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LETTERS

Pesticides and the Delaney Amendment

Philip H. Abelson, in his timely editorial "Pesticides and food" (26 Feb., p. 1235), has drawn our attention to the potential chaos the Delaney amendment will cause in its application to pesticide residues. The time is long overdue to initiate an effort to correct the many other problems caused by this legislation that has displaced science. The Delaney amendment has underwritten the philosophy that any level of a certified chemical carcinogen must be removed from the human environment. This concept, in truth, has never had a solid scientific foundation and has not been thoroughly examined for several decades.

The present situation has been compounded by the current bureaucratically based approach to the certification of certain chemicals as carcinogens. An apparatus has been created outside of the academic research community to assist in the implementation of this scientifically unsubstantiated effort to prevent cancer. Certification of carcinogenicity is carried out largely by the International Agency for Research in Cancer (IARC) of the World Health Organization, bolstered by the U.S. National Toxicology Program (NTP). The IARC has established rules for certification that are quite rigid and scientifically dubious. The NTP provides grist for the IARC mill; numerous compounds that have been tested in a rote manner in rodents are submitted for certification having already been certified by the NTP's own committees.

Neither the IARC nor the NTP pay enough heed to the manner in which humans are exposed to these chemicals or to their mechanisms of action or even dosage requirements needed to induce tumors. The procedures used often defy many of the usual rules of the toxicologist.

It is time to review this area in depth and to promote toxicology in the academic research community. I advocated the inclusion of proper carcinogenicity testing in chronic toxicity tests some years ago (*1*), never dreaming that the current public relations nightmare would occur. The testing of chemicals for carcinogenicity constitutes a vital protection against the introduction of a potential disaster. However the testing must be done thoughtfully, be individually designed, and be combined with research and interpretation of results left to scientists with some common sense.

As far as one can ascertain none of this mammoth effort has been of significance to the health of mankind. Rather much panic has been engendered, considerable economic damage has been inflicted, and many potentially able research workers as well as research funds have been sidetracked from productive effort.

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1. P. Shubik and J. Sicé, *Cancer Res.* 16, 728 (1956).

We agree with Abelson that the Delaney Clause needs to be modified and strengthened, but we disagree with some of his other statements. He indicates that soil erosion would increase without the use of herbicides and if no-till culture were reduced. Some studies report that herbicide use has the opposite impact, that is, herbicide use and clean culture increase erosion (*1*). Erosion of fertile cropland continues to be a serious agricultural problem, despite the widespread use of herbicides (*1*).

The increase we are witnessing in erosion in land used for agriculture results from major changes in agricultural technology, like the replacement of crop rotations with large monocultures (*1*). These practices have resulted in an increase in the use of other pesticides, like insecticides, for several crops and have raised the portion of crops lost to insect pests.

Although pesticides continue to be a major benefit to agriculture, returning about $4 per dollar invested in pesticidal controls (*2*), they cause serious health and environmental problems. More than 67,000 human pesticide poisonings occur annually in the United States, with 27 accidental deaths, and between 6,000 and 10,000 cases of cancer are associated with pesticides (*3–5*). These toxic chemicals destroy beneficial natural enemies of pests, increase pesticide resistance in pests, kill beneficial honeybees and wild bees, kill birds, fish, and other wildlife, kill domestic animals, and contaminate well and ground water. Nielsen and Lee (*6*) report that, if adequate U.S. well and ground water were monitored, the yearly cost would be about $1.3 billion annually. Including this $1.3 billion, the total environmental impacts of using pesticides cost the nation more than $8 billion per year (*5*).

Abelson correctly points out that approximately 36% of all food sampled by the Food and Drug Administration has measurable lev-

els of pesticide residues and 1% is above the legal tolerance level. However, the 1% of the food with excessive residues is not removed from the marketplace. By the time the samples are analyzed, the highly contaminated food has been sold and eaten (*7*).

Evidence that pesticide use in agriculture can be decreased without reducing yields or cosmetic standards is found in countries where such decreases have been legislated. In Sweden, Denmark, the Netherlands, and the Canadian province of Ontario, pesticide use has been lowered by 50% (*2*). Sweden plans another 50% decrease without a reduction in crop yields or change in cosmetic standards. In Indonesia, pesticide use has been decreased by 65% while rice yields have increased by 12% (*8*).

The extent of pesticide use and the presence of toxic chemicals in our food supply are complex problems that call for more investigation. In considering modifications to the Delaney Clause, many issues must be resolved on the basis of further research.

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3. T. L. Litovitz, B. F. Schmitz, K. M. Bailey, *Am. J. Emerg. Med.* **8**, 394 (1990).
4. *Unfinished Business: A Comparative Assessment of Environmental Problems* (U.S. Environmental Protection Agency, Washington, DC, 1987).
5. D. Pimentel *et al.*, *BioScience* **42**, 750 (1992).
6. E. G. Nielsen and L. K. Lee, *The Magnitude and Costs of Groundwater Contamination from Agricultural Chemicals: A National Perspective* (ERS Staff Report No. AGES870318, U.S. Department of Agriculture, Washington, DC, 1987).
7. *Regulating Pesticides in Food* (National Academy of Sciences, Washington, DC, 1987).
8. I. N. Oka, unpublished material.

Response: My editorial noted that the level of pesticides in foods was being monitored by the Food and Drug Administration. In general, the foods are meeting exacting standards mandated by the Environmental Protection Agency (EPA). The Pimentels assert that pesticides are having major deleterious health effects, and they cite references that ostensibly support their views. Their reference 3 is an article that constitutes the 1989 annual report of the American Association of Poison Control Centers (AAPCC). The 70 participating centers served a total population of 182.4 million.

The AAPCC receives calls for assistance that involve presumed or actual exposures to man-made or natural toxic substances. In 1989, 1,581,540 telephone contacts reporting "exposures" were documented. Table 10 of the AAPCC article shows that 66% of the calls were about situations either asymptomatic or symptomatic but unrelated to exposure. The Pimentel letter states that more than 67,000 human pesticide poisonings occur annually in the United States, with 27 accidental deaths. Table 17 of the AAPCC article presents data on 5,531 reports of "exposures" to herbicides and 48,283 reports of "exposures" to insecticides/pesticides. In the total of both categories the majority of the outcomes were either no effect or minor effects. Moderate effects in the two categories were noted in 1225 cases, and major effects in 125 cases. There were 18 deaths, of which 13 were suicides. Only three deaths were listed as resulting from accidental exposures.

The Pimentels also state that annually in the United States between 6,000 and 10,000 cases of cancer are associated with pesticides. Their reference 4 is a publication of the EPA. Appendix I of that document reveals that an estimate of 6,000 cancer deaths is based on rodent experimentation, and it lists uncertainties inherent in such research (p. B-11).

> First, the actual amount of pesticide residues consumed by humans is not known with certainty. . . . Second, there is uncertainty in extrapolating toxicological effects in animals to expected effects in humans . . . some toxic effects occur in animals but are rarely seen in the human population (e.g. liver tumors in mice). . . . Third, the mathematical low-dose extrapolation procedures used in animal studies to quantify human risks for pesticide residues are uncertain.

In the light of these multiple uncertainties, human epidemiology, although imperfect, assumes importance. During the 1960s and 1970s, hundreds of thousands of agricultural workers received huge exposures to pesticides (current exposures have been reduced). If the pesticides were highly carcinogenic, large numbers of cancers should now be evident. The Council on Scientific Affairs of the American Medical Association has reviewed evidence in the matter. A summary [*J. Am. Med. Assoc.* **260**, 959 (1988)] includes the following.

> A large number of pesticidal compounds have shown evidence of genotoxicity or carcinogenicity in animal and in vitro screening tests, but no pesticides—except arsenic and vinyl chloride (once used as an aerosol propellant)—definitely have been proved to be carcinogenic in man.

—Philip H. Abelson