Neonicotinoids & Risk Management

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What are neonicotinoids?

Neonicotinoids are a class of insecticide that is chemically related to nicotine. Neonicotinoids are often simply referred to as "neonics." Chemicals in the neonic family are neurotoxins and include acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, nithiazine, thiacloprid, and thiamethoxam. These chemicals are the active ingredients in pesticides. Neonic mode of action is systemic. As a neuro-active insecticide, it binds to nicotinic acetylcholine receptors. Due to differences between invertebrates (e.g., insects, etc.) and vertebrates (e.g., humans, mammals, birds, etc.), neonics are selectively more toxic to invertebrates than vertebrates. They have become widely used due to their relative affordability, ease of use, wide availability, and lower toxicity to mammals and humans than traditional insecticides. Neonics are systemic, meaning that the crop absorbs the chemicals. Neonics can be applied as a pesticide spray to plants or as a powder on seed. Neonic covered seed is often referred to as 'treated seed.' It is considered less environmentally damaging to apply neonics directly to seed than to plants as a pesticide, as the treated seed is often applied at lower rates, is more targeted, and less susceptible to drift than when sprayed as a liquid. Common crops that have treated seed options include corn, soy, potato, and vegetables. Neonic seed treatments (NSTs) prevent damage from common crop pests like wireworm and seedcorn maggot which can devastate fields, resulting in total crop loss.

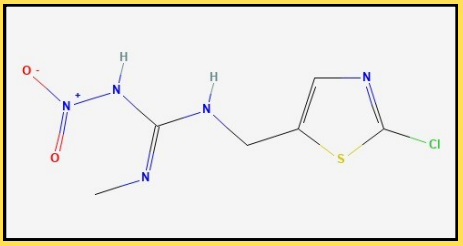

Image 1. Molecular structure of clothianidin a common neonicotinoid.

What is the risk? Insects, water, soil, and air

Neonics are a pesticide and as such are designed to be extremely toxic to insects. While used to prevent damage by pests, it also can negatively impact beneficial insect populations like natural insect enemies and bees. When applied as a spray, neonics can miss their target crop through drift. Dust from the treated seed during planting or after settling on the soil surface can move through wind erosion. For treated seeds, the majority of the insecticide is not absorbed by the plant and can enter the environment by adsorption to soil or through surface or ground water. Most neonicotinoids do not degrade quickly and can persist in the soil for months to years after application. Neonic losses to the environment through wind, water, and soil retention have the potential to put insects, soil organisms, and water organisms at risk of exposure. When not lost to the environment, they are absorbed by plants and can be redistributed to insects when eaten with potential to accumulate further up the food chain. The ubiquitous use of neonics has led the widespread detections in the environment.

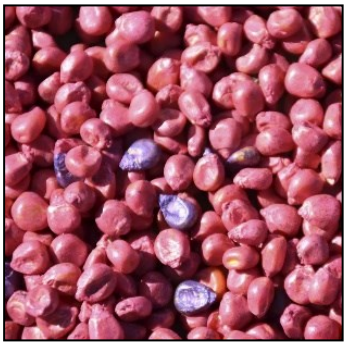

Image 2. Neonic treated corn seed.

How is risk mitigated? BMPs and dust stewardship

Prevention before planting

In some cases, it may be possible to avoid planting with NSTs through integrated pest management (IPM) methods. One way to reduce risk of exposure to neonics from treated seed is to assess the potential need for using them. Later corn planting can reduce the risk of pest migration patterns occurring at the time when plants are most

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vulnerable. Fall or early spring scouting can help inform the potential for pest outbreaks. You can find out more about how to scout for wireworms and seedcorn maggot at the website: https://www.uvm.edu/extension/nwcrops/integrated-pest-management-ipm.

If pests reach an economic threshold, pesticide spray applications may be the most effective at maintaining yield. For some pests (e.g., wire worm and seedcorn maggot), if early season scouting shows pest damage, a pesticide rescue plan may not be sufficient and replanting may be necessary. Planting with NSTs may be appropriate when risk factors are high. For example, risk factors are higher for wireworm impacts when organic matter is greater than 5% and in fields rotating from sod into corn.

Technology

Several improvements have been made to manufacturing and planting neonic treated seeds since its commercial use began in the early 2000's. Some companies improved seed coatings to stick more to the seed in an effort to minimize dust. Dust contaminated with neonics are susceptible to drift with vacuum-type planters. Planters with deflectors installed onto the pneumatic sowing equipment directs 90% of the dust down toward the ground which reduces airborne drift.

Planting

Read and follow the instructions on the seed tag, including handling instructions and wearing any personal protective equipment. Load the planter boxes in a way that minimizes dispersion of dust. When planting, avoid windy days to minimize drift. To prevent seeds from sticking together, a lubricant like talc, graphite, or commercial product may be used. However, this can be abrasive to the seed coating and contribute to neonicotinoid contaminated dust. Eliminating lubricants and preventing dust from entering machinery reduces the risk of neonic drift. Dispose of any unused treated seed properly by following the instructions on the seed tag, which may include planting in headrows, planting double rows, or otherwise burying it to reduce potential consumption by animals. In some cases, dust from treated seeds may be left on equipment. This dust should be vacuumed and any vacuumed dust or contaminant materials (bags, filters, etc.) should be put in a plastic bag and disposed of according to local waste handling regulations.

For more information on handling, storage, and disposal of treated seed, refer to Vermont Agency of Agriculture, Food and Market's Seed Program: https://agriculture.vermont.gov/public-health-agricultural-resource-management-division/animal-feeds-seed-fertilizer-lime/seed

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