Look What's Out There

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Changes in Toxicological Dogma

If you haven't yet heard of "hormesis" you probably soon will. A revolution is taking place in toxicology which will eventually change perspectives radically about the hazards or otherwise of pesticide traces in food. Hormesis is described as the paradoxical effect of toxins at low concentrations. The paradox is that although most chemicals are toxic at high concentrations (or dose), the majority are likely beneficial at low concentrations (or dose). The common regulatory assumption is that if a chemical is toxic at high dose it continues to be toxic but with diminishing toxicity as the dose is lowered. In contrast, hormesis indicates that many chemicals have the opposite effect at low doses to those at high doses. There are a number of common examples that are in the hormetic category. A tablet of aspirin a day is recommended to improve the circulation; 50 tablets a day will not improve the circulation 50 fold, but likely see its complete cessation. This activity in not unlike most pharmaceuticals. The recommended daily intake of vitamin A is 1-3 mg/day; teratogenic effects appear at 9-10mg/day. Fluoride at 1 part per million in drinking water strengthens teeth against decay; 100 ppm is definitely poisonous. Copper is essential for plant growth but rapidly becomes toxic as the concentration in the soil increases.

It is unlikely that just one mechanism is responsible for the hormetic response. A good example is sunshine/UV-exposure. At low concentrations sunshine beneficially induces the formation of vitamin D. At higher levels, protective melanin formation ensures that potentially higher and future UV stress can be tolerated. But exposure to large doses of UV without protection causes oxidative damage to the skin, overwhelms protective mechanisms, and potentially initiates skin cancer. This sequence is a fair analogy to the response to many chemicals. Hormetic protective mechanisms were probably essential for hunter-gatherers who ate a varied diet containing many potentially toxic chemicals in fruit and vegetables. The large number of natural pesticides in fruit and vegetables may exert the known protective effects against cancer that result from a diet high in fruit and vegetables. Possible conclusions include the idea that there are safe doses for many chemicals and that the effects of low concentrations of toxins such as pesticides can be directly beneficial by decreasing cancer incidence or increasing growth. For more information see http://www.belleonline.com. (Anthony Trewavas FRS, University of Edinburgh, UK, via AgBioView via AgNet, 1/7/03).

Certain Pesticide Mixtures Cause Label Confusion

Anytime a field is treated with more than one pesticide there is a risk for an interaction among the pesticides. With most products the interaction does not significantly influence product performance, and thus is of little concern to farmers. However, with some products the interaction may result in an economically significant response. The interaction may be reduced performance (e.g. reduced grass control when tank mixing a broadleaf herbicide with an ACC-ase herbicide such as Assure® or Poast Plus®) or reduced crop safety (e.g. tank mix of Accent® and Clarity®). In most situations these interactions are inconsistent, thus making it

difficult to access the risk associated with the combination of products.

However, the potential for organophosphate insecticides to increase herbicide injury on corn is well documented. Organophosphate (OP) insecticides can reduce the margin of crop safety to any herbicide that is metabolized by the cytochrome P-450 enzyme system. This enzyme system is responsible for degrading several important herbicides, including the sulfonylureas (Accent®, Beacon®, etc.) and Callisto® (mesotrione). The OP insecticide can reduce the speed at which the cytochrome P-450 enzyme metabolizes the herbicide, allowing the herbicide to remain at a toxic concentration in the plant for a longer time than if the insecticide wasn't present. Several factors influence the potential for crop injury when one of these herbicides is used on a crop treated with an OP insecticide, including the relative margin of crop safety to the herbicide, the insecticide used, and any factor that influences crop vigor. The risk of a herbicide/insecticide interaction varies among OP insecticides largely due to the mobility of the insecticide within the crop. For example, in corn, terbufos (Counter®) generally has a greater risk for herbicide interactions than chlorpyrifos (Lorsban®) because it is absorbed by corn roots and translocated within the plant more readily than chlorpyrifos.

Although the physiological cause of the OP/herbicide interaction is well understood, end users (i.e., farmers, ag chemical dealers) of these products may be confused by the conflicting statements found on the product labels. For example, the current Callisto® label states “severe crop injury may occur if Callisto® is applied postemergence to corn crops that were treated with Counter® or Lorsban®.” The original label went even further, stating not to use Callisto® postemergence on corn treated with Counter® or Lorsban®. Dow AgroSciences, the manufacturer of Lorsban®, has stated that the risk of significant injury from postemergence applications of Callisto® on corn treated with Lorsban® is equivocal, and thus feel the warning should not be on the Callisto® label. To support this position, Dow AgroSciences released a supplemental label (2ee) recommending postemergence applications of Callisto® on corn treated with a soil application of Lorsban®. Syngenta has maintained that the label warning is warranted in order to minimize the risk of crop injury since they are likely to be held responsible for any injury complaints, and recommends not using Lorsban® or Counter® if Callisto® is to be applied to the corn postemergence. Since Callisto is a pigment inhibitor, symptoms of injury are easily noticed; however, under most situations any crop response will be short-lived and should not threaten yields (in corn). (Iowa State University, 1/3/03 via AgNet, 1/7/03).

Pesticide News

▪ In what he called a "shot across the bow," retiring House Resources chair, James Hansen (R-UT), filed a bill to exempt military lands, private property and all plant life from the Endangered Species Act, contending that his bill reflects Congress' original intention. In his statement, he said the Endangered Species Act can be used to thwart everything from military use of bases for "mission-critical" training to "the farmer's simple desire to plant a crop ... [to] feed his family," and that his suggestions could give the next Congress something on which to act swiftly. (CropLife America *Spotlight*, 11/15/02).

▪ A university biomonitoring study shows family members, on farms where pesticides are applied, generally do not have appreciably-increased pesticide levels compared with non-farm participants. The study analyzed urine samples from 95 farm families in Minnesota and North Carolina over four days after pesticides were applied on respective farms, along with a pre-pesticide application sample. The head researcher was quoted as stating that "For the types of pesticide scenarios we observed, the Farm Family Pesticide Exposure Study shows that it can be erroneous to assume appreciable pesticide exposure based on participants presence on the farm." (CropLife America *Spotlight*, 1/3/02).

▪ An aquatic toxicologist from the University of Georgia has patented a genetically engineered

fish (Japanese medaka) that will allow scientists to examine genetic damage caused by exposure to chemicals in the environment. The fish model, which behaves remarkably similar to rodent models, is of greater benefit because they are smaller, less expensive to keep and maintain than mammals, and they allow fast replication of studies. (*Pesticide & toxic Chemical News*, Vol.31, No. 9).

▪ The city council of Vedic City, IA, under the guidance of Maharishi Mahesh Yogi (yes, the one from the Beatles) unanimously passed a resolution requiring all food items sold in the city to be organic. Vedic City Mayor Bob Wynne was quoted as saying, "Vedic City doesn't endorse poisoning its citizens." Wynne stated the resolution was prompted by an outbreak of allergic reactions in city residents. He believes the allergic reactions were related to recent crop dusting on nearby farms. If passed, the resolution makes the sale of any food that is genetically modified or not grown organically illegal inside Vedic City. Vedic City currently has one restaurant, located at the Raj resort, and no grocery stores. (*The Fairfield Ledger* via AgNet, 12/2/02).