Ohio State University On-Farm Fertilizer Strip Trial Guidelines – 2018 and beyond

Ohio State University is leading efforts to update the Tri-State Fertilizer Recommendations in Corn, Soybean and Wheat. From 2014-2017, we conducted over 250 on-farm fertilizer strip trials to evaluate crop response to fertilizer N, P, K and S. Data from these trials is currently being compiled and new recommendations will be released in the coming months.

Although our main push to collect data has ended, farmer interest in on-farm fertilizer strip trials is building and we want to encourage these trials to continue in the future. This document is intended to provide guidance on minimum criteria needed for successful on-farm fertilizer strip trials. If followed, data generated from trials could be included into our existing database as we continue to refine and update the recommendations. Not following these guidelines here can still provide you with reasonable information, but these minimum criteria will be required for us to use your data. These guidelines are based off our last 4 years of experience and working with these data. Note these guidelines do not address best-practices for collecting spatial data in precision agriculture platforms or frameworks.

Trials and specifics are outlined below by fertilizer type. If you are planning a trial that differs from what is outlined below, I recommend you call/email for any feedback or concerns before the trial is conducted.

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All strip trials need to be:

1) Replicated a minimum of 3 times. Four replicates will nearly always provide better information and is highly encouraged, especially in non-uniform fields.
2) Treatments randomized. Randomization is essential and ensures there is no systematic bias over the field.

1. Broadcast or Starter Phosphorus, Potassium and Sulfur Trials (Corn, Soybean, Wheat, Hay)

Objective: Determine crop yield response to P, K, or S fertilizer.

Minimum Criteria
- We are particularly interested in low-testing P, K, S fields.
- Only need 2 treatments: i) fertilized, ii) unfertilized (control). You could test one fertilizer (Map 1) or multiple fertilizer sources, rates, timings or placements (Map 2).
- No required rate, source, timing or placement of fertilizer – manipulate whatever is of greatest interest to you and your farmer cooperator.
- Suggested minimum rates are 50 lbs P₂O₅/acre, 50 lbs K₂O/acre, or 20 lbs S/acre

Minimum data needed to collect:
- GPS coordinates of field
- Soil test levels before fertilization
- Grain yields
- Basic management information such as planting date, hybrid, tillage practice, rate, timing, source and placement of fertilizer.

Factors of greatest interest to manipulate:
- Rate: Fertilizer application vs. not
- Placement: Starter banded (in-furrow or 2x2) vs. broadcast

Map 1. Field map layout for P trials (6 strips total)

<table>
<thead>
<tr>
<th>Rep 1</th>
<th>Rep 2</th>
<th>Rep 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>No fertilizer (P, K or S)</td>
<td>+fertilizer (P, K or S)</td>
<td>+fertilizer (P, K or S)</td>
</tr>
</tbody>
</table>
2. Nitrogen Rate Trials (Corn, Wheat)

Objective: Determine economically optimal N rate in corn.

Minimum Criteria

- **5 N rates.** In some cases 4 will be sufficient, but we've had to throw out many trials with only 4 rates if we can't construct a reliable curve. Experience has shown that 5 is much better than 4. Including a 5th rate greatly increases the chances of your data being usable.

- **Wide range of N treatments.** This is very important, as again, we've had to throw out trials with the lowest N rate being 100 lb N, or the highest N rate at 200 lb N, if we cannot model the N response robustly.

- The lowest N rate should not be more than 50 lbs N/acre. A zero N rate provides extremely valuable information and is highly encouraged, but many farmers do not want to do this.

- The highest N rate should not be less than 250 lbs N/acre.

- Recommended with 5 rates: <50, 100, 150, 200, 250 lbs N/acre; Recommended with 6 rates: 0, 50, 100, 150, 200, 250 lbs N/acre.

- **Minimum data needed to collect:**
  i) GPS coordinates of field
  ii) Soil test levels before fertilization
  iii) Grain yields
  iv) Basic management information such as planting date, hybrid, tillage practice, rate, timing, source and placement of N fertilizer.

Nitrogen timing:
The timing of N fertilization (preplant, planting, sidedress, split applications) can vary based on your equipment and operation. A key point is that all N manipulations should occur at the same time. In other words, you can apply all N upfront, or all N at sidedress, or apply 30 lbs N at planting and then manipulate the rates at sidedress. In the last example, you would apply: 0 lb N rate = 0 at planting, 0 at sidedress; 100 lb N rate = 30 at planting, 70 at sidedress; 150 lb N rate = 30 at planting, 120 at sidedress; 200 lb N rate = 30 at planting, 170 at sidedress; 250 lb N rate = 30 at planting, 220 at sidedress. Map 3 below provides a suggested experimental design.
3. Late Season Nitrogen Timing Trials (Corn)

Late season N applications are becoming more viable with equipment (Y-drops, highboys) and farmers are interested in seeing if late season N fertilization can increase yields and decrease N fertilizer costs. Late season N deals with timing issues, but we can also look at how timing influences N rate. The two timings of N fertilizer we consider include: 1) Preplant and/or Starter and/or sidedress and 2) Late season (V15-VT). Since farmers have different practices with early N application, we will consider the three opportunities to fertilize (preplant, starter, sidedress) as a single timing event and the late season as a second timing event. Of course, we recognize that N timing between preplant and sidedress matters, but in the interest of creating a uniform experimental on-farm protocol, we lump together to contrast with late season N application.

In the table below, we establish 2 ‘Core Treatments’ that should be used in all studies. The ‘Preplant + Starter + Sidedress’ column represents the sum of the N applications across these three timings. The specifics of how much N is applied and when will vary across farms. Keeping your N rate 'reasonable' is important, so we can detect possible differences in yield if there is a treatment effect. In other words, we do not want to supply excessive N or treatment differences may be obscured. The MRTN economic model says that for corn following soybean, this would be around 175-185 lbs N/acre.

In addition to the ‘Core Treatments’, if a farmer is interested in a timing x rate component, they can pick another set of treatments (or multiple sets) to address the associated questions.
Suggested Treatments for Late Season N Study. Use the Core Treatments, then pick from one or more set of treatments, depending on which question you are most interested in. Total N rates applied across the growing season can vary, but please keep this N rate ‘reasonable’, not excessive.

<table>
<thead>
<tr>
<th>Core Treatments (Timing)</th>
<th>Preplant + Starter + Sidedress</th>
<th>Late Season (V14 – VT)</th>
<th>Total N Applied (lbs N/ acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Treatments</strong></td>
<td>180</td>
<td>0</td>
<td>180</td>
</tr>
<tr>
<td><strong>(Timing)</strong></td>
<td>140</td>
<td>40</td>
<td>180</td>
</tr>
</tbody>
</table>

**Can late season N reduce N requirement?**

| 160                     | 0                | 160                     |
| 140                     | 20               | 160                     |

**Can late season N increase yields?**

| 200                     | 0                | 200                     |
| 140                     | 60               | 200                     |

Map 4. Field map layout for late-season N-timing study (12 strips total)