illegal pesticide use is not only financial (Pethig, 2004) but it also has to deal with issues of insufficient information on the topic of risks placed on society and the environment from pesticides use. Findings have indicated that pesticides have effects in human health (Sorensen et.al., 2003, Gilden et al., 2010) not only directly but as residuals on agricultural products. Accurate analysis of pesticides presence in each step of the food chain is necessary because of their potential toxicity and the presence of amplified toxic effects due to synergic interactions. In the same way it is necessary to evaluate the environmental effects of the whole pesticides cycle, from industrial production until final disposal of used containers and residuals (Donati et al., 1993). Furthermore, pesticides are held

responsible for contributing to the loss in biodiversity and the deterioration of natural habitats (Pauli et al., 1999).

Legislation at the European community level dates back to 1976 when Council directive 76/895/EEC specified maximum levels for pesticide residues for 43 active substances (AS). The EU has a new legislative framework on Maximum Residue Levels (MRLs) of pesticides in Food. Furthermore Integrated Pest Management (IPM) programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property and the environment.

There is a lack of information regarding the pesticide registration especially for the end-users, and the risks at stake. There has been none endeavor of assembling an electronic form for the Greek legislation regarding pesticides and the consequences of illegal use and trading of these products for farmers' and consumers' health, crops and environment.

2.2 Database management systems

The take-up of ICT by professionals of agriculture, farmers or agribusinesses is crucial to the raising of their business productivity potential and future growth prospects, but also to the achievement of sustainable agriculture. The complexity of agricultural processes has as an outcome a cumbersome and error-prone data acquisition and manipulation. Therefore data loss is frequent (Hunt et al., 2001). Modern database technology has the potential to solve these issues. Difficulties of data management refer to problems of data entry, quality control and changing requirements for storage and output variables (Hunt et al., 2001), searching and editing necessities.

Database management systems (DBMS) are increasingly used to develop computer-based information systems. A DBMS is a computer program (or more typically, a suite of them) designed to manage a database (a large set of structured data), and run operations on the data requested by numerous clients. Advantages that are generally associated to a database are reduced redundancy, the integration of data and integrity, meaning that in a database, data elements will appear just once and reduced redundancy increases the likelihood of data integrity.

Relational database management systems (RDBMS) use a natural tabular structure to store data and provide design guidelines for choosing good structures. This natural structure results in an interface that makes relational systems easy to use when compared to other database systems. This makes RDBMS attractive to those users who are increasingly taking an active part in system development (Date, 2000).

The advantages of database management consist of the use of standard file formats. The Microsoft Access format has become popular, since all of a database's tables and indexes can be contained in a single file.

MS Access is the Microsoft database-management program, part of the Microsoft Office suite that is used to maintain databases - collections of data arranged according to a fixed structure. Its structure makes the information easy to select, sort,

display, and print in a variety of formats. With Access, one can create and maintain as many databases as they need, or even share them with other people over a local area network or the Internet. Access databases are made up of objects.

3 Results

Associated data to different types of pesticide, (fungicides, insecticides, herbicides, miticides) and risks for public health and environment (R-phrases, S-phrases) are stored in a database managed by MS Access.

The database consists of several tables and comprises properly relationships between tables. The updating of the database is trouble-free when it comes to delete or add one or several pesticides. The design of the database ensures that no large modifications in its structure are needed for updating purposes.

By definition the user interface is the uppermost layer in the system, thus it resides in the external level of a database system and its prime concern is to place the entire functionality of the database system at the disposal of users. To be of real practical value, a user interface for a database must serve a wide variety of users with different training, knowledge, and background. The aim was to achieve a simple interface that is comprehensible to every user.

The user interface presents the following capabilities for its users:

- Users can scroll through the selected records.
- Users can filter the records to constrain which records are selected from those available.
- Users can delete, add and print records
- Users can read the Minister decisions of the release of each pesticide from the Greek Ministry of Rural Development and Food in a pdf format, which includes all the information for the pesticide and the right usage in the framework of plant protection.

The database management component (in Greek) is presented (Fig. 1) in a column form. It includes all the basic elements that introduce the identity of each pesticide, like the name, the type, the composition, the category, the manufacturing company, the approval release, the launch and expiration date, the indication of each pesticide and the risks for public health and the ecosystem.

S-phrases (short for Safety Phrases) are defined in Annex IV of EUs Directive 67/548/EEC, "Safety advice concerning dangerous substances and preparations" while R-phrases (short for Risk Phrases) are defined in Annex III of European Union Directive 67/548/EEC, "Nature of special risks attributed to dangerous substances and preparations"(Council Directive 67/548/EEC). The list was consolidated and republished in Directive 2001/59/EC, where translations into other EU languages may be found.

S-phrases and R- Phrases are presented in the type of sub forms, in order to identify the meaning of each representation.

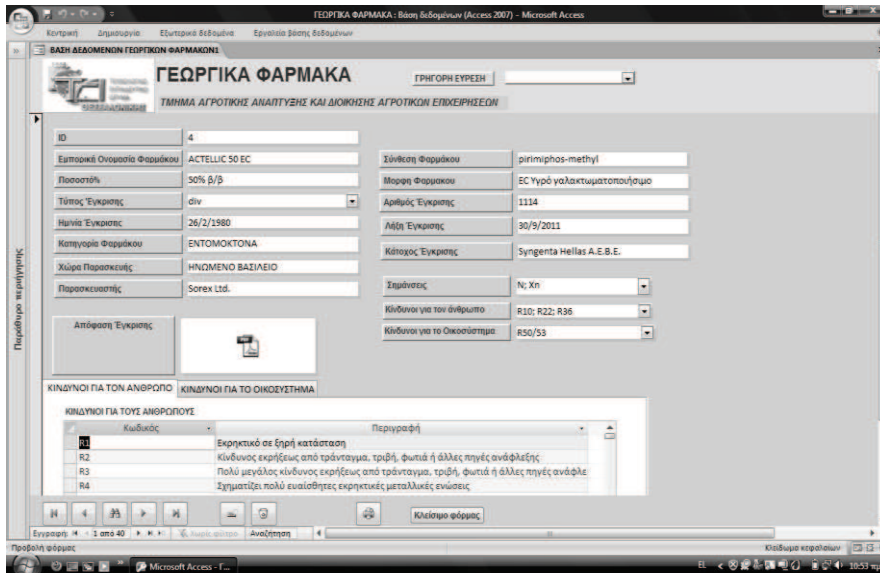


Fig. 1. Snapshot of the pesticide form

Users can apply the quick find (Fig. 2) in order to view the type of pesticide and the form (suspension, powder, liquid, solution, etc.). Database users are able to scroll through the records with the available buttons for “next”, “previous”, “last” and “first” record buttons.

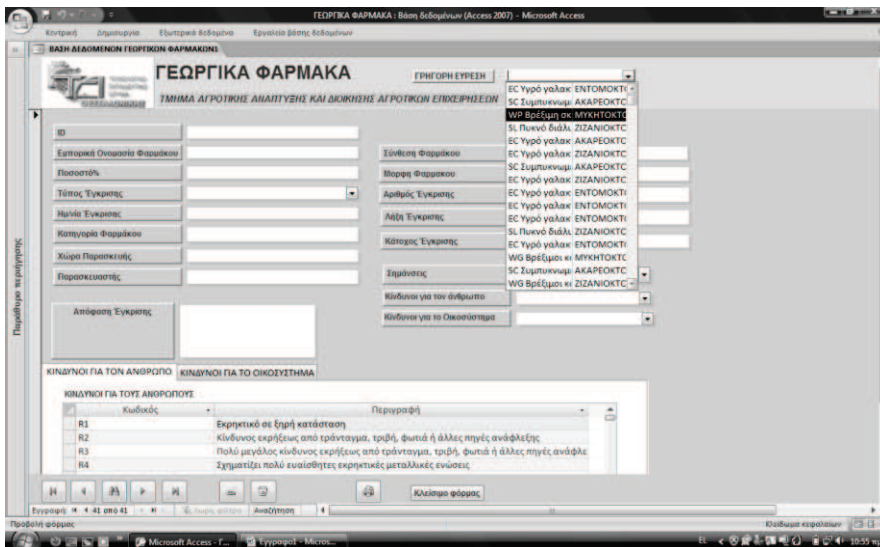


Fig. 2. The quick find of the form

Moreover users can erase records in case a pesticide is no longer available for usage or insert new records for a new release approval. In addition users can apply their own selection criteria, depending upon their query on the database, and acquire the information they search.

The option of printing out the information that is useful is also available, in a variety of selected pages, all, current and of course the pdf file of the Decision of the Greek Ministry of Rural Development and Food.

The Ministry decision release is presented as an attachment (Fig.3) which the user can open to read or even save in a computer folder or any storage media. The user has also the ability to delete or add a new file in case a new Ministry decision release is available.

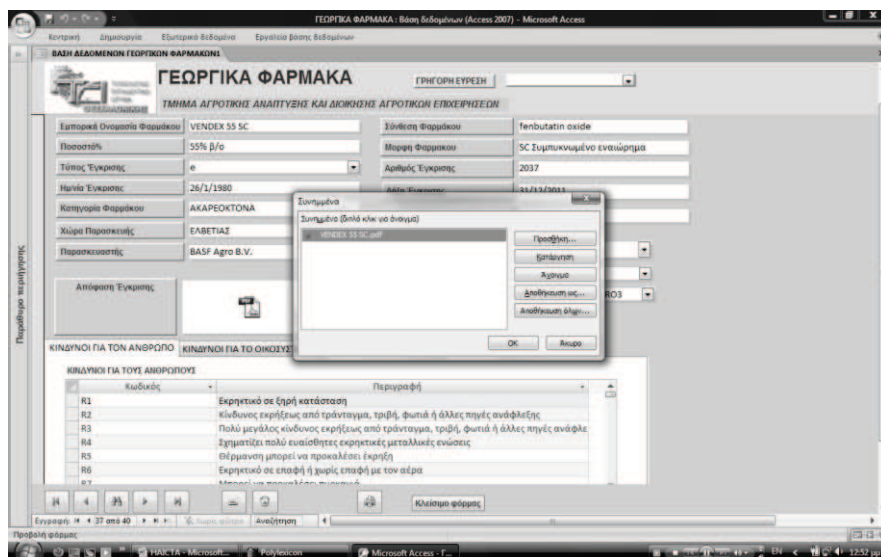


Fig. 3. The Ministry decision release attachment

The Ministry Decision release (Fig. 4) includes all the information for the pesticide regarding its active substances (AS), the date of licence and the expiry date of approval along with references for the manufacturing corporation, the packaging company etc.

The release form also includes information's concerning the right usage of the pesticide in the framework of plant protection, human health's safety and environmental impacts, by mentioning the S-phrases (Safety Phrases), "Safety advice concerning dangerous substances and preparations" and R-phrases (Risk Phrases) "Nature of special risks attributed to dangerous substances and preparations" that correspond to each pesticide.

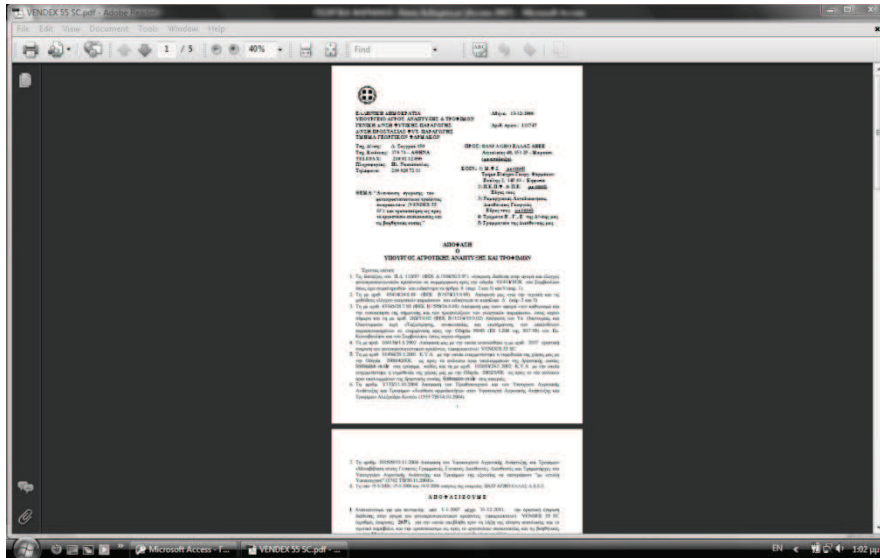


Fig. 4. The Ministry decision release pdf file

4 Conclusions

One of the critical conditions required of the agricultural sector is to ensure that good governance structures and related policies are in place at all levels (UNEP, 2008). Agricultural governance, lies beyond regional, national or global level, the whole community is involved stakeholders in their way and that universal sense can be assisted only from another widespread trend such as ICT (Vassiliadou and Mpoutakidis, 2011).

The primary aim of the project is to list, inform and educate all groups involved in pesticide commerce and use, including the final users of the products - farmers. The issues of focus are: the Greek legislation regarding pesticides and the consequences of mistreatment of these products for farmers and consumers' health, crops and environment. This is presented in a user-friendly and comprehensible format, using a widespread database application available in most personal computers, since end-users are not necessarily computer literate.

Regarding the database management system, data ease of use and handling within management or modeling purposes is a promising fact. Efficient and well-organized information are vital on the track towards more comprehensive and reliable assessments. The only drawback on the undertaking usability of this component is the availability and quality control of data.

Pesticide safety education and pesticide applicator regulation are designed to protect the public from pesticide misuse, but do not eliminate all misuse. Farmer training programs and education along with pesticide surveillance and monitoring programs is an investment for pest control.

Furthermore, integrated pest management (IPM), is promoted as a mean of sustainable agriculture. Reducing the use of pesticides and choosing less toxic pesticides may reduce risks placed on society and the environment from pesticide use. In addition it is important to take into account cumulative and synergistic effects of pesticide in human health and the ecosystem. Therefore it is highly important to develop novel means of communication and information for the public and the related stakeholders regarding those issues, including impact assessments, risk management and related decisions.

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