



# The Contaminants of Emerging Concern in Agriculture



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**M**ost processes in agriculture require chemical intervention to either stimulate plant production to ensure food security or to decrease the probability of disease in livestock. Whilst such chemicals are necessary to achieve desirable outcomes on the farm, they sometimes contribute to inadvertent contamination of the environment. Contaminants of Emerging Concern (CECs) have recently been spotlighted as a field of priority in our freshwater ecosystems.

## What are agricultural CECs?

Contaminants of Emerging Concern are best described as synthetic or naturally occurring unregulated chemicals, particles or microorganisms commonly found in surface water resources as well as the environment in trace amounts and are not typically detectable or monitored (Noguera-Oviedo and Aga, 2016). Agricultural CECs are contaminants that originate from agricultural inputs such as the use of inorganic fertilizers, pesticides, herbicides, fungicides, and hormones. These inputs are increasingly used in agriculture to increase livestock production, crop quality and yield.

## Origin of agricultural CECs

The global issue of soil health decline, infringement on farming lands and the growing population has put strain on the availability of food resources to sustain the populous. Exponential population growth is fuelling the constant need for food and water due to the number of people increasingly outweighing resource availability. This has then pressured the agricultural industry to use several different inputs to improve yield and output to meet the overwhelming demand (Chowdary et al., 2005). Several types of agriculture are therefore compelled to use various synthetic products to accommodate their respective customers. For example, livestock farmers have adopted the use of veterinary medicines such as hormones to increase animal and dairy output whilst there is also an increase in the use of chemical as well as inorganic substances in crop farming. These inputs are used to fight pests, weeds and microorganisms that pose a great threat to crop quality and yield by feeding on the crops thus either damaging the crops or inducing stunted plant growth.

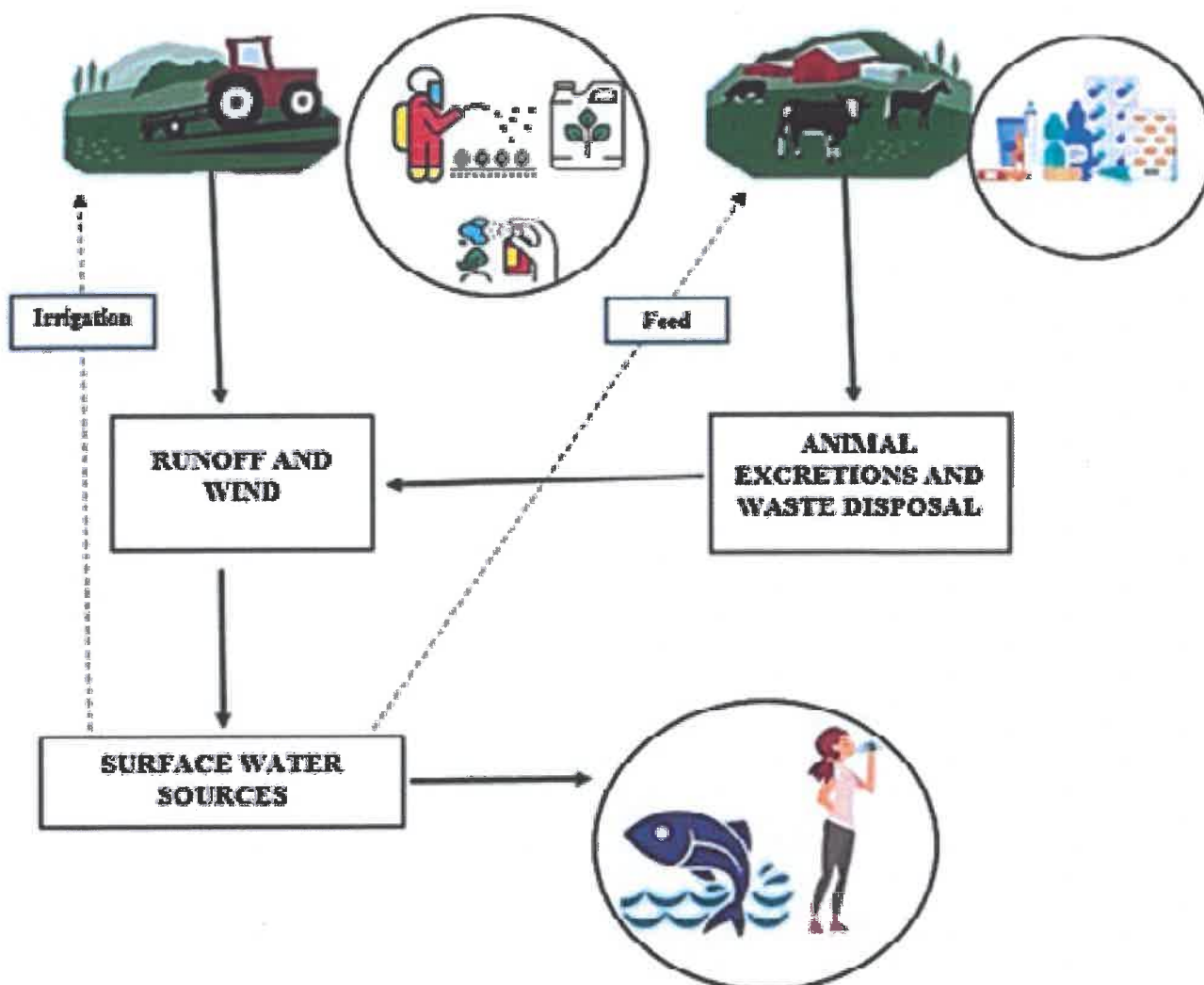


Figure 1: Sources of agricultural contaminants of concern

### Entry into water sources

Agricultural CECs make their way into the water sources in diverse ways depending on the nature of the CEC and application. Some CECs are applied through spraying due to being in either liquid or powder form. When sprayed they are blown by wind into the atmosphere and may land in open water sources such as rivers, dams and lakes which are utilized by surrounding communities. The most common route of agricultural CECs, however, is runoff. During rainy seasons, the CECs that settle on the crop and soil are easily washed off during precipitation and deposited into nearby water bodies (Ahmed and Wohnlich, 2014). In terms of commonly used hormones such as oestrogen and androgen, it can enter the environment due to improper disposal after use but most commonly it is excreted by animals that only utilize a proportion of medicine or hormones. The leftover residues then tend to accumulate in the aquatic environment due to their

inability to degrade therefore posing a threat to aquatic life and the environment.

### Impact of agricultural CECs on the environment and animals

Increase in the agricultural CECs in water bodies reduces water quality and directly impacts the lives of all the organisms dependent on those water resources. Studies have shown that different pesticides, fungicides, and veterinary medicine residues can induce endocrine-disrupting activity, promote carcinogenesis in humans, and trigger physical as well as reproductive behavioural changes in aquatic animals (Grabicova et al., 2017). They have also been noted to have a negative genetic and reproductive impact on essential environmental microorganisms inhabiting water and soil by altering fundamental environmental factors such as pH, moisture content and oxygen concentration. Changes in environmental conditions have a direct effect

on organisms inhabiting the environment, which means that environmental changes can even lead to fatalities of aquatic animals including fish and frogs. These changes may be small, but they have significant impact on the food chain and ecology by causing an imbalance in the ecosystem.

### Management and mitigation of agricultural CECs

The use of inorganic agricultural inputs can be reduced by practicing of organic farming methods such as the use of organic and biodegradable farming amendments. There is a growing interest in the organic approach, which is driven by the introduction of the more environmentally friendly alternatives. Although there are organic and eco-friendly alternatives, there is still concern over the excessive use as even the organic substances can cause contamination when excessively used. Simple changes like using appropriate quantities of organic and biofertilizers as well as eco-friendly substances with less chemicals can significantly reduce the footprint of agricultural CECs. These are, however, costly compared to their traditional counterparts and often contaminants can wash downstream from sources where release occurs upstream.

### What can you do to help?

The Agricultural Research Council (ARC) initiated a project funded by the Water Research Commission (WRC Project No. 2021/2022-00256), in collaboration with Tshwane University of Technology, North-West University and University of South Africa, to establish an online portal consisting of information relating to newly detected aquatic pollutants and we require your help. Please submit any questions you have relating to water quality and CECs which you suspect could be present on your farm. We would like to use these to setup an information page on the CEC Knowledge Hub webpage to assist farmers in how to mitigate any risks of exposure to CECs and educate farmers on how to monitor their water quality long term. Feel free to ask us anything related to CECs and agricultural practices.

Questions can be submitted via email to:

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