

## Dow attacks study used to ban 2,4,5-T

A recent study, cited by the Environmental Protection Agency two weeks ago as the basis for its "emergency suspension" of two controversial herbicides, was denounced last week by Dow Chemical Co. officials as "unscientific" and "seriously flawed." The study claimed to find "statistically significant" peaks in the spontaneous-abortion rate for women in Alsea, Ore., during the past six years. The peaks followed by two or three months the spraying of nearby forests with 2,4,5-T. Dow is the major producer of 2,4,5-T and silvex (a home-garden weed killer containing 2,4,5-T); EPA banned both on March 1.

Emergency suspension — the most drastic measure EPA can take under law — was used to prevent the spring spraying season, only weeks away, from further exposing up to four million persons unwittingly as a result of forestry, pasture and rights-of-way uses.

Controversy over the chemical goes back to the late 1960s when North Vietnam complained that use of Agent Orange — containing 2,4,5-T — by U.S. forces to defoliate jungles was causing adverse health effects in its people. Since the Defense Department halted its use of Agent Orange in 1970, more than 500 Vietnam veterans have filed disability claims with the Veterans Administration blaming 2,4,5-T for nervous disorders and cancers.

Further adding to its controversial status, 2,4,5-T is always contaminated with TCDD or tetra dioxin — an extremely potent toxin — which even at very low levels causes birth defects, miscarriages and tumors in laboratory animals. In announcing its emergency action, EPA said 2,4,5-T has been under intense review for more than a year, primarily because of adverse health effects associated with TCDD. EPA's emergency ban is temporary, pending a "full review" of human-health risks.

But Dow and 10 other firms filed suit in Federal District Court on March 6 asking that the ban be revoked.

At a press conference in Washington last week, Perry Gehring, Dow's director of health and environmental studies, lambasted the EPA study, beginning with the charge that EPA's conclusions are inconsistent with numerous animal studies.

"Absolutely not true," says EPA's Jack Griffith, an epidemiologist involved in the Alsea study. "There are at least 40 animal studies that have unmistakably pointed out carcinogenicity, birth defects and spontaneous abortions in laboratory animals from the mouse up through the rhesus monkey."

Gehring further charged that the EPA study failed to account for major, critical differences between the control (unexposed) and study populations such as

socioeconomic factors, availability of obstetric specialists and vacationers. Griffith disagrees, saying the field team who worked with the state health department made an "excellent match" after concentrating on precisely those factors.

To the charge the EPA "ignored totally the results of three other studies finding no association between birth defects and spraying 2,4,5-T," Griffith again said, "Not true." Although one study never addressed health effects and another looked at only four to six people, no study was ignored, he said.

Gehring claims a high peak in spontaneous abortions following the spraying of 2,4,5-T was an artifact and accuses EPA of "gerrymandering data." What's more, similar seasonal peaks occur in Miami, Fla., and Midland, Mich. Griffith says the study used hospital records on the age of the fetus at death to find conception dates. The results showed that conception and spray periods practically coincided, he said. But Dow references to other cities are spurious, he contended, since the Miami data measured deliberately induced abortions, not natural, spontaneous ones, and Midland already has two to three times the birth-defect rate of the rest of Michigan.

Griffith says that the Alsea women may have been exposed to parts-per-trillion levels of TCDD in their water or the wild game they are known to eat. While those levels may not kill a grown man, they may kill a fetus. It's that concern, raised by Alsea data, that made EPA take 2,4,5-T off the market, Griffith says. □

## Triumph over senescence in soy

Death comes rapidly to a soy plant. Stem and root growth halts, flowers and pods stop forming and the leaves yellow and drop. This genetically programmed self-destruction is triggered by the plant's developing seed pods. Larry D. Noodén and colleagues at the University of Michigan recently have made surprising discoveries about soybean senescence and now report a hormonal antidote to that deterioration. Their findings open the way to new strategies in crop management and yield improvement, Noodén says.

A 23-foot-tall soybean plant, the product of 15 months' growth, confirms other evidence that neither age nor size determines the soybean's lifespan. This lanky plant was prevented from flowering by long-day lighting conditions, but horticulturists knew that removing flowers and fruit prolongs the life of many plants that ordinarily die as their fruit matures.

Noodén challenges the earlier belief that greedy flowers, fruits and pods drain a plant's nutrients, condemning the parent to "exhaustion death." A series of surgical modifications of plants, reported last year



*Pods do not necessarily kill the soy plant. In a graft of two varieties, where only the lower portion fruits, the plant survives when enough leaves are maintained.*

(NATURE 271:354-357), uncoupled senescence from seed development. For example, in plants trimmed to just one branch of leaves and one cluster of pods, the leaves yellow and drop only when they are below the pods. The leaves remain healthy if they are located above the pod cluster, although the seed weight and yield of the pods is the same for both arrangements. Noodén concludes that seeds can develop without killing the rest of the plant.

Leaves appear to be the primary target for the senescence signal, which Noodén believes is a hormonal flux. When two varieties of soy plant are grafted together and kept under conditions where only the bottom half of the grafted plant produces fruit, the leaves on the lower portion yellow and fall off. However, the stem and roots remain alive and the upper portion of the plant continues to produce green leaves and grow.

The prime candidate for the senescence signal now is abscisic acid, although other hormones may also be involved. Abscisic acid, which can promote leaf shedding and dormancy, rises in concentration before the leaves yellow. In soybean seeds, levels of that hormone rise and then drop before pod maturation. However, in plants from which the pods have been removed, abscisic acid, applied to the leaves, does not substitute for pods and induce senescence.

A combination of two plant hormones can completely prevent both the yellowing and falling of soy leaves, apparently overriding the senescence signal, Noodén finds. Plants sprayed with benzyladenine and alpha-naphthalene acetic acid continue to accumulate starch in their leaves, while the pods mature normally. Therefore, in the presence of those hormones, the plant's photosynthesis and nitrogen fixation can meet the needs of the growing seeds without depriving the leaves. Perhaps further work with a compound that initiates pod formation will allow botanists to increase crop yields by taking advantage of a soy plant's hormonally sustained lifespan. □