Starter Fertilizer Distribution On Winter Wheat As Affected By Rate Of Application

Purpose:

Seed-placed starter fertilizer is an important planting practice for winter wheat. It has been shown to increase yields, on average, by 7.5 bushels per acre. The primary objective of a starter fertilizer is to provide nutrients for early growth and promote root development. This improves winter survival and crop uniformity the following spring. However, even though many studies indicate that starter fertilizer improves yield, there are a few challenges that have lead growers away from the practice. A critical issue regarding starter fertilizer is the application rate: how much do I have to apply to gain these benefits?

To test how well your money is spent on starter fertilizer, a visual demonstration simulating the spread of phosphorus fertilizer material (liquid and dry) at a range of rates was designed. This allows a determination of how close the fertilizer gets to the seed. As phosphorus does not move freely in the soil, it is critical that fertilizer be within 1 inch of the seed to allow the first roots to contact the fertilizer and receive the starter effect.

There are several different application methods used for starter fertilizer application. This experiment included an evaluation of both “surface broadcast” and “in the seed furrow” (in furrow) application techniques.

Methods:

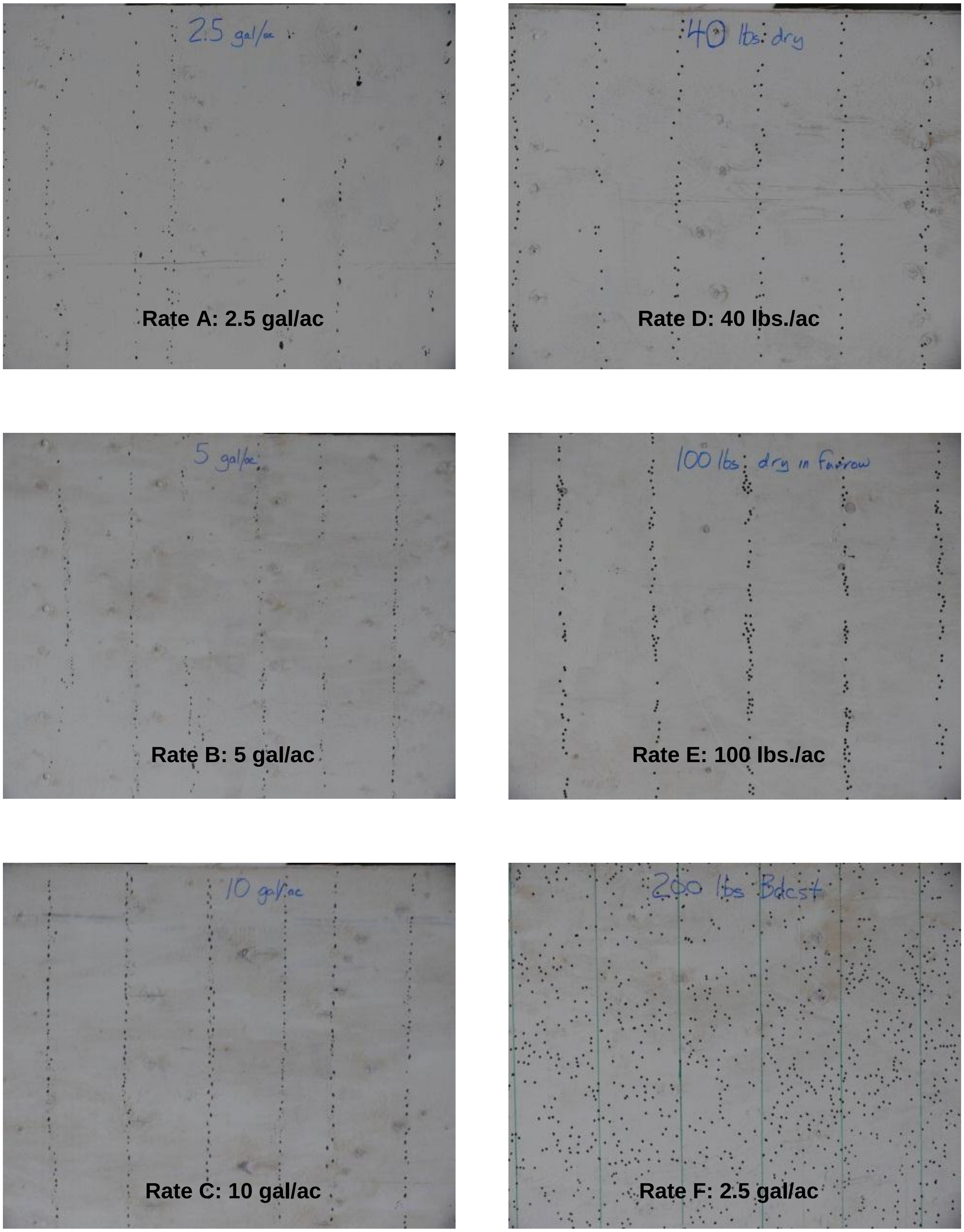
Three different rates were tested for each dry (MAP) and liquid (6-24-6) phosphorus fertilizer. Five 7.5-inch in-furrow banding applications were simulated using a John Deere 1560 drill with 1590 boots; and one broadcast application was simulated using a Valmar Airflow system. To conduct the simulation, a 4 x 8 foot white board was used to act as the soil surface. The drill was calibrated for each fertilizer rate and each product, and driven at field speed over the wood board with the fertilizer engaged. The droplets of liquid or granules of dry fertilizer were then marked on the board using black permanent marker.

Results:

Photographs were taken of the different liquid and dry treatments. Ideally, when looking at the following images, fertilizer should fall into semi-perfect 7.5-inch rows to be uniformly available to each and every seed. Rate C and E achieved this distribution. Rate C, 10 gal/ac, demonstrates a clean line of liquid fertilizer drops into 7.5-inch rows while Rates A and B do not. You can see in these images that Rate B (5 gal/ac) is better than A (2.5 gal/ac), but that drops are not well distributed; the pattern is far too scattered. Similar results are seen with the dry fertilizer. Rate E, 100 lbs./ac, demonstrates the most even fertilizer distribution. Rate D, 40 lbs./ac, is acceptable but not as good at Rate E. For broadcast, Rate F, you can see that the distribution may appear uniform across the board, but when the 7.5-inch seed row is drawn as a black line on the white board, very little fertilizer contact with the seed row is achieved.

Figure 1: Distribution of Fertilizer as Impacted by Rate of Application

Liquid (gal/ac) | Dry (lbs./ac)



Choosing the right application rate and method is not as easy as reading the label. You want to ensure that the **phosphorus is going down with the seed!** Two primary concerns when you are planting with a starter fertilizer are surface tension and your method of application.

Surface Tension:

From this experiment you can see Rate A (2.5 gal/ac) and B (5 gal/ac), demonstrate variable coverage across the board. The scattering of the liquid fertilizer results from surface tension of the liquid at the release point from the drill. At low rates, the fertilizer drops form a mass of liquid that does not drop until the weight of the droplet exceeds the surface tension of the liquid. With higher rates, droplets form more rapidly and overcome the surface tension, producing a more even 7.5 inch row pattern. An example of good liquid distribution is Rate C (10 gal/ac).

Similar in-furrow patterns are seen with granular fertilizer but with less intensity compared to liquid. Rate D (40 lbs./ac), has an acceptable distribution, but Rate E (100 lbs./ac) is the best.

Application Method:

Rate E (100 lbs./ac), uses only ½ the fertilizer of Rate F (200lbs/ac broadcast), but using a band application significantly increases fertilizer contact with the seed. Although Rate F appears to have good coverage over the ground, when you look closely to the 7.5 inch row lines, the contact of fertilizer with the seed is less consistent then Rate E.

Point of surface tension

Summary:

Fertilizer distribution was disappointing at low liquid and dry rates. Distribution of liquid fertilizer is dependent on surface tension of the liquid at the release point from the drill. At low rates, the fertilizer forms drops of liquid that do not fall until large enough for gravity to overcome surface tension, resulting in a scattered, non-uniform distribution, rather than the constant stream promoted as a feature of liquid technology. Ultimately this results in some seeds planted with no contact to the phosphorus material. At rates lower than 10 gal/ac this problem exists, if there is not direct contact with the soil of the liquid delivery system (ie: Keeton or Rebounder applicators). With higher rates, liquid flow is sufficient to produce a constant stream of droplets, with good distribution. Similar in-furrow patterns are seen with granular fertilizer but surprisingly with less intensity compared to liquid. It appears that drill setups of this nature require 10 gal/ac or 100 lbs./ac dry to get good fertilizer distribution for maximum wheat yields. A liquid fertilizer strategy could be to add water to your rate of liquid fertilizer, to achieve a total application volume of 10 gal/ac even when using lower volumes of the liquid fertilizer itself.

Next Steps:

The concept of diluting low liquid fertilizer rates with water to achieve improved in-furrow distribution should be tested and taken to yield to fully evaluate this concept. This project may be looked at in future trials.

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