Streaky Fields and Uneven Application of N Fertilizer

By Peter Scharf

(ABOVE) Uneven nitrogen fertilizer applications with a spinner spreader are probably the cause of the streaks taken in this photo late in August 2008.

In the last issue, I wrote about widespread loss of nitrogen fertilizer from corn fields in 2008 (http://ppp.missouri.edu/newsletters/ipcm/archives/v19n1/a2.pdf). Something that always strikes me when I am taking aerial photos in areas that have had excessive rainfall and nitrogen loss is how many fields have obvious streaks of light and dark green. I would say that in 2/3 of all fields where I see severe N stress I also see at least some streaking.

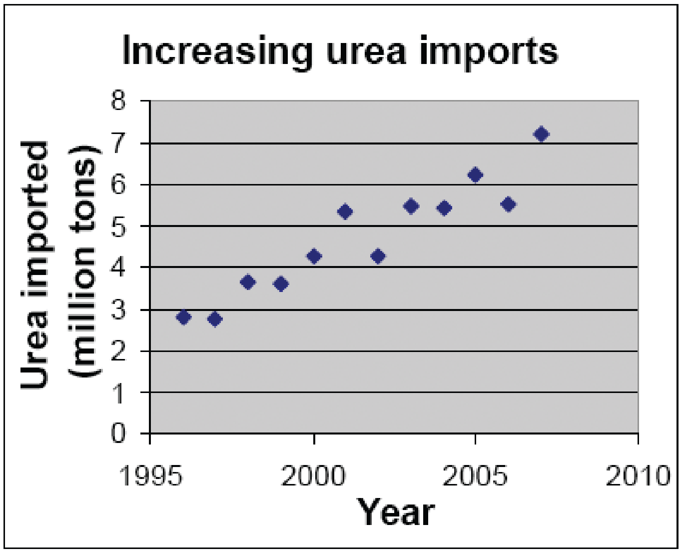
In some of these fields, I have georeferenced the aerial photos so that the distance between streaks can be determined. In all cases, the distance between streaks has matched up with some kind of nitrogen fertilizer applicator–most often 30 or 40 feet for anhydrous applicators, and 40, 50, or 80 feet for spinner spreaders. Occasionally I have run into evidence that there was a pattern problem with application of nitrogen solution, but this is relatively rare.

Why are problems with nitrogen application patterns so common? One important reason is quality of dry fertilizer materials. Over the past ten years, domestic production of nitrogen fertilizer has decreased due to high natural gas prices relative to other places in the world. The cost of natural gas is about 3/4 of the cost of producing nitrogen fertilizer, so it's considerably cheaper to make nitrogen fertilizer in places where gas prices are 10-20% of the prices in the U.S., then ship the fertilizer here. This has resulted in more than a doubling of urea imports over the past ten years (see graph).

By the time it gets to the field where it will be spread, imported urea has been through more augers than domestic urea. This handling can break down individual granules or prills into smaller particles. In the limited amount of dry fertilizer that I see, I have noticed a clear decline in average quality over the past ten years as import levels have increased.

Most dry fertilizer in Missouri is applied using spinner spreaders. These spreaders are very efficient in spreading fertilizer. However, broken granules will not travel as far as intact granules when applied with a spinner spreader. When poor quality fertilizer with lots of broken granules is applied using a spinner spreader, the small particles all fall near the path of the spreader. This results in a high N rate near the path of the spreader and a low N rate midway between passes. It's clear that this problem can cause a lot of yield loss in fields like the one shown above. It's not clear how much yield loss results from the same poor pattern in a year with less loss of N.

Continued on page 11



What are the possible solutions to uneven application of dry nitrogen fertilizers? Air boom spreaders probably handle low-quality material better than spinners. You can't throw dust, but you can blow it. This may be the simplest and easiest solution, but I hear more retailers talk about moving from air boom machines back to spinners than the other way around. My thought is that it's worth it to producers to pay enough extra for air boom spreading to make it worthwhile for retailers to use these machines. Another possibility is to start more careful grading of dry fertilizer, and pay a premium for the better-quality material that can be spread evenly using a spinner machine. (This would mean that lower-quality material is cheaper, again creating an advantage for air-boom spreaders). I occasionally hear about conscientious retailers

(ABOVE) Anhydrous ammonia was applied preplant to this field parallel to the corn rows. Dark streaks are about 30-feet apart which was the applicator width. This is probably a case of end knives putting out low rates.

double-spreading poor-quality material. This certainly helps to improve fertilizer distribution, but is not really making an even application–making the pattern of unevenness less obvious may be one of the main benefits. Screening poor quality dry fertilizer is another possibility. This introduces a lot of extra work, but may cost less than poor distribution, especially as the proportion of poor quality material in the system continues to increase.

Anhydrous ammonia applicators also frequently give poor distribution of fertilizer. Uneven splitting at the manifold appears to be the main source of this problem in several studies that I have read or heard of. Newer manifolds with interior structures that are designed to swirl the ammonia around the manifold chamber apparently improve distribution, as do vertical dam manifolds. At the high end, pumping/metering systems provide the most thorough solution. At the low end, simply randomizing hoses is the most effective step that does not involve new equipment. This is a little like double-spreading poor quality dry material: the problem still exists, but the pattern is more complex and the low spots are not as large. When the manifold outlets near the intake are putting out the lowest rates, and on both sides these are attached to the knives near the end of the bar, several rows near the end of the bar will be under-applied, then the adjacent rows will be under-applied on the next pass. This is a pretty common occurrence, judging from what I've seen from the air, and can produce a strong striping effect. Other factors, such as knife inspection/maintenance/replacement and making hoses even in length, can provide a small amount of improvement.

It's very unfortunate to lose as much N as we did this year, but the visual feedback that it gives us on nitrogen fertilizer distribution shows that this is a major problem that needs to be addressed. Air boom spreaders or double spreading are the main ways to improve evenness of poor-quality dry materials, while better manifolds are the key to improve evenness of ammonia application.

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