PESTICIDES POLLUTION OF FOOD - RISKS AND IMPLICATIONS FOR CONSUMER PROTECTION

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Abstract:

The paper examines the current meanings and implications of pesticide residues in foods for human consumption, suggesting attitudes and courses of action required in this area in order to minimize the negative effects from the consumer protection perspective.

The analysis is based on studying the relevant information from various different sources concerning the use of pesticides, the effects of consumption of food contaminated with pesticide residues, the state of the regulations in this area, the attitudes of the various actors, drawing - on this basis – a set of necessary actions to be taken in order to ensure real protection for consumers.

The fact that the presence of pesticide residues in food - above the scientifically established limits - is a real danger is already a known fact, unfortunately not sufficiently considered by the legislative decision bodies.

Due to the controversial character of data on the impact and effects of pesticide residues that can be found today - in increasingly large quantities - in the food, this field is a delicate one, being subject to changes in vision, keeping up with increasing availability and acceptability of scientific data.

The question that arises can be formulated as follows: will we be able to place first the need for food safety and consumer health, by sacrificing economic interests?

Keywords: food pollution, pesticide residues, health risks, consumer protection

JEL Classification: D18, Q18

INTRODUCTION

Food pollution or food contamination is a derivative of ambient pollution, consisting of the introduction of foreign substances in food, while disrupting the ecological balance, to the detriment of health and consumer welfare.

In principle, the presence of foreign, undesirable substances appears as a consequence of food pollution (when the substances are introduced intentionally, for a technological purpose, but going beyond permissible limits and becoming hazardous by consumption) and the contamination of food (when their presence is not intentional, but they are accidentally or incidentally occurring in food). Whatever the source of their presence in food may be, *pollutants* are "tolerable" only because of the inability to avoid them, manifesting different ways of penetration; the most common categories – and having the most harmful impact - include: pesticides, biostimulators and fertilizers used in agriculture and zootechny, carcinogenic hydrocarbons, toxic metals and metalloids.

Of particular importance is the chemical contamination and pollution of food, which occurs as a result of occasional or permanent use of chemicals in agriculture, zootechny and veterinary medicine. In this direction, we emphasize the importance of *pesticide* pollution of food, as a consequence of their use in the fitosanitary or animal health treatment.

At present, at the global scale, an increasingly large number of the most frequently purchased food, consumed in their natural form or after processing, are contaminated with considerable doses of pesticide residues (BCERF, 1999a): products of animal origin (meat, fat and organs, ham, milk, milk products, butter, meat, poultry, eggs, fish products), bread and flour products made from wheat and corn, fresh vegetable products (vegetables and fruit), canned products resulting from industrial processing. Residues were found even in dietary products, organic food or children designated food.

Generally, pesticides are not found in food at levels that cause acute poisoning, but having regard to their permanent action on the body, they can cause chronic poisoning, with allergic, neurotoxic and teratogenic effects (Banu (coord.), 1982).

A significant number of scientific studies based on laboratory testing of animals (Ames, Gold, 1997) demonstrate the carcinogenicity of a wide range of pesticides, indicating that although some substances had not been used on crops for many years, toxic substances were kept in the soil, the new productions being also compromised.

Therefore, of great importance are both the practical measures against their presence in food and establishing allowable daily consumption of pesticides to humans, i.e. *maximum residues limits* of pesticide residues (BCERF, 1999b). Those are subject to research and regulation for both international (the Codex Alimentarius Commission, 2000, 2002) and regional bodies, which propose and adopt science-based requirements in order to minimize the harmful effects of these substances, in order to achieve effective consumers' protection.

PESTICIDES: CHARACTERISTICS, IMPACT AND RISKS TO CONSUMERS

Pesticides represent the generic associated name for chemicals used in fighting different kinds of pests. Since the pesticides currently used do not have an absolute selective action, for chemical substances in this category was also proposed the term *"biocides"* (Petrescu et al., 2000).

Depending on destination, pesticides can be classified into the following *categories* (Segal et al., 1985): fungicides and bactericides (inorganic, organic) insecticides (organoclorurate, high-persistence: dichlorodiphenyltrichloroethane - DDT, Hexachlorocyclohexane, Oxafen, Aldrin, Dieldrin, Lindane, Endrin; organophosphorous, with high toxicity: Parathion, Dicorvos, tetraethyl pyrophosphate, Tricorfon, Malathion etc..); acaricides; nematocide and soil sterilizers; rodenticides, molluscicides and repellents; herbicides; defoliants and desiccants; growth regulators.

Pesticide pollution intensity depends not only on the accessibility of distribution channels, but also on their physico-chemical and toxicological properties. The inherent hazard of pesticides increases alongside with their resistance to physico-chemical action of environmental factors, namely their degree of remanence.

Food contamination with pesticides may be *direct*, through the treatment of vegetable raw materials being consumed directly, or *indirect* through the residual doses of soil, water, air or the pesticides' transfer to animals, by animal raw materials through fodder and water.

The ways and sources of contamination may be different (occupational, non-occupational, intentional, non-intentional or accidental) (Ibitayo, Monosson, 2007), which leads to the idea that pesticides may simultaneously act as pollutants and contaminants. In the following lines, we address the situation of food pollution by pesticides, hence analyzing their presence as residues in foodstuffs.

Unfortunately, the amount applied in agricultural practices is generally greater than required for destructing parasites and pests, causing an overload by voluntary treatment, which generate excessive amounts of residues in food, with all the associated risks.

Designated to be used in agriculture to kill pests, pesticides may consequently generate major adverse effects on *human health* – the human being is also a living system – and on *the environment* as well. Their inherent toxicity - making them unique among the substances released by humans into the environment - has been repeatedly emphasized by scientists and physicians worldwide.

In the U.S., for example, to a great extent, the population has a high concentration of pesticides in the body, as shown in the biomonitoring studies conducted by specialists of the Center for Disease Control and Prevention (EWG, 2009).

Pesticides have been associated with a wide range of *toxic effects*, such as nervous system effects, carcinogenicity (Ames, Gold, 1997), endocrine effects, irritation of the skin, eyes and lungs (EWG, 2009).

Symptoms of pesticide contamination may include, according to scientific studies (Ibitayo, Monosson, 2007): headache, weakness, blurred vision, vomiting, irritability, problems concentrating, abdominal pain, immune system suppression, depression, asthma, lower quality semen, blood and liver disease, nerve damage.

The risk increases given that some implications may be hidden and of insidious nature, so that they cannot be linked directly with the real source; moreover, certain symptoms such as nausea, body weakness, sweating condition may be confused with influenza. In addition, the adverse effects of chronic exposure to relatively low levels of pesticides over a long period of time are not always correctly interpreted, being relatively inconspicuous, so that health consequences may be delayed. Besides the negative effects of agricultural pesticides' active ingredients, some "inert" substances and impurities, such as dioxin, carbon tetrachloride, chloroform may cause serious effects on the liver and nervous system (Ibitayo, Monosson, 2007).

Children are considered a *major risk category*, having their organs and vital systems affected during critical periods of development, which can have both immediate and long term effects, because of the metabolism, physiology and biochemistry being different from adults. Young bodies are less able to metabolize and inactivate toxic substances, consequently they are more vulnerable to the harmful effects of pesticides. The nervous system, the brain, the reproductive organs and endocrine glands may be permanently compromised by exposure to toxic chemicals before birth or during childhood, although adults do not suffer measurable or visible damage. Accordingly, experts consider that reducing exposure to residues for infants and young children is essential to minimize the impact.

Several international studies show that there are differences of degree of contamination by country of origin (Eng, 2009). Different categories of vegetables and fruit containing the highest levels of pesticides are (Wallop, 2009): grapes, bananas, spinach, tomatoes, peaches, apricots, apples, pears, vegetable marrows, strawberries, melons, cherries, broccoli, green beans, potatoes; also, meat and derivatives have a high content of residues.

Beyond their proven toxic effect, pesticide residues in food generally exert an effect of altering the organoleptic characteristics of food, conferring unpleasant taste.

Each year new studies are published on the toxic nature of pesticides on health and environment, even if they are used in quantities previously considered to be "safe" by the industry and regulations.

The incidence of pesticide contamination increases due to abusive using, misusing or ignoring safety requirements, especially in developing countries, out of failure to comply with the label instructions, import of banned or restricted pesticides, in the absence of strict regulations and appropriate enforcement of the existing ones (Ibitayo, Monosson, 2007).

Ranging outside economic interests governing the field, a series of views belonging to scientists, NGOs, farmers, health and environmental organizations advocate, through a sustained activity, for optimal regulation of pesticides utilization and for finding preferred alternative solutions, in a manner in which care for humans and the environment take priority.

In this regard, Pesticides Action Network (PAN) Europe initiatives - that mostly promoted the tightening of pesticides legislation in the European Union (EU) - are significant, bringing together solid, relevant research, representing the interests of parties concerned with eliminating the dependence upon chemical pesticides and with encouraging sustainable farming practices that do not jeopardize human health and the environment. Annual monitoring report prepared in 2008 provides a series of *disturbing evidence* (PAN Europe, 2008):

- 49% of the amount of fruit, vegetables and cereals in the EU contain pesticides at a level of contamination determined to be the highest, representing an increase of 20% over the past 5 years;
- 4.7% of fruits, vegetables and cereals contain pesticides at concentrations above the maximum allowed limits, while over 10% contain 4 or more different pesticide residues;
- five of the most common pesticides in food sold in the EU are classified as carcinogenic, mutagenic, and toxic to reproductive system or causing hormone disruption; these are: Maneb, Procymidone, Iprodione, Carbendazim, Deltamethrin.

Unfortunately for human health and the environment, official actions are too slow, especially since many pesticides have been considered as 'safe' until being banned (e.g. in the US: DDT, Chlordane, Dursban), and lack of action cannot be excusable if public and especially children

health is at stake. Therefore, many steps remain to be imposed and carried out in supporting the consumers, while pesticide manufacturers and farmers often preclude strict application of rules, especially those which require special precautions (as for newborn and children), which are inconvenient to meet (EWG, 2009).

But, against the background of the general concerns caused by recent food safety crises, consumers are entitled to wonder whether this level of protection is best for the individual, or is a compromise, in which economic interests prevail.

CURRENT ORIENTATIONS IN THE USE OF PESTICIDES. LEGISLATION ON PESTICIDE RESIDUES

The global activity of the Codex Alimentarius Commission, together with that of FAO and WHO organizations, provided over time a comprehensive reference point for research and scientific investigation on food, including in the field of pesticide residues and veterinary drugs. Many of these activities are carried out as studies conducted by scientists, laboratories, institutes and universities - in collaboration with the joint committees of experts and consultants FAO / WHO (Codex Alimentarius Commission, 2002).

Meeting Joint FAO / WHO Meeting on Pesticide Residues (JMPR) was founded in 1963 following the decision of the FAO Conference, that the Codex Alimentarius Commission should recommend maximum residue limits for pesticides and environmental contaminants in certain foodstuffs, in order to guarantee the safety of products containing such residues. At the same time, it was decided that the JMPR should recommend sampling and analysis methods. MPR members are eminent scientists, working as independent experts in the field of pesticides, chemicals and residues, being summoned on their own behalf and not as government representatives.

FAO designated specialists establish maximum residue limits for substances under evaluation, based on experiments conducted worldwide. Experts appointed by WHO conduct toxicological analyses of pesticides and subsequently, the reports resulting from the assessments are to be published and debated.

Between JMPR (which produced the latest set of recommendations in 2009) and the Codex Committee on Pesticide Residues (CCPR) there is close cooperation, the latter identifying substances requiring priority assessment. After JMPR evaluation, CCPR discuss the recommended limits and if they are deemed acceptable, they are submitted to the Commission for adoption as Codex "maximum residue limits" (MRL). At present, Codex establishes maximum residue limits for 218 substances from the class of pesticides.

Given the need to assess short-term impact of pesticides, JMPR proposed in 1994 the concept of *"acute reference dose",* meaning an estimate of the quantity of a substance, expressed in terms of body weight, which can be ingested within 24 hours without leading to appreciable effects on consumer health, based on known data at the time of evaluation. An international group of experts associated to JMPR has developed the Guide for establishing the acute reference dose (WHO, 2009), taking into account multiple potential effects, in order to scientifically assess the Codex recommendations.

In the light of these recommendations, the world's states formulate their own national requirements, based, unfortunately, not always upon innocuity considerations but also economic needs of producers and traders. Thus, we witness a situation where certain pesticides are accepted in some countries and prohibited in others, while the maximum limits for residues can be different.

In the *U.S.*, to regulate food safety, Environmental Protection Agency (EPA) sets levels of tolerance or the maximum legal limits for pesticide residues in food products nationally sold. EPA tolerances are based on a strict set of conditions; experts determine *"no observed effect level"* (NOEL), setting a safety limit to a level 100 times lower, making it legal residue level. If the maximum possible exposure is below the legal level, the EPA approves the tolerance level (Bessin, 2009).

Similarly, at *European* level, the maximum amount of pesticide residues allowed to be ingested by humans is calculated using the no-effect dose assessment. This corresponds to the maximum dose of a substance which produces no effect on the most sensitive animal, subdued to the most severe test. The no-effect dose is measured by short-term studies (lasting between 28 days and 3 months), then supplemented by long-term studies (18 months to 2 years). *Acceptable Daily Intake* (ADI) for long term exposure is obtained by dividing the no-effect dose by a safety factor (minimum 100), corresponding to the maximum quantity of residues that can be ingested daily by an individual throughout life, without creating health risks. The level of residues likely to be found in foodstuffs is measured experimentally by tests that take account of the use of plant protection products' recommendations by the manufacturer (dose, number of applications, pause before harvesting). Knowing the ADI, it is possible to determine the maximum residue limit (MRL) legally acceptable in food.

However, many experts consider that the duration of studies is too limited to draw the correct conclusions on risk, being necessary to measure the residues likely to be ingested daily by an individual through the food of the "daily consumption basket". Thus, a first requirement should be that the sum of all residues contained in the "daily basket" does not exceed the acceptable daily intake, but even then the question of cumulative effects in the long run, still remains insufficiently studied.

The review of legislation at European level by the entry into force, on 1st September 2008, of the Regulation (EC) no. 396/2005 had become necessary since the set of rules valid before 2008 was too complex; maximum residue limits for some pesticides were fixed either by the Commission or at the Member State level (as they can even choose a higher level) or were not established at all. This diversity of rules created confusion for retailers, importers, and consumers, in terms of food safety.

The new rules cover the entire range of agricultural products and feed (European Commission, September 2008), establishing a harmonized set of maximum residue limits for new pesticides, for all pesticides already used in agriculture within and outside the EU, a list of safe pesticides and an overall limit of 0.01 mg/kg applicable for the unlisted ones.

The revised legislation is aimed at ensuring safety for all consumers, the responsibility for the safety assessment falling on European Food Safety Authority (EFSA) and being carried on according to pesticide toxicity, maximum permissible levels and prevailing food consumption patterns.

Each Member State is required to make annual national monitoring programs to assess the degree of foodstuffs pollution with pesticide residues. Effectiveness and impact of these programs depends on the scope of the allocated resources (for example, in Britain, the cost of developing the annual report amounted to 2.1 million pounds in 2008, funded from taxes applicable for production and distribution of pesticides, besides government funding) (PRC, 2009).

Subsequently, in January 2009, after three years of negotiations, the Framework Directive on the sustainable use of pesticides and the Regulation on the marketing of plant protection products were adopted, through which the EU banned more than 22 active substances (Phillips, 2009), underlying the production of pesticides considered extremely dangerous, highly toxic (carcinogenic, mutagenic, harmful to reproductive, immune and hormonal systems). EFSA will play a major role in developing a positive list containing allowed substances, upon which nationally approved pesticides will be established. Also, new regulations prohibit substances that kill bees (thus undermining the process of pollination of crops), in the context of massive death of bees worldwide, attributed to the toxicity of pesticides. In addition, certain procedures and practices are prohibited or restricted (aerial spraying, use around children's playgrounds, schools, hospitals, public parks).

Unfortunately, toxic pesticides will be withdrawn from the market only after trading licenses expiring (Phillips, 2009), which represent, as we believe, a controversial step, because it allows, in this way, the spread of known harmful effects, for economic reasons. In addition, if a

substance is proven necessary to fight a serious threat to plant health, it may be approved for a period of 5 years even if it does not meet safety criteria.

Thus, despite the tightening of EU legislation in this field, this approach proposes a compromise onto consumers' health, marked by the continued use of hazardous substances, insufficiently studied in terms of effects, but generating productive and commercial advantages.

Meanwhile, Member States should develop national action plans with specific targets for reducing the risk and impact of pesticides and encouraging alternatives for pest control and drinking water safety.

Although not yet sufficiently severe, as it leaves room for dangerous practices, the new set of legislation has triggered the opposition of traditional farmers' interests representatives, concerned about production costs growth and lower productions prospects (Melik, 2009), but also the support from organic farmers, according to which organic agricultural production is able to provide sufficient food without using pesticides.

In the same context, Colin Ruscoe, Chairman of the British Crop Production Council (Melik, 2009), stresses the economic consequences of banning certain pesticides, arguing that manufacturers will turn to other markets, possibly towards genetically modified crops, which is not necessarily a desirable fact in terms of food safety.

By contrast to conventional methods, *organic farming* seems to offer a preferable alternative, generating a low residue level, avoiding exposure to toxic pesticides, which justifies consumers' conversance towards organic products.

In this regard, an annual monitoring report prepared in 2008 by EFSA highlighted the presence of pesticides also in organic products, generating many controversies, the source of contamination being, most probably, environmental pollution or unlawful use of pesticides in farming.

At present, determining the residues level generated by various agricultural alternatives remains of particular interest to researchers. Despite the reduced data availability, a group of American scientists conducted a study that revealed that organic agriculture generates lower quantities of residues than conventional agriculture, but that organic foods are not completely free of pesticide residues; their presence can be explained by environmental pollution or by cross-contamination from nearby crops (Baker et al., 2002). The study supports the compromise solution of using natural pesticides, with a low level of toxicity and remanence, suggesting the choice of organic foodstuffs as a preferable option.

At *national* level, the National Annual Report on pesticide monitoring in Romania for 2008 (ANSVSA, 2008) was based on evaluation of 2718 samples of fruits, vegetables and grains of different origin, covering 98 types of residues (as compared to 400 samples tested, 240 pesticides targeted in a similar study in the United Kingdom). Among the local samples, high quantities of residues were identified in apples, grapes and tomatoes, while among the imported foodstuffs, the most polluted are oranges, grapes and grapefruits.

Overall results of the analysis indicate that in the 2187 samples analyzed, 366 contained pesticide residues, as follows: 298 - one residue, 59 - 2 residues, 8 - 3 residues, 1 - 4 residues. Of the 2514 samples of fruits and vegetables, 14.2% contained pesticide residues and of the 204 samples of grains, 3.9% contained pesticide residues.

Also, in the national monitoring program there were analyzed 466 samples of food for children coming from EU countries and the results showed the performance of legal values.

We believe though that those values, while creating an overall picture and responding to harmonized requirements do not necessarily draw a realistic frame, in terms of quantitative and qualitative limits of the study, consisting of a relatively small number of tests and residues taken into account.

The information appears to be reassuring, while at global level, more and more specialists draw attention to the increasing exposure to pesticides pollution and to the major associated risks, against the background of contradictions between the data and conclusions of different studies.

On this subject, a series of general and concrete practices and national guidelines for sustainable use of pesticides - in accordance with the Thematic Strategy on Sustainable Use of Pesticides adopted at European level - have been applied in a national *workshop* in 2008, bringing together representatives of all stakeholders in the field.

Participating experts agreed that the main expected outcome of the National Plan of Action for pesticide should be reducing the negative impact of their use on human health and that the use of pesticides should be possible only on precautionary principle basis.

At the event there were mentioned challenges facing the field, showing that currently, excessive amounts of pesticides are found in the environment, especially in the soil and water, and agricultural residues are present above the regulated limits. It was also admitted that nationally there is not a transparent system for reporting and monitoring pesticide use and residue levels in products, fact requiring the improvement of the legal framework proved so far to be insufficient in preventing health risks and environmental hazards.

However, the findings have focused upon the acceptance of the idea that ensuring affordable food for the entire population remains a primary goal, especially in the context of the global crisis.

Participant researchers considered that the rejection of using pesticides is a preconception, based on lack of data and transparency in information exchange, stressing that the purpose of such restrictions is to reduce the risks associated with pesticide use, so as to protect human health and the environment while ensuring optimal conditions for significant agricultural production in terms of quality and quantity.

Thus, elimination of hazardous pesticides seems to be contrary to the producers' interests, who claim that the measure is too harsh, even having disastrous effects on Romanian agriculture due to reduced subsidies, high fuel prices, possible increases of pesticides' price - which could lead to bankruptcy for many farmers.

Although the new approach promotes organic farming, one could consider today that the Romanian market is not ready for more expensive products than those treated with chemicals, especially given the climate change and global warming (INCDPM, 2008), which is leading to a broader spectrum of diseases and pests.

As regards *computer applications* in the field, internationally and regionally there is growing concern regarding access to information and documentation for both professionals and consumers, but their relevance to the individual level is relatively narrow, to the extent that consumers' self-protection using these resources is also limited.

For example, in the U.S., Durango software is a platform for analyzing the pesticide exposure, useful both for governments, businesses and individuals; it includes a package for evaluation of pesticide exposure in daily food intake, a software based on the calendar for assessing aggregate and cumulative exposure to pesticides from both food and environment, an analytical software correlated with a database on American consumers, taking into account the daily quantities of foods consumed and their content of pesticide residues and food additives.

Free of charge, this time, *the websites* of Codex and the EU provide data access concerning maximum pesticide residues allowed in food groups, according to official regulations, but these tools only respond to a requirement for transparency or addresses only the specialists, without supplying serious customer support.

The high cost and difficulties associated with accessing such information packages cause reduced accessibility to consumers, thereby a minimum application at this level. In addition, access to databases on allowed pesticides, permitted food/crops and also the acceptable residue dose represents less relevant information to the consumer as an individual. They should be taken into account by the actual users of pesticides, by control and regulatory authorities, since only through their cooperation results the effect of real consumer protection.

CONCLUSIONS AND PERSPECTIVES

Despite scientific evidence propagation, pesticide manufacturers continue to defend their products, claiming that there is no reason for concern about food safety. However, these claims are not based on real data, as government studies do not seek long-term effects of exposure to small quantities of pesticide mixtures.

The risks of contamination are amplified particularly in developing countries (which represent the fastest growing market demand for pesticides, but also ¾ of incidents of contamination and contamination related deaths), amid a poor nutritional status and lack of facilities in the area information and health, especially in rural areas.

Beyond these particular issues, we believe that all people are at risk of pesticide pollution, to the extent that currently we are witnessing an unprecedented incidence of residual quantities in food.

Some possible *strategies* for reduction of pesticides pollution could include actions and measures such as:

- development of educational programs among farmers, on the following aspects: communication on risks associated with pesticides; proper use of protective equipment; controlled collection of banned, unused, outdated pesticides and empty packaging; handling of obsolete pesticides in accordance with rules for hazardous waste and safe disposal;
- promotion of safer agricultural practices by adopting integrated pest management (IMP), based on a series of alternative measures: selection of hybrids resistant to diseases and pests, removal of diseased parts of plants, crop rotation, biological control, etc..;
- prevention of illegal use of pesticides;
- frequent communication to consumers, based on relevant studies, on the ways to reduce the amount of ingested residue, the food groups with the highest/lowest degree of contamination and preferable substitutes;
- encouraging funding of research and innovation projects in the field, by setting the priority for projects of sustainable use of pesticides;
- effective controls for pesticides entering the country; preventing importation and marketing of counterfeit and/or unauthorized plant protection products.

Consumers can exercise *self-protection* measures by targeting the healthier food alternatives (organic foods), by the practice of thorough washing and cleansing of fruits and vegetables, and enjoying food from own production.

Although the benefits resulting from the use of pesticides and their role in ensuring a competitive and sustainable agricultural production are undeniable, consumers must be better informed about the risks to health and the environment, adverse effects on short and long term that their use may involve.

Taking into account current technologies, institutional guidelines and current legislation, the production and use of pesticides cannot be stopped yet, but stringent measures become necessary to restrict or even prohibit the use of toxic compounds with high remanence.

Although pesticide utilization carried out on a scientifically sound basis, using the criterion of allowed substances, a number of issues still remain unclear and raises questions among aware consumers:

- have the effects of pesticides been studied for long enough, for an adequate period of time?
- in this context, are the moral requirements on animal testing taken into consideration?
- is the effect of accumulation, combination and synergy of the types of pesticide residues ingested daily, in terms of quantity and quality, taken into account?
- are possible interactions with other pollutants and contaminants of food products, such as food additives, genetically modified organisms, heavy metals, metalloids, radionuclides, etc. taken into account.?

Governments must be able to better respond to growing consumer concerns with scientific data from valid studies, beyond simplistic concepts and explanations which claim that, in

accordance with good agricultural practices, pest control will be achieved without generating residues in food *"more than necessary* ". In fact, pesticides serve mainly, in a relatively comfortable manner, for increase production and hence profits in agri-food chain.

It is possible that the consumers' requirements should soon be more consistently expressed, drawing and expanding existing dispute in relation to other aspects of food safety (genetically modified foods, irradiated foods, food additives, fast food, etc.), and food and agricultural technologies may be urged to innovate in order to provide safety. Once again, it remains to be seen for whom the balance will tilt further, given the imbalance of power between consumers and food industry, which currently operates to the detriment of effective protection of individuals as consumers, essentially undermining their fundamental right to the protection of life, health and safety.

Achieving consumers' protection objective against harmful effects of pesticide residues should be based on the combination and interdependence of *effective protection*, consisting of an urgent review of regulations to dramatically reduce the amount of toxic pollutants in food and of better informing the consumers, but also of *self-protection*, based on the existence of aware consumers, able to select safe and wholesome food choices.

Thus, as long as the review of the regulation process in the field is laborious and uncertain, unable to provide safety in immediate terms, we believe that the solution lies in increased consumer awareness of the risks associated with pesticide residues, so that consumers are able to make optimal food choices.

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