INTRODUCTION

A long-term experiment was conducted in Missouri on fields with rice-soybean rotations to determine the optimum potassium (K) and phosphorus (P) programs for both crops.

Three important soil test factors:
- **Target** is the level of a soil extractable nutrient at which more fertilizer will not increase crop yields.
- **Crop removal** is how much a nutrient is reduced annually in the soil from harvested forage, grain, or fiber.
- **Buildup** is the additional fertilizer needed above crop removal to increase low- and medium-testing soil P and K to the target fertility levels for crop production.

P AND K SOIL BUILDUP EQUATIONS

Shown below are the equations used at University of Missouri to calculate the P and K build-up part of soil test recommendations.

$$\text{Build-up } P_{2O_5} = 110(X_d^{1/2} - X_o^{1/2}) \quad \text{Build-up } K_{2O} = 75.6(X_d^{1/2} - X_o^{1/2})$$

where:
- $$X_d$$ = target soil test level in kg P or K per ha
- $$X_o$$ = observed soil test level in kg P or K per ha
- Years = desired time period for build-up

MATERIALS AND METHODS

Potassium and phosphorus buildup treatments were untreated check, 1-year, 4-year, and 8-year P and K buildup fertilizer programs. Targets were also evaluated. Missouri target soil P buildup for rice was 39 lb Bray-P ha\(^{-1}\) and soybeans was 50 kg Bray-P ha\(^{-1}\). Target ammonium acetate extractable K was 140+ (5.6 x CEC) for rice and 246+ (5.6 x CEC) for soybeans. Rice received 150 lb N acre\(^{-1}\) in a 2-way split application.

CONCLUSIONS

All build-up programs produced more rice and soybean yields than the untreated check (N only for rice). But there was not a yield advantage to increasing P and K levels to target levels faster than 8 years. Rice P and K targets were increased as a result of this research.
INTRODUCTION

A long-term experiment was conducted in Missouri on fields with rice-soybean rotations to determine the optimum potassium (K) and phosphorus (P) programs for both crops.

Three important soil test factors:
- **Target** is the level of a soil extractable nutrient at which more fertilizer will not increase crop yields.
- **Crop removal** is how much a nutrient is reduced annually in the soil from harvested forage, grain, or fiber.
- **Buildup** is the additional fertilizer needed above crop removal to increase low- and medium-testing soil P and K to the target fertility levels for crop production.

P AND K SOIL BUILDUP EQUATIONS

Shown below are the equations used at University of Missouri to calculate the P and K build-up part of soil test recommendations.

\[
\text{Build-up } P_{2O5} = 110(X_d^{1/2} - X_o^{1/2}) \quad \text{Build-up } K_{2O} = 75.5(X_d^{1/2} - X_o^{1/2})
\]

Where:
- \(X_d\) = target soil test level in lb P or K per acre
- \(X_o\) = observed soil test level in lb P or K per acre
- Years = desired time period for build-up

MATERIALS AND METHODS

Potassium and phosphorus buildup treatments were untreated check, 1-year, 4-year, and 8-year P and K buildup fertilizer programs. Targets were also evaluated. Missouri target soil P buildup for rice was 35 lb Bray-P acre\(^{-1}\) and soybeans was 45 lb Bray-P acre\(^{-1}\). Target ammonium acetate extractable K was 125+ (5 x CEC) for rice and 220+ (5 x CEC) for soybeans. Rice received 150 lb N acre\(^{-1}\) in a 2-way split application.

Table 1. Fertilizer buildup programs and targets affect on rice yields.

<table>
<thead>
<tr>
<th>Build-up</th>
<th>PK soil target</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>N only</td>
<td>--</td>
<td>168</td>
<td>142</td>
<td>131</td>
<td>189</td>
<td>121</td>
<td>138</td>
<td>168</td>
</tr>
<tr>
<td>1-year</td>
<td>45/265†</td>
<td>192</td>
<td>160</td>
<td>133</td>
<td>269</td>
<td>145</td>
<td>159</td>
<td>247</td>
</tr>
<tr>
<td>4-year</td>
<td>45/265</td>
<td>193</td>
<td>161</td>
<td>136</td>
<td>268</td>
<td>138</td>
<td>161</td>
<td>269</td>
</tr>
<tr>
<td>8-year</td>
<td>45/265</td>
<td>187</td>
<td>159</td>
<td>151</td>
<td>241</td>
<td>150</td>
<td>160</td>
<td>204</td>
</tr>
</tbody>
</table>

Table 2. Fertilizer buildup programs and targets on soybean yields.

<table>
<thead>
<tr>
<th>Build-up</th>
<th>PK soil target</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>N only</td>
<td>--</td>
<td>40</td>
<td>39</td>
<td>52</td>
<td>30</td>
<td>30</td>
<td>61</td>
<td>42</td>
</tr>
<tr>
<td>1-year</td>
<td>45/265†</td>
<td>52</td>
<td>54</td>
<td>63</td>
<td>39</td>
<td>30</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>4-year</td>
<td>45/265</td>
<td>51</td>
<td>46</td>
<td>62</td>
<td>35</td>
<td>29</td>
<td>73</td>
<td>49</td>
</tr>
<tr>
<td>8-year</td>
<td>45/265</td>
<td>51</td>
<td>44</td>
<td>62</td>
<td>38</td>
<td>29</td>
<td>67</td>
<td>48</td>
</tr>
</tbody>
</table>

CONCLUSIONS

All buildup programs produced more rice and soybean yields than the untreated check (N only for rice). But there was not a yield advantage to increasing P and K levels to target levels faster than 8 years. Rice P and K targets were increased as a result of this research.