

Finding an Ozone-Tolerant Soybean



A ring of horizontal pipes 70 feet in diameter seems to hover over a soybean field on the South Farms at the University of Illinois. The pipes release ozone into the wind as it blows across the soybean plot simulating the higher concentration of ozone that could be a reality for our atmosphere in the year 2050.

"In the northern hemisphere, ozone levels in industrial countries are rising at a rate of 1 to 2 percent a year, and this trend is predicted to continue," said Randall Nelson, one of several USDA-ARS and U of I scientists who have been using this outdoor-air laboratory to study how Illinois crops will fare in the future.

Approximately one pound of ozone is released into each ring per day. This amount exposes the growing soybeans to a level approximately 20 percent higher than the level found in the air outside of the ring.

The increased ozone levels result in a significant decrease in soybean yield, but not for all soybean varieties.

Nelson said that the most sensitive varieties yielded more than 30 percent less under the elevated ozone concentration compared to normal conditions.

The average yield reduction of the 22 varieties tested was 19 percent. But a few varieties were quite tolerant of the elevated ozone with yield reductions of approximately 5 percent.

"We tested varieties that were grown in Illinois more than 50 years ago as well as current varieties," said Nelson. "Ozone-sensitive and ozone-tolerant varieties were found within both groups. There are genetic differences among our current varieties for ozone tolerance, but ozone levels are not sufficiently consistent for soybean breeders to select for ozone tolerance under natural conditions."

"The capacity of the SoyFACE [Soybean Free Air Concentration Enrichment] facility permits us to currently evaluate only 22 varieties per year," Nelson said. "We are working to develop procedures that will allow us to more extensively evaluate ozone tolerance. It's important to identify those varieties that are most likely yielding at less than full potential under current conditions and to identify more highly tolerant germplasm for developing future varieties."

The problems of surface ozone changes are regional, depending in part on proximity to urban and industrial areas. Illinois is likely to be among the soybean-producing areas with the highest ozone exposure. Concentrations for central Illinois have exceeded thresholds for soybean yield reduction in recent years.

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For more information,
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