

Original Article

General Aspects about Pesticides Residues in Fruits and Short Description of Organic Farming versus Conventional Farming

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Abstract

For the reason of reducing the loss and maintain the quality of fruits and vegetables harvest, pesticides are used to destroy pests and prevent diseases. But, the use of pesticides during production often leads to the presence of pesticide residues in fruits and vegetables after harvest. In every country the purpose of pesticide monitoring programs is to ensure that fruits and vegetables do not exceed maximum residues levels (MRLs). Future research needs to confirm whether and to what extent pesticide residues levels vary between organic and conventional products.

Keywords: drinking water, bottled water, cadmium, iron, chromium, Cluj-Napoca city.

1. Introduction

Agriculture is the world's largest economic sector. On a worldwide basis, more people are involved in agriculture than in all the other occupations combined. While many of the basic steps in agriculture have remained the same: tilling, planting, harvesting, raising livestock and marketing, farming techniques have changed dramatically over the years. The modern farmer has had to become increasingly conscious of costs and profits, and pay much greater attention to efficiency and business management [7].

Fruits and vegetables are important components of the human diet since they provide essential nutrients that are required for most of the reactions occurring in the body.

A high intake of fruits and vegetables (five or more servings per day) has been encouraged not only to prevent consequences due to vitamin deficiency but also to reduce the incidence of major diseases such as cancer, cardiovascular diseases and obesity [1].

Like other crops, fruits and vegetables are attacked by pests and diseases during production and storage leading to damages that reduce the quality and the yield. In order to reduce the loss and maintain the quality of fruits and vegetables harvest, pesticides are used together with other pest management techniques during cropping to destroy pests and prevent diseases [1].

The use of pesticides have increased because they have rapid action, decrease toxins produced by food infecting organisms and are less labor intensive than other pest control methods. However, the use of pesticides during production often leads to the presence of pesticide residues in fruits and vegetables after harvest [1].

The term 'pesticide' is a general term that includes compounds used for a wide variety of

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purposes to control a range of living organisms [2]. Pesticides are toxic (poisonous) chemicals that are designed to kill pests. There are different types of pesticides. Some are specially designed to kill insects, others kill fungi or bacteria, some are used to kill rodents, and growing amounts are used to kill weeds. However, most of these chemicals are also toxic not only to pests but to many species of plants and animals, including humans [6].

Pesticides may be subdivided into two main groups:

- Agricultural pesticides - those used in agriculture, horticulture and forestry, and weed killers around water courses and non-agricultural land such as roads and railways.
- Non-agricultural pesticides like those used for wood preservation, treatment of masonry, anti-fouling agents, and for control of insects for public hygiene purposes [2].

Most chemicals used as pesticides however are toxic and the major argument against their use is the health risk factor and the danger of environmental pollution. These concerns, including the potential chronic effects, form the basis of all regulations that control the use of pesticides, the setting of safety standards and the monitoring of residues on foods [7].

Small quantities of these chemicals could kill a person, make them very ill or cause other long term health problems [6].

2. Safety risks in agriculture and food production

The use of selective breeding techniques, fertilizers, herbicides, pesticides and fungicides in farming has dramatically increased the efficiency of food production. These modern production methods have reduced the cost and increased the variety of foods available. Because food production is so complex, a systematic approach is needed to identify potential hazards at each point in the food chain so as to avoid outbreaks of food-borne illness and contamination of foodstuffs [7].

Food-borne exposure to agricultural and environmental chemicals is of great public concern and, owing to the development of sensitive methods of detection, trace amounts of potentially harmful chemicals can be detected in many foods [7].

The presence of pesticide residues is a concern for consumers because pesticides are known to have potential harmful effects to other non-targeted organisms than pests and diseases. The major concerns are their toxic effects such as interfering with the reproductive systems and fetal development as well as their capacity to cause cancer and asthma [1].

Some of the pesticides are persistent and therefore remain in the body causing long-term exposure. The concern has led to governments setting up monitoring systems in order to assess the safety situation and make informed decisions when passing legislation [1].

Fortunately, the levels of human exposure to these chemicals are generally well below the tolerable daily intakes and the regulatory limits set by international committees. Nevertheless there are still cases of inappropriate use of agrochemicals, and analyses of foodstuffs sometimes detect pesticide residues of compounds that should not have been applied. Constant surveillance and monitoring in the use of pesticides is therefore very important [7].

The purpose of pesticide monitoring programs is to ensure that in fruits and vegetables do not exceed maximum residues levels (MRLs) allowed by the government, no misuse of pesticides that could result in unexpected residues in food and that good agricultural practices (GAP) are maintained. In the European Union (EU) there is a coordinated program for all the member countries to follow from the European commission and the member states national programs. The results are then yearly as a single report by the European Food Safety Authority (EFSA) [1].

Maximum residue levels are the highest levels of residues expected to be in the food when the pesticide is used according to authorized agricultural practices. The MRLs are always set far below levels considered to be safe for humans. It should be understood that MRLs are not safety limits, a food residue can have higher level than MRL but can still be safe for consumption [1].

For pesticides, there are three outputs of hazard characterization:

- ADI (acceptable daily intake) - the amount of a chemical that can be consumed every day for a lifetime in the practical certainty, on the basis of all known facts, that no harm will result
- ARfD (acute reference dose) - the amount of a chemical that can be consumed at one meal or on one day in the practical certainty, on the basis of all known facts, that no harm will result
- AOEL (acceptable operator exposure level) - a level of daily exposure that would not cause adverse effects in operators who work with a pesticide regularly over a period of days, weeks or months [2].

Safety limits are assessed in comparison with acceptable daily intake (ADI) for short term exposure or acute reference dose (ARfD). MRLs are subject to legal requirements in most of the

countries. In developed regions like Europe the responsibility of the legislation is lead by the European Commission (EC) with input from the member states, EFSA and the standing committee on the Food Chain and Animal Health [1].

In the US, the leading agency is Environmental Protection Agency (EPA) with input from the United States Department of Agriculture (USDA) and the Scientific Advisory Panel while in New Zealand the leading agency is the New Zealand Food Safety Authority (NZFSA) with input from the Environmental Risk Management Authority [1].

3. Aspects of conventional and organic farming

A significant percentage of conventional food products contain pesticide residues in excess of legally-defined, maximum, authorized residue limits in Europe and the US. As a result, most people carry pesticide residues in their bodies (100% of the people tested in the US), but the level can be drastically reduced by the adoption of an organic diet [5]. Legally defined "maximum residue limits" (MRL) are not a guarantee of "zero health risk." First, MRLs set by governments are not always set on the basis of health criteria. For instance, in the EU, MRLs (expressed in mg/kg) are based on Good Agricultural Practice (GAP) data. Therefore, foods derived from commodities that comply with the respective MRLs are intended to be toxicologically acceptable. In this case, MRLs are just indicators of the violation or non-violation of Good Agricultural Practices, not an indication of health risk. However, a recent study has shown that an organic diet provides a dramatic and immediate protective effect against pesticides residues [5].

Organic production is an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes [4]. International studies have similarly reported higher levels of contaminants in conventional compared to organic plant produce. An Italian residue survey reported 10-fold greater contamination in conventional (27%) compared to organic products (2.6%) with multiple residues reported in 8.8% of conventional and only 0.8% of organic samples. US data shows organically grown foods consistently record about one-third as many residues as conventionally grown foods, with multiple pesticide residues reported in 26.7% of conventional and 2.6% of organic samples [3].

Organic Agriculture relies first on preventive measures and only as a last resort on natural pesticides. Therefore, pesticide application is not routinely used as in conventional agriculture. Mineral inputs used in Organic Agriculture should contain as few heavy metals as possible [5].

Due to the lack of any alternative, and long-standing, traditional use in Organic Agriculture, copper and copper salts are exceptions for the time being, many certifiers put restrictions on the use of copper (often limited to 6 kg/ha per year on a rolling average basis) and/or require that, if farmers are using copper, they are required to conduct soil tests to make sure there is no copper toxicity [5]. Contrary to what most people believe, "organic" does not automatically mean "pesticide-free". In fact, under the laws of most states, organic farmers are allowed to use a wide variety of chemical sprays and powders on their crops. It means that these pesticides, if used, must be derived from natural sources, not synthetically manufactured. Also, these pesticides must be applied using equipment that has not been used to apply any synthetic materials for the past three years, and the land being planted cannot have been treated with synthetic materials for that period either [8]. Pesticides are classified as organic or conventional pesticides. Organic pesticides are derived from natural sources, whereas conventional pesticides are man-made chemicals developed and manufactured specifically for use as pesticides [9].

Because are man-made chemicals, so are synthetic, pesticides used in conventional farming are more likely to have a residue level that might exceed the maximum residue limits allowed to be in fruits. For example the substance folpet or captan has a MRLs of 3mg/kg in pome fruits, but mancozeb, has the MRLs about 5 mg/kg. All these substances are used against apples scab. An alternative for these synthetic substances are fungicides derived from natural sources, such as copper compounds and sulfur, traditionally used in organic agriculture against apples scab and powdery mildew of apples.

4. Conclusions

The biggest problem which is still in everyone's minds is that of the potential health implications of exposure to pesticide residues. Restriction of the number of approved synthetic pesticides would not necessarily reduce the residues, because there still remains the problem of those few approved pesticides

Existing studies show that organic foods generally contain lower levels of pesticide residues

and contain more minerals and vitamins and a more balanced protein profile

Organic agriculture, with its restrictions on the use of synthetic pesticides, seems to offer a low-residue alternative to conventional methods.

5. References

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