

# Nitrogen on no-till corn creates acid soil

UNIVERSITY PARK — Farmers planting no-tillage corn should be aware of potential problems in using nitrogen fertilizer, a research agronomist at The Pennsylvania State University declared recently.

"No-tillage corn fields given high rates of ammonium sulfate or ammonium phosphate will most likely need to be limed or plowed every other year to avoid soil surfaces so acid that herbicides won't work," stated Dr. Richard H. Fox, crop scientist dealing with soil fertility.

"The fact is," he affirmed, "weeds must be controlled chemically in no-till corn fields."

And he pointed out that significant amounts of nitrogen can be lost as a gas when urea-containing fertilizers are used. That's because the fertilizer is not incorporated into the soil in no-till corn management, he said.

In addition, Dr. Fox recommended that ammonium-containing or ammonium-yielding fertilizers should not be spread on fields where lime has not been worked into the soil. He explained that lime may cause a large fraction of the nitrogen to be lost as ammonia gas.

"Under the above circumstances, the best nitrogen fertilization for no-tillage corn is to use ammonium nitrate and plow in lime when necessary, or to 'knife-in' anhydrous ammonia," he stated.

For every 100 pounds per acre of nitrogen added to a field as ammonium sulfate, 714 pounds of pure calcium carbonate or lime are needed to neutralize the acidity produced in converting ammonium to nitrate, he said.

"A farmer applying 200 pounds of nitrogen per acre as ammonium sulfate to his no-till corn would need to use over two tons of lime per acre every three years just to neutralize the acidity caused by the fertilizer."

"He would need to add even more lime than this to compensate for the additional acidity produced by leaching of nutrients and other weathering processes that occur at varying rates in the soil," Dr. Fox affirmed.

He pointed out that ammonium nitrate requires only half as much lime to neutralize the acidity as does ammonium sulfate. The same is true for urea and anhydrous ammonia, he added. However, as stated earlier, nitrogen can be lost

as gaseous ammonia with the area fertilizers.

As for ammonium phosphate, he reported there is almost as much acidity released with this fertilizer in the nitrifying process as there is with ammonium sulfate. To neutralize the acidity resulting from 100 pounds of nitrogen from ammonium phosphate, 677 pounds of lime are needed.

In three years of no-till experiments at Penn State, Dr. Fox and associates found that 180 pounds of nitrogen per year as ammonium sulfate reduced the average pH of the surface inch of soil to 5.1, almost two pH units below the soil which received no nitrogen.

At this low pH, herbicides such as atrazine and simazine are ineffective and aluminum and manganese may approach toxic levels. Such toxicity can reduce stands and yields. The pH of the surface inch in some plots treated with the high rate of ammonium sulfate was 4.8.

"Taking a normal soil

sample to a depth of six inches may miss the problem of soil surface acidity," he cautioned. "The average pH of the surface six inches of the test plots receiving 180 pounds of nitrogen per acre as ammonium sulfate was 5.8 which was 0.7 units higher than the pH of the surface inch."

The results demonstrated

that after three years' application, 90 pounds of nitrogen as ammonium sulfate—or 180 pounds nitrogen as ammonium sulfate, ammonium nitrate, or nitrogen solution per acre per year—lowered significantly the pH of the surface inch of soil.

In 1977 there were three rain-free days immediately after nitrogen application,

the only year the rain-free period was more than a day. Treatments receiving urea-containing fertilizers in 1977 yielded 15 to 20 fewer bushels per acre than the ammonium nitrate treatments receiving the same rate of nitrogen. This showed that nitrogen can be lost as ammonia gas from surface-applied urea in as short a period as three days.

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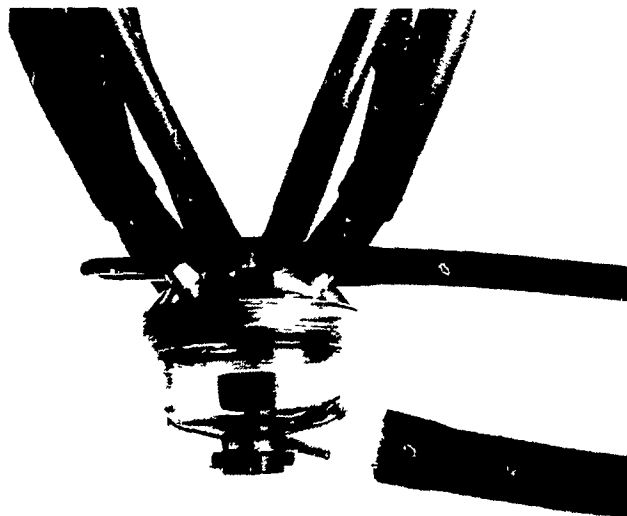
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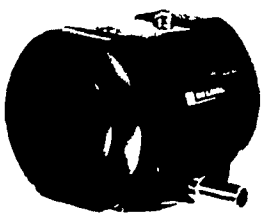
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