

# ENVIRONMENT

## Sulfur dioxide stunts soybeans

Yields of soybean fields subjected to airborne sulfur dioxide within legally permissible limits can be reduced as much as 20 percent, according to a two-year outdoor study conducted by Joseph Miller at Argonne National Laboratory. The finding points to a potential problem for one of the Midwest's most important cash crops. The Department of Energy is encouraging a shift to coal burning—a major source of atmospheric SO<sub>2</sub>—as supplies of cleaner fossil fuels dwindle.

In tests using 80- by 100-foot plots, plants were fumigated periodically each summer. In 1977, three plots were fumigated about five hours daily for 24 days. In 1978, four were fumigated about four hours daily for 19 days. Average SO<sub>2</sub> concentrations ranged from 94 parts per billion on the least fumigated plot in 1978 to 786 ppb on the most heavily gassed plot in 1977. Unfumigated plots nearby received only five to 10 ppb. (Federal standards permit an average annual atmospheric concentration of 30 ppb and a maximum 24-hour concentration to 140 ppb; that may be exceeded once a year for a three-hour period to 500 ppb.)

Results were striking. The yield of the plot receiving 94 ppb dropped five percent. Yields fell 20 percent in the plot getting 300 ppb. And the heavily overdosed field showed a 45 percent decline in productivity, which included reductions in the size and weight of seeds, number of filled seeds per pod and number of pods per plant.

## Burn trees not coal to reduce SO<sub>2</sub>

Burning wood instead of its ancestral counterparts—coal and low-sulfur oil—would reduce atmospheric sulfur dioxide, according to a study headed by Elton H. Hall at Battelle Columbus Laboratories. What's more, particulates and nitrous-oxide emissions—components in the formation of smog—would not increase. Battelle estimates that more than 50 percent of the annual fuel needs of large industrial plants could be supplied by wood wastes in the form of chips.

SO<sub>2</sub> emissions would drop 2.85 million tons per year if 150 million tons of green wood were substituted for 50 million tons of coal, its btu equivalent, Hall said. The same reduction using stack-gas scrubbers would require that they operate at 85 percent efficiency and be installed on 1,175 coal-fired boilers, each rated at 250,000 pounds of steam per hour. And if the scrubbers used limestone, more than 18 million tons of sludge, requiring disposal, would result. Hall found.

Though his team identified more than 325 wood-fired facilities, Hall foresees no wood-burning renaissance in industry; wood is relatively inconvenient, lacks a supply-market structure and requires a costly conversion in existing boilers.

## Methyl chloroform control likely

Growing evidence for the ozone-depleting capability of methyl chloroform (SN: 9/23/78, p. 212) has prompted the Environmental Protection Agency to take two steps toward regulating its release into the stratosphere, an EPA official told a group of scientists and regulators recently.

At an agency-sponsored conference on ozone depletion held in Washington, D.C., Robert Kellam of EPA's Office of Air Quality Planning and Standards in Research Triangle, N.C., said the agency is recommending to its state offices that the chemical be taken off the list of substances that are currently exempted from control by the Clean Air Act. In addition, he said, "a package" of regulations for industrial uses of methyl chloroform is "being prepared." Most likely, he said, control will involve available technology such as that currently used to regulate two other degreasing solvents, trichloroethylene and perchloroethylene.

MARCH 17, 1979

# EARTH SCIENCES

## Plant burning is major CO source

The major global source of carbon monoxide in the atmosphere is not fossil fuel burning, according to a recent study. It is, nevertheless, a human source: the burning of vegetation.

Revised, but as yet unpublished, estimates by Paul Crutzen of the National Center for Atmospheric Research in Boulder, Colo., and co-workers put the amount of CO released by vegetation burning at 10 to 20 x 10<sup>14</sup> grams per year—20 times more than an estimate published just last year, and about three times more than the amount produced by fossil fuel burning.

The new results, Crutzen says, came about because atmospheric chemists discovered that the reaction rate of CO with the hydroxyl radical, OH, is twice as high as thought. That meant a large source of CO was lurking somewhere, undiscovered. (OH "cleanses" the lower atmosphere by reacting with nearly all pollutants. An excess of CO, however, will suppress OH and allow the level of other pollutants to build.) Having studied CO emissions from forest fires near Boulder, Crutzen's team decided to estimate worldwide CO production by vegetation burning. Traditional agricultural practices of underdeveloped countries appear to be responsible. Burning of savannas, or grasslands, domestic and industrial wood-burning for fuel, burning of agricultural wastes, agricultural burning by nomadic farmers and forest burning for urban expansion are the major sources, the researchers found.

## Successful Soviet quake prediction

Soviet scientists accurately predicted, within limits, the time, place and magnitude of a Nov. 1, 6.7 magnitude earthquake, reports a U.S. researcher who was in the Soviet Union at the time. The success means that U.S. geologists can have "more confidence" in earthquake prediction, says David Simpson of Lamont-Doherty Geological Observatory, and shows that prediction requires long-term, consistent observations.

According to Simpson, who gave the U.S. Geological Survey an account of the event when he returned to the United States in November, the Soviets based their prediction both on long-term variations in seismicity and on short-term physical phenomena such as tilt measurements, gravity changes and well-water levels. Scientists were monitoring ten artesian wells about 150 kilometers away from where the quake occurred in the Alai mountains, 100 miles south of Andizan and 100 miles east of Garm. When the water "stopped flowing completely" in the deepest well, Simpson said, the field teams were alerted to expect a quake within the next 24 hours.

## 'Seeing' bumpy air

Peter Kuhn was the right man in the right place at the right time. Kuhn, a meteorologist with the National Oceanic and Atmospheric Administration in Boulder, Colo., was on a plane full of astronomers about three years ago, operating an infrared radiometer that measures water vapor in the atmosphere. (Water vapor, as an indicator of atmospheric disturbance, is important to astronomers in interpreting their data.) Being a more earth-bound scientist, Kuhn soon noticed an interesting effect—after he saw blips on his screen indicating pockets of water vapor, the plane was jolted by turbulence. When he tilted the radiometer away from the heavens and toward the plane's path, the correlation between blips and turbulence increased. Since then, Kuhn and co-workers have found that "breaking waves" in the atmosphere tend to create pockets of moist and dry air that are detected by the instrument about three to four minutes before the plane hits bumpy air. The instrument is now tuned and ready for use; United Airlines is planning to test it.

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