FACT SHEET

23 September 2014

Nanomaterials and agriculture

What are nanomaterials?

Nanomaterials are objects with one or more dimensions, or surface structures, on the nano-scale. The nano-scale ranges from approximately 1-100 nanometres - with one nanometre being one billionth of a metre. The properties of matter change at the nano-scale and nanomaterials can therefore behave quite differently to bulk particles of the same substance. They also have a greater surface area relative to volume. This makes them much more chemically reactive – and potentially toxic - than larger particles.

How are nanomaterials used in agriculture?

Nanomaterials are used in agricultural products across the supply chain including in chemicals and fertilisers, feed and supplements for farm animals, machinery and storage facilities.

Nano-pesticides

All of the leading producers of agricultural chemical, including BASF, Monsanto and Syngenta are actively researching nanotechnology for use in agriculture and pesticides and nanoscale ingredients are already on the market.[1] In the last ten years, over 3000 patents have been filed for pesticides with nanoscale ingredients.[2] These are mainly reformulations of existing pesticides at the nanoscale.[3]

These products are generally intended to be more targeted in delivery, more toxic, to have greater persistence on leaves and to allow reduced quantities of chemicals to be used with greater effect.

Nanoencapsulation and microemulsions

Microencapsulations are designed to improve delivery to the target pest, enhance herbicide transport through stubble, reduce adsorption and increase herbicide longevity in soil due to the gradual release and diffusion of active ingredients from the capsule.[4]

Products such as Subdue MAXX, a fungicide for turf available in Australia, are characterised as microemulsions, however, scientists at the University of Vienna have determined that they are actually nanoscale emulsions. It appears the term microemulsion is commonly being used as a term for formulations containing organic nanoparticles.[5]

Nano-fertilisers

Fertilisers advertised as nanoscale are freely available on the market, but do not appear to be produced by major chemical companies. They are promoted as ways to improve nitrogen use efficiency, yields, control efficiency, limit waste and improve quality.[6]

Animal feed

Nanoscale minerals, vitamins, additives and supplements in animal feed are already on the market but do not currently appear to be widely used.

Environmental concerns

The rapidly expanding use of nanomaterials will invariably lead to their accumulation in soil and water.[7] Furthermore, studies have shown that nanomaterials can potentially harm beneficial soil microorganisms, plants, nematodes and earthworms and prevent nitrogen fixation.[8]

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Health concerns

Nanomaterials are generally more chemically reactive than larger particles of the same chemicals and are much more likely to be taken up into our cells and tissues than larger particles. [9] Numerous studies have shown that nanoparticles can be absorbed through the intestine and often accumulate in the liver, kidney, spleen, lung and brain.[10]

There is a growing body of peer reviewed work indicating potentially serious health concerns with some nanomaterials.[11] Nanoparticles have been associated with immune dysfunction and colon cancer and there is evidence that nanoparticles may remain in the body for extended periods.[12]

Although the uptake of nanomaterials in the edible tissues of a variety of food plants has been shown in a number of studies, a recent review concluded that research is so limited that the "the risk posed to humans consuming these food products is completely unknown."[13]

Regulation of nanomaterials in agricultural products

The US EPA now requires registration of all pesticides containing nanoscale ingredients, regardless of whether they are active or inactive,[14] and the EU requires a risk assessment, authorisation and labelling for nanomaterials, including both active and non-active nanomaterials in biocidal products (EU 528/2012). Nanomaterials require separate approval from conventionally sized materials.

The Australian Pesticide and Veterinary Medicine Authority (APVMA) previously claimed that "data supporting a chemical or chemical product that contains engineered nanomaterials will be independently evaluated, regardless of a conventional counterpart product being approved." Although they noted that "not all engineered or manufactured nanoscale materials are novel and will need to be assessed."[15] However, this ostensible requirement has now been removed from the APVMA website and replaced with the statement that "the APVMA has not yet published any detailed guidelines specifically about the registration and regulation of products containing nanomaterials." It is suggested that those proposing to register a product using nanomaterials 'should' first contact APVMA, but this is not mandatory.[16]

What needs to happen?

Friends of the Earth is calling for:

- a mandatory register of nanomaterials to help protect agricultural workers and allow regulators to conduct risk assessments.
- regulations that ensure nanomaterials are not used in agriculture until they have undergone an independent safety assessment and that all nanomaterials in agrochemicals and animal feed are labelled.

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[10] *Ibid.*

[11] *Ibid.*

[12] *Ibid.*

[13] Deng, y. *et al.* (2014) Interactions between engineered nanomaterials and agricultural crops: Implications for food safety. *J. Zhejiang Univ-Sci A (Appl Phys & Eng)* **15**(8):522-572, pp. 553, 559 564

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