TITLE:

Testing of Precision Agriculture Technologies in Irrigated Cotton at AG-CARES, Lamesa, Texas, 2000.

AUTHORS:

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METHODS AND PROCEDURES:

Experimental Design: Randomized complete block with 3 replications
Plot size: 53 ft wide (16 40-inch rows) and > 500 ft long.
Experimental area: 27 ac
Soil type: Amarillo sandy loam to sandy clay loam
Variety: Paymaster Roundup® Ready 2326
Soil sampling: Half-ac grid (Fig.1 and 2)
P fertilizer rate: Blanket-rate of 30 lb P₂O₅/ac,
Average Variable-rate of 38 lb P₂O₅/ac
Planting date: May 10, 2000
Harvest date: October 4, 2000
Irrigation: LEPA on a 3.5 day schedule at 75% estimated cotton ET replacement

RESULTS

Cotton responded to P fertilizer in all three landscape positions of the precision agriculture site at AGCARES (Table 1 and 2). Historically, the greatest yields have been observed in the bottomslope where re-distribution of water and nutrients occurs. Variable-rate (VRT) and blanket-rate resulted in lint yields greater than zero-P in both sideslopes. In the bottomslope, only the variable-rate treatment affected lint yields. The south-facing sideslope had the lowest lint yields in 2000. This may be due to the greater amount of blowing observed there and to faster soil water evaporation. The Micro-Trak® yield data was less variable than the hand-picked lint data and only the machine data showed the P fertilizer response (Table 1 and 2).

Temik® was applied at planting at a rate of 5 lb/ac to the entire 27-ac area. Greater nematode numbers were observed in the bottomslope, and for this reason, the VRT strips of this area received an additional 5 lb/ac sidedress of Temik. However, yields in this area were not affected by Temik®.

Preliminary cost and returns economic analysis of the VRT technology is shown in Table 3. This analysis does not consider the greater cost of grid-soil sampling or of VRT equipment. The average P fertilizer rate applied in the VRT plots was 38 lb P₂O₅/ac, compared to 30 lb P₂O₅/ac in the blanket-rate plots. Although statistically there was no difference between the VRT-P and blanket-P treatments we did this analysis by calculating a “return to P fertilizer” for each. This preliminary analysis indicates that up to $24/ac return of VRT-P is possible. Extra or variable-rate Temik was not economical.

Table 1. Micro-Trak® cotton lint yields (lb/ac) for variable-rate, blanket-rate and zero-rate P fertilizer application, Lamesa, TX, 2000.
<table>
<thead>
<tr>
<th>Treatment</th>
<th>North-facing sideslope</th>
<th>Bottom-slope</th>
<th>South-facing sideslope</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable-rate P fertilizer</td>
<td>536 a¹</td>
<td>590 a¹</td>
<td>485 a¹</td>
<td>537 a¹</td>
</tr>
<tr>
<td>Blanket-rate P fertilizer</td>
<td>540 a</td>
<td>544 b</td>
<td>479 a</td>
<td>521 a</td>
</tr>
<tr>
<td>Zero P fertilizer</td>
<td>493 b</td>
<td>521 b</td>
<td>434 b</td>
<td>483 b</td>
</tr>
<tr>
<td>Mean</td>
<td>523 a²</td>
<td>552 a</td>
<td>466 b</td>
<td></td>
</tr>
</tbody>
</table>

1 Means in a column followed by similar letter are not different by pairwise comparisons, p>0.05

**Table 2.** Hand-picked cotton lint yields (lb/ac) for variable-rate, blanket-rate and zero-rate P fertilizer application, Lamesa, TX, 2000.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>North-facing sideslope</th>
<th>Bottom-slope</th>
<th>South-facing sideslope</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable-rate P fertilizer</td>
<td>679 a¹</td>
<td>759 a¹</td>
<td>570 a¹</td>
<td>670 a¹</td>
</tr>
<tr>
<td>Blanket-rate P fertilizer</td>
<td>634 a</td>
<td>673 a</td>
<td>564 a</td>
<td>623 a</td>
</tr>
<tr>
<td>Zero P fertilizer</td>
<td>596 a</td>
<td>665 a</td>
<td>523 a</td>
<td>594 a</td>
</tr>
<tr>
<td>Mean</td>
<td>636 a²</td>
<td>699 a</td>
<td>552 b</td>
<td></td>
</tr>
</tbody>
</table>

1 Means in a column followed by similar letter are not different by pairwise comparisons, p>0.05

**Table 3.** Input application rates and cost and returns of input applications, Lamesa, TX, 2000

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Avg rate of input (lb/ac)</th>
<th>Unit cost of input ($/lb)</th>
<th>Cost of input ($/ac)</th>
<th>VRT cost minus blanket-rate cost ($/ac)</th>
<th>Benefit of VRT with income from $0.60/lb cotton&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable-rate of P fertilizer (lb P₂O₅/ac)</td>
<td>38.4</td>
<td>0.31</td>
<td>11.90</td>
<td>2.60</td>
<td>23.83</td>
</tr>
<tr>
<td>Blanket-rate of input</td>
<td>30.0</td>
<td>0.31</td>
<td>9.30</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Zero rate</td>
<td>0</td>
<td>0.31</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Temik nematicide (lb/ac)</td>
<td>6.3</td>
<td>3.25</td>
<td>20.48</td>
<td>-4.23</td>
<td>-4.23&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Blanket-rate of input</td>
<td>5.0</td>
<td>3.25</td>
<td>16.25</td>
<td>-1.30</td>
<td>19.60</td>
</tr>
<tr>
<td>Sum of products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Assumes no gain in yield

<sup>b</sup> Does not consider capital costs of variable-rate application equipment or the greater cost of 0.5-ac grid soil sampling and laboratory analysis for the VRT treatments.
Fig. 1. Half-acre grid soil sampling locations and Mehlich-3 P, AGCARES, Lamesa, TX 2000
Fig. 2. Variable-rate inputs experimental layout and P fertilizer rates applied (V = VRT, B=blanket-rate, Z=xero-P), AGCARES, Lamesa, TX 2000