Food and Agriculture Organization of the United Nations

INTERNATIONAL YEAR OF PLANT HEALTH 2020

Antimicrobial Resistance (AMR) in relation to pesticide use in plant production

Key facts

AMR occurs when microbes become resistant to antimicrobials

Antimicrobials used as pesticides are antibiotics and fungicides applied against plant diseases

Plant Health is important to reduce the need for intervention of antimicrobials used as pesticides

AMR is a natural phenomenon that cannot be eliminated but it must be controlled

AMR is a huge threat to plant, human and animal health and to food security

Background

The Codex Alimentarius defines antimicrobial resistance (AMR) as *"the ability of a microorganism to multiply or persist in the presence of an increased level of an antimicrobial agent relative to the susceptible counterpart of the same species"* (FAO & WHO, 2015). An antimicrobial (AM) agent, in turn, is defined as *"any substance of natural, semi-synthetic, or synthetic origin that at in vivo concentrations kills or inhibits the growth of microorganisms by interacting with a specific target"*. In the context of plant production, some pesticides are used as antimicrobial substances, namely antibiotics (used against bacterial diseases) and fungicides (used against fungal diseases). There is growing concern that some of those select for antimicrobial resistance (AMR) among pathogens important to plant, human and animal health (Snelders, 2012). AMR is a natural phenomenon that can be exacerbated by the overuse of antimicrobial substances, including antimicrobial used as pesticides or pesticides that are suspected to enhance antibiotic resistant effects (such as herbicides) (Kurenbach *et al.*, 2018).

How is antimicrobial resistance related to plant production?

Antimicrobial resistance in the context of plant production has two implications; first the resistance of plant pathogens against antimicrobials used as pesticides. This is described in the FAO Guidelines on Prevention and Management of Pesticide Resistance (FAO, 2012) as the *"change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species"*.

Contributes to UN Sustainable Development Goals

The second implication is the occurrence of human and animal pathogens that could become resistant to antimicrobials due to common use patterns of antimicrobials used as pesticides. On the one hand, the first implication is well established and taken into account in many guidelines, including the European Plant Protection Organization (EPPO) standards, which have been developed to tackle this problem in plant production. On the other hand, the second one is much less known and it is uncertain to which extent antimicrobials used as pesticides in plant production contributes to the problems of AMR among human and animal pathogens of health significance (FAO & WHO, 2019a). Nevertheless, the FAO/WHO Joint Meeting on Pesticide Management (JMPM) recommended on October 2018 that antimicrobial resistance issues should be integrated into technical guidelines, wherever relevant, and, antibiotics used for human and animal health should not be registered as pesticides (FAO & WHO, 2019b).

What are the concerns regarding antimicrobials used as pesticides?

Currently, there are no robust global data on the volume of antimicrobials used as pesticides in plant production. As an example, at least 20 countries have registered antibiotics to control fire blight and citrus greening disease in plants. In some countries, streptomycin is authorized to control certain bacterial diseases in some fruits and vegetables. Kasugamycin, oxytetracycline and oxolinic acid are other antibiotics used to control bacterial diseases in plants (León *et al.,* 2008; Stockwell & Duffy, 2012). In Asia, antibiotics are authorized against the rice blast disease. In India it is quite common to use a mixture of two antibiotics called streptocycline to treat vegetables and fruits on a regularly spraying basis (Khullar, Sinha & Khurana, 2019). Some of these and others, including aminoglycosides, quinolones and tetracycline, are used in human and veterinary medicine and listed on WHO's list of medically

important Antimicrobials for Human Medicine (WHO, 2019). Outbreaks of foodborne disease associated with antimicrobial-resistant pathogens have been linked to the consumption of vegetables and fruits. However, it is uncertain the extent to which the treatment of plants with antimicrobials used as pesticides promotes AMR in pathogens found on edible portions of fresh plant (FAO & WHO, 2019a). Furthermore, there is growing concern regarding pesticides, like the triazole fungicides used in plant production, have contributed to anti-fungal resistance in the pathogen responsible for the human disease Aspergillosis (Rivero-Menendez *et al.*, 2016).

What can be done?

By preventing diseases in all sectors, the need for all types of antimicrobials could be greatly reduced. International AMR focus has shifted from antimicrobial management and use towards implementing good agricultural and production practices, biosecurity, and infection control, thereby reducing the need for antimicrobials. In terms of plant production specifically, strong emphasize should be made on the prevention of plant diseases as well as strengthening of the Integrated Pest Management approach which uses pesticides as a last resort when all other practices to control the disease have failed.

Ongoing actions

- Awareness raising through factsheets on antimicrobials used as pesticides in plant protection to be published during the International Year of Plant Health.
- Guidelines on Pesticide Legislation under amendment to have the cross-cutting issue of AMR reflected.
- FAO/WHO has an ongoing project on the impact of antimicrobial application to plants on Antimicrobial Resistance Genes on vegetables and in soils.
- IPPC Contracting Parties initiated the discussion on the effects of the use of antimicrobial products for plants health.
- IPPC Secretariat is encouraging Contacting Parties to collect systematic data of the effects of antimicrobials used it plant health.
- Methodology to analyze AMR-relevant legislation in the food and agriculture sector
- Technical guidance provided to field projects and initiatives highlighting the importance of integrated pest and disease management for sustainable crop production, in line with Save and Grow principles, reducing reliance on synthetic pesticides and antibiotics.

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