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Pesticides and the public's perception of risk

Are natural products safer than synthetic ones? This is a fundamental question that has been asked by faculty who have reviewed the scientific literature, such as Dr. Joel Coats of the Department of Entomology at Iowa State University. It is a difficult question to pose and analyze, but needed to clarify some of the confusion over the assessment of risk.

The experience of the general public on controlling pests is limited to their house, yard, garden, and pets. Urban situations account for at least a quarter of all insecticides used. Consumers seem to have a wide acceptance of pesticides as long as they are the ones using them, regardless of the fact that they are not professionals. The same people may indicate a distrust when these materials are in the hands of others even though they may be trained and licensed and aware of the label regulations. There are also other factors that contribute to this distrust.

Most chemicals registered as pesticides are lab-synthesized, petroleum-based ingredients. Distrust of synthetic insecticides began in 1962 when the press featured stories about DDT contaminating fish, causing fish-eating predator populations to decline as a result of thin egg shells. Later insecticides were the organo-phosphates and carbamate esters that were more biodegradable but had broad-spectrum toxicity and could affect non-target organisms. Some were highly target-specific and very safe, such as carbaryl (Sevin) used in gardens and in flea collars for cats and dogs.

Most people do not understand pesticide products, and therefore are uncomfortable with their use in food supplies. For instance, inhaling benzene fumes while filling up the car with gasoline poses a much greater health risk than irradiating food or administering growth hormones to cows. But, people are familiar with filling up their car with gasoline and the use of gasoline. They do not understand the actions of pesticides or appreciate their use very well.

The general public feels far removed from the decision-making process that registers products or controls exposure to them. Most people's experience with exposure is a result of mis-applications such as herbicide drift on the lawn, yard or garden or to bodily reactions because they spilled the concentrated product or sprayed it on themselves unintentionally. Interestingly, germicidal pesticides, fungal ointments and bug repellents are widely accepted. But, again these are more familiar and their purpose clearer to the public. Also exposure is usually voluntary.

The public is also suspicious that not all the effects of chronic, long-term exposure are known. There are a few cases where this may have happened. For instance, it took many years for the environmental effects of chlorinated hydrocarbons to be fully understood. These cases are rare but not unique to agricultural chemicals. Common and serious examples are lead in paint, recently re-appearing on children's toys from China, and asbestos in school buildings.

Surveys showed that just about every household in this country had used some pesticide product within the past year. Many homes are treated every year by pest control operators, and yards are treated by lawn care outfits. Pesticide products are applied with care, following labeled instructions, and few accidents occur. Factors that are responsible for the most deaths in this country, over 10,000 per year, are tobacco,

Continued on page 4

Inside this issue:

Minimum-risk chemicals listed under Section 25(b)

Chemical products containing active and inert ingredients considered minimum risk are registered under Section 25(b) of FIFRA (Federal Insecticide, Fungicide Rodenticide Act). They are NOT required to have an EPA registration number and are exempt from EPA regulations on efficacy and toxicity. The exemption from Federal registration is allowed only if the manufacturer uses approved active and inert ingredients, and follows EPA labeling guidelines. There are 31 approved active ingredients with pesticide claims on the Section 25(b) list and nearly all of them are natural products (Table 1). A pesticide is defined by FIFRA as "(1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, (2) any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant, and (3) any nitrogen stabilizer." (http://www.epa.gov/opppmsdt1/PR_Notices/pr2000-6.pdf).

Table 1. Active Ingredients under Section 25(b) FIFRA

1. Castor Oil
2. Cedar Oil
3. Cinnamon and Cinnamon Oil
4. Citric Acid
5. Citronella and Citronella Oil
6. Cloves and Clove Oil
7. Corn Gluten Meal
8. Corn Oil
9. Cottonseed Oil
10. Dried Blood
11. Eugenol
12. Garlic and Garlic Oil
13. Geraniol
14. Geranium Oil
15. Lauryl Sulfate
16. Lemon grass Oil
17. Linseed Oil
18. Malic Acid
19. Mint and Mint Oil
20. Peppermint and Peppermint Oil
21. 2-phenylethyl propionate
22. Potassium Sorbate
23. Putrescent Whole Egg Solids
24. Rosemary and Rosemary Oil
25. Sesame (includes ground Sesame plant stalks) and Sesame Oil
26. Sodium Chloride (common salt)
27. Sodium Lauryl Sulfate
28. Soybean Oil
29. Thyme and Thyme Oil
30. White Pepper
31. Zinc Metal Strips

Products exempted from registering with EPA under Section 25(b) are also exempted from full state registration by the Nebraska Department of Agriculture (NDA). NDA requires that Section 25(b) labels be submitted, reviewed and approved by them prior to sale within the State. (http://www.agr.state.ne.us/division/bpi/pes/25policy.htm).

Some characteristics of Section 25(b) labels are:

- No approval or review by EPA done.
- Manufacturer is responsible for label content.
- Ingredients are limited to those approved by the EPA.
- No EPA Reg. number issued to identify label.
- No EPA Establishment number is required.
- No signal word is required notifying danger.
- No personal protective equipment (PPE) is required.
- False or leading statements as defined are not allowed.

To growers, a key important point about Section 25(b) products is that the sellers do NOT have to prove efficacy for their claims to either the EPA or the states. An example is a product with the Section 25(b) active ingredients sodium lauryl sulfate @ 0.109 percent, soybean oil @ 0.0004 percent and corn oil @ 0.002 percent plus various "inert ingredients" (99.8 percent). Sodium lauryl sulfate is a foaming agent refined from coconut oil and found in shampoos. This product is sold as an insecticide, however, demonstrations have shown that this product does not kill insects much. It still can be sold for this use since EPA and state registrations are not concerned with efficacy.

Note that there are products resembling Section 25(b) products in the marketplace that have not received federal and state approval. So a buyer should be aware and wary of unsupported label claims. These products may contain unapproved ingredients. Since they do not contain signal words or requirements for PPE, they could pose potential health risks. They also may be ineffective, as already noted, and be a waste of money.

Source:
Schulze, L. 2003. The Label v.15,i.11.)

Agriculture 'wonder' products: Buyer beware

Wonder products are seldom worthless, but usually are not worth their cost for the effect that they may or may not have. Often they are sold with scientific-sounding promotion and promise incredible benefits that are not directly substantiated.

A typical promoted effect is a reduction of fertilizer application. However, soil fertility is often high in potato crop land and fertilizer application can be reduced even without the wonder product. Another pitch similar to the old "snake oils" is that the product is a "cure all" for practically all soils and crops. Advertising and sales are usually built entirely on testimonials or anecdotes. Actual, objective data supporting the claims are lacking or taken out of context. Often claims of results are based on visual observations showing an obvious effect of the product. In my experience, this has occurred when the ingredients of the product are not disclosed but the odor clearly indicated the presence of urea, which is known to cause a temporary greening of foliage.

So, beware of products claiming:

- Increased soil water-holding capacity,
- Increased soil aeration,
- Increased nutrient-holding capacity or availability,
- Improved soil structure or stability,
- Increased microbial activity,
- Improved uptake of organic matter,
- Increased pest resistance,
- Increased water penetration,
- Improved water-use efficiency or lower evaporation,
- Improved root respiration,
- etc.

Types of Wonder Products:

Soil additives are claimed to reduce or supplement fertilization. Often they contain trace elements and report the total amount present. This may not indicate their availability to the plant, and the soil often naturally has more of the elements than the product.

Soil amendments are claimed to improve the physical or chemical properties of the soil. Changing soil structure, soil texture, pore capacity, aeration, or water-holding capacity is just about impossible and would require massive amounts of amendments. For example, it takes several tons of elemental sulfur per acre to lower soil pH. Therefore, adding several pounds would cause a negligible change.

Microbial inoculants supposedly increase populations or stimulate activity. The amount of contribution of these inoculants is infinitesimal compared to the actual natural population already in the soil. Some products were pasteurized for shipping and handling, and so any organisms are actually dead. Note: These products should not be confused with nitrogen-fixing bacteria, Rhizobia spp., used in legume agriculture which are well-documented in science.

Soil humus, humic acid and fulvic acid are terms used for mineral organic matter products and are classed as humates. They are claimed to increase soil levels and activity of soil organic matter. Soil humus is composed of a lot of compounds ranging from known biochemicals to polyelectrolytes resulting from dead microbes. These products would have little effect on the soil. For example, soil containing 3 percent organic matter contains 60,000 pounds of organic matter per acre at furrow depth. Adding 500 pounds of a commercial humate containing 60 percent organic matter will increase the soil's organic content to 3.03 percent.

Plant growth regulators (PGR) are well documented to affect plant growth, and many are natural hormones found in the plant. They can have both a beneficial and a harmful affect on plants, depending on dose and application timing. Examples are gibberellic acid for potato sprout promotion, maleic hydrazide for sprout inhibition, and 2,4-D for weed control. Some wonder products may contain some real PGRs. However, PGRs have very defined specific uses and applying them to the soil is NOT one of them. In 40 years of research on PGRs, I have never come across one or combination of PGRs that is active when applied to the soil. To have an effect, PGRs need to be applied to living plant tissue, seed, tuber, stem, leaves, root, flower, fruit, etc. Examples of PGRs in agriculture are auxins such as 2,4-D and dicamba, cytokinins such as kinetin, gibberellins such as gibberellic acid (GA3), and ethylene, a gas.

Wonder products or "soil medicines" cannot ever substitute or supplement good agronomic practices. So, buyer beware.

Reference:

McDole, R.E. and C.G. Painter. 1979. Wonder Products in Agriculture. U. Idaho CIS #510.

Pesticides and perception of risk

Continued from page 1

alcohol, cars, murder, and falls. Of poisonings, pesticides accounted for 12 possible cases in 1988.

People often respond to risk irrationally -- that is, not in agreement with statistical records on likelihood of hazard occurrence. One measure of risk used by governments is the chance of dying in any year of one individual out of a million. Under this measure, you would have a one-in-a-million chance of dying in the coming year by traveling on a bicycle for 10 miles, in a car for 150 miles or in a jet plane for 3,500 miles, or even canoeing for six minutes. The same is true if you eat 40 tablespoons of peanut butter or have a chest X-ray. Surgery, X-rays and alcohol use are much more dangerous than pesticides, police work or privately flying a plane; however the public believes the opposite to be true. Risks are perceived based on low familiarity and high dread.

Of the chemicals synthesized in the laboratory or found in nature, such as glycoalkaloids, some can be hazardous and some safe. Some may be toxic and some not, and some may leave residue and some may not. Three significant conclusions can be discerned:

1. The biological activity of a chemical depends on its structure regardless of source.

2. Safety depends on the chemical structure and the way the chemical is used.

3. Perceived risk is often not consistent with actual risk but related to familiarity.

References:

Facts Versus Fears: A Review of the Greatest Unfounded Health Scares of Recent Times. 1998. by Lieberman, A.J. and Kwon, S.C., publ. American Council on Science and Health, NY, NY

Coats, J.R. 1994. Risks from natural versus synthetic insecticides. Annual Review of Entomology 39:489-515. (source: Schulze, L. 1994. The Label v.6,i.5.)

The Nebraska Potato Eyes
is on the World Wide Web at:
www.panhandle.unl.edu/peyes.htm