Fluids Compared With Dry In Dryland Winter Wheat Trials

Results indicate a good potential for dryland wheat to respond to fluid P in the low-rainfall crop-fallow areas of eastern Washington.

Summary: Quadratic responses to fluid phosphorus (P) were observed in four of six site years. High rates of fluid P reduced dry matter and grain yield, possibly due to P stimulation of vegetative growth and subsequent depletion of stored soil moisture. Grain yields with dry P fertilizer were similar to or lower than with fluid P. Results indicate a good potential for dryland wheat to respond to fluid P in the low-rainfall, crop-fallow areas of eastern Washington. Intermediate rates of fluid P should be applied to optimize plant growth and prevent yield reductions.

Table 1. Study of location and average initial soil test P (0 to 1-foot depth).

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Acetate P</th>
<th>Bicarbonate P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lind</td>
<td>2005-2006</td>
<td>7.3</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>2006-2007</td>
<td>3.9</td>
<td>11.0</td>
</tr>
<tr>
<td>Ralston</td>
<td>2005-2006</td>
<td>5.8</td>
<td>17.8</td>
</tr>
<tr>
<td></td>
<td>2006-2007</td>
<td>5.5</td>
<td>22.5</td>
</tr>
</tbody>
</table>

*Adequate soil test values are 8 mg/kg (ppm) for the acetate (Morgan) method and 16 mg/kg for the bicarbonate (Olsen) method.
Al-based minerals form. Beginning in fall 2004 we conducted a series of P fertility studies in a chemical fallow-winter wheat production system in the low rainfall zone of eastern Washington. Various rates of fluid P fertilizer were applied in a deep band directly beneath the seed row at planting. Responses to P were obtained in each of three years and with soil test P levels at or above critical values (Figure 1). These responses to P suggest more routine P use may be warranted in the low rainfall zones. High rates of fertilizer P appeared to reduce yield compared to intermediate rates in one year (Figure 1). Residual effects of P applications were not measured but are expected.

Based on the results of this earlier research, we conducted experiments to evaluate dryland winter wheat response to fluid and dry P fertilizer in the low and high rainfall zones of eastern Washington. The intent was to compare wheat responses to dry and fluid P in more common crop-tillage fallow and annual cropping systems.

**Fluids shine**

Responses to fluid P at summer fallow locations were obtained when soil test levels were near or above historical critical values based on bicarbonate extraction (Table 1). This suggests that current soil-test-based fertilizer recommendations may be outdated and critical levels do not accurately predict a response to P in these situations. Alternatively, the bicarbonate extract may not be accurately estimating plant-available P in these recently acidified soils. Acetate-extractable P was below critical levels for 5 of 6 site years. Grain yield responses to dry P were lower than responses to fluid P at three of the 6 site-years. These were similar to results from Australian research, showing better responses to fluid P than to dry P.

Interestingly, responses to fluid P rate were quadratic in 3 of the 4 site-years (Figures 2 and 3). At the highest rate of P, anthesis whole-plant dry matter and final grain yields were reduced slightly at 40 lbs/A of P$_2$O$_5$ compared to the low or intermediate rate. Moisture is the main limiting factor in summer fallow cropping systems at these locations. Higher rates of P apparently
stimulated excessive vegetative growth that depleted stored soil moisture and reduced late-season grain yields. This is similar to the “haying off” response observed in wheat grown in low-moisture, crop-fallow rotations in Australia. Early results of this study indicate a good potential for dryland wheat to respond to fluid P in the low rainfall, crop-fallow areas of eastern Washington. Intermediate rates of fluid P should be applied to optimize yield and prevent grain yield reductions in this moisture-limited environment.

**Methodology**

**Fertilizers.** Fertilizers used were fluid ammonium polyphosphate, 32-0-0, and MAP.

**Placement.** P was placed at (Figure 1) or two weeks before seeding (Figures 2 and 3). Soft winter wheat seeding rates were 40 lbs/A with 12-inch spacing.

**Crop.** Winter wheat grown in a traditional, 2-year crop-tillage fallow rotation.

**Plots.** Individual plot dimensions were 7 to 8 feet wide by 50 feet long.

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**Figure 3. Effect of P rate and form on dry matter and grain yields of winter wheat at Lind (top) and Ralston (bottom) in 2006-07.**