1-1975

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*CROPS
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UNIVERSITY of KENTUCKY • COLLEGE of AGRICULTURE

AGRONOMY NOTES

DEPARTMENT of AGRONOMY ═══ Lexington 40506

Vol. 8, No. 1 January 1975

EFFECT OF TOPDRESSING DIFFERENT FORMS OF NITROGEN FERTILIZER ON CORN

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Nitrate nitrogen is the dominant form of plant-available nitrogen in soils, since even ammonium nitrogen is rapidly converted to nitrate nitrogen under Kentucky field conditions. Nitrogen in the nitrate form can be lost by leaching in the drainage water and by denitrification when the soil is saturated with water for a relatively short period of time. With the increased cost and short supply of nitrogen fertilizers, it is especially important that applications be made at a time and in a way that will minimize losses.

Recent research and field trials have shown that risk of loss of nitrogen fertilizer can be lessened if a portion of it is applied 4 to 6 weeks after the corn is planted in comparison to applying all the nitrogen before planting. The amount of nitrogen that can be lost during the 5 to 7 week period between planting and the time plants have made sufficient growth to take up appreciable nitrogen may vary from almost none to considerable amounts, depending primarily on the amount of rainfall, soil temperatures, and the soil type.

Nitrogen fertilizers have a high salt content and will burn foliage when they come in contact with the foliage for short periods of time. Broadcast application of pelleted or granular forms of both ammonium nitrate and urea may result in burned spots where particles adhere to the foliage, but since most of the material will fall off the leaves, damage to the foliage is not extensive. On the other hand, applications of nitrogen solutions that permit the solutions to come in contact with leaves of corn plants usually will cause extensive damage to the foliage since much of the fertilizer remains on the leaves.

To determine the extent of any yield depressions associated with leaf damage through topdressing of fertilizer nitrogen over standing corn plants, sources and times of application were compared on plots that had received adequate nitrogen at planting time. The study was conducted in 1974 on a Maury silt loam at Lexington, Kentucky. Plots receiving urea either as overhead or soil application consisted of 8 rows, 25 feet in length and were replicated four times. Nitrogen solutions containing 30% nitrogen (about 3 1/4 lb of nitrogen per gallon) were sprayed either on the soil or on the plants of one row and there were three replications. The yields are shown in Table 1.

Agricultural and Home Economics Extension Service of the University of Kentucky, the United States Department of Agriculture, cooperating. Charles E. Barnhart, Director. Issued in furtherance of the Acts of May 8 and June 30, 1914.

Table 1. The effect of source and time of topdressing nitrogen fertilizer on the grain yield of corn. Lexington, Kentucky, 1974.

Nitrogen application pounds per acre		Source of topdressed nitrogen	Growth stage	Yield bushels per acre
Preplant[1]	Topdressed			
0	0	--	--	82.6 a[2]
100	0	--	--	169.0 b
100	100	Urea	8 leaf	169.7 b
100	100	Urea	On soil (10 leaf)	169.5 b
100	100	Urea	Silking	175.3 b
			$LSD_{(.05)} = 23.7$	
150	100	30% Sol	3 leaf (on soil)	178.1 a
150	100	30% Sol	3 leaf	164.0 ab
150	100	30% Sol	8 leaf	146.8 b
			$LSD_{(.05)} = 21.6$	

[1]All preplant nitrogen was applied as ammonium nitrate.

[2]Yield values followed by the same letter are not significantly different at the 5% level.

The data show that on this field, 100 pounds of nitrogen per acre at planting was adequate for maximum yield. Consequently, any treatment receiving at least 100 pounds of nitrogen per acre as a preplant application should not show an increase in yield due to topdressing with supplemental N. Thus, any differences shown would be related to leaf damage from foliar contact with supplemental N.

While some leaf burning was evident immediately following broadcasting of pelleted urea at the 8-leaf and at silking stages, it was not extensive, and it did not affect yields as shown in Table 1. This would indicate that granular urea or ammonium nitrate may be broadcast over corn plants when foliage is dry at rates up to 100 pounds of nitrogen per acre with little risk of reducing the yield potential of the crop due to leaf damage.

When nitrogen solution was sprayed on the corn plants at a rate of 100 pounds of nitrogen per acre, leaves were severely burned, although none of the plants were killed. Two to three weeks after the application, new growth developing from the leaf whorl was normal and the damage was no longer evident. However, values in Table 1 indicate there was some yield reduction associated with foliar application. Yields of 164 and 147 bushels per acre were obtained where the spray applications were directed over the plants at the 3-leaf and 8-leaf stages, respectively. Where the nitrogen solution was directed onto the soil, a yield of 178 bushels per acre was obtained. Thus, broadcast foliar application of nitrogen solutions did reduce yields when the solution contacted the leaf surfaces.

The corn growing on plots that had received no nitrogen at planting was showing nitrogen deficiency symptoms by the time it had reached the 8-leaf stage. At this stage of growth nitrogen solution was sprayed over the plants in a single row in each of the four no-nitrogen plots at a rate to supply 100 pounds of nitrogen per acre. Without nitrogen, the four replications averaged 83 bushels of corn per acre compared to an average of 113 bushels from the four single rows sprayed with the nitrogen solution. The increase of 33 bushels is a somewhat lower yield increase than would be expected for the 100-pound rate of nitrogen. The rows on both sides of the single-row plots utilized a portion of the applied nitrogen as indicated by the vegetative growth following application. Nevertheless, this comparison shows that the temporary adverse effects of leaf damage from the solutions were less detrimental to yield than was the nitrogen stress.

Based on the data from one year, it would appear that granular nitrogen fertilizers can be topdressed on corn when foliage is dry with little risk of severe foliar burning or yield decrease. However, when nitrogen solution is sprayed on the foliage, severe leaf damage will occur and yield potentials will be lower. When nitrogen solutions are applied as topdressing on corn, it is suggested the spray applicator be equipped with drop hoses or drop nozzles to direct the solution onto the soil in the "row middles" thus reducing extensive leaf damage.