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AGRICULTURAL HEALTH STUDY

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Retinal Degeneration and Fungicide Use

Retinal or macular degeneration is breakdown of the retina, the inner layer of the eye that transmits images from the lens to the brain. (The macula is the central, most sensitive portion of the retina.) Retinal degeneration causes vision to be reduced or lost and is the leading cause of blindness in older adults. The risk of developing retinal degeneration increases with age and is greater for women than men. Other factors that may be related to the condition include light eye color, hypertension, diabetes, and sun exposure, but little is known about the role of exposure to occupational or environmental toxins. Some studies of animals suggest that exposure to organophosphate insecticides or fungicides may damage the eye.

In order to investigate the relationship of retinal degeneration to pesticide exposure, we used information from the Agricultural Health Study, a long-term study of licensed pesticide applicators in Iowa and North Carolina. Only 154 applicators (less than 1%) reported having a doctor's diagnosis of retinal degeneration. Information from questionnaires completed at the time of enrollment in 1994-1997 was used to compare pesticide use in these applicators with pesticide use in 17,804 applicators without retinal degeneration. Most of the participants in this retinal degeneration study were farmers (99%) and most were white men (97%).

Retinal degeneration was:

- Two times more common in applicators who had used fungicides—chemicals used to control fungus and prevent rot on crops. Results were similar in North Carolina and Iowa.
- One-and-a-half times more common in applicators who had used organochlorine pesticides—a group of insecticides, including aldrin and DDT, that are mostly no longer in use.
- Not clearly related to other pesticides.
- More than twice as common in applicators who raised orchard fruit (apples or peaches).

The Agricultural Health Study is a long-term study to investigate the effects of environmental, occupational, dietary, and genetic factors on the health of the agricultural population. This study will provide information that agricultural workers can use in making decisions about their health and the health of their families. The study is conducted in North Carolina by Battelle Centers for Public Health Research and Evaluation and in Iowa by the Department of Epidemiology at the University of Iowa. **The study is directed by the National Cancer Institute, the National Institute of Environmental Health, and the US Environmental Protection Agency.**

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The study's most important finding is that retinal degeneration was consistently related to fungicide use. This relationship was seen in farmers from both Iowa and North Carolina. Farmers who had used fungicides for more days over their lifetime were more likely to report the condition than those who had used fungicides for fewer days.

Also, applicators who used certain methods to apply fungicides were more likely to have retinal degeneration. These methods—hand spray gun, backpack sprayer, and mist blower—may all involve greater contact with the fungicide than other methods, such as tractor boom. Using personal protective equipment did not appear to reduce the likelihood of developing retinal degeneration, although our study did not have enough information to resolve this issue completely. In particular, the condition appeared to be related to exposure to the whole body, not necessarily to the eye, and was not reduced by using goggles or face masks.

The relationship of retinal degeneration to raising orchard fruit, described above, was seen only in farmers who used fungicides. Orchard farmers who did not use fungicides were not more likely to have retinal degeneration. This finding suggests that the condition is related to using fungicides, not to raising orchard fruit.

The relationship of retinal degeneration to insecticide use that we found in our study is similar to relationships found in other studies of humans and animals. However, this is the first study in humans to report a relationship of retinal degeneration to fungicide use. Because no one study by itself can fully answer a question, more work needs to be done to determine whether this relationship will hold up. Epidemiology studies like ours report a statistical association, which needs to be confirmed by additional epidemiology studies, as well as animal and mechanistic studies, before we can determine whether fungicide use actually causes retinal degeneration.

For further information about this study, please visit the Agricultural Health Study website at www.aghealth.org.

The Agricultural Health Study seeks to identify factors that promote good health.