

# **Crop Rotation with Rice Fertility Concerns**

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**Most agronomist do not recommend corn, cotton, grain sorghum or wheat in rotation with rice because of the phosphorus problems caused by the tie up and unavailability of the soil and fertilizer P after the soil dries down.**

# Categories of P in Soils

- √ Organic P
- √ Inorganic P, (5 types)
  - Fe phosphates
  - Al phosphates
  - Ca phosphates
  - Reductant soluble P
  - Occluded Fe and Al phosphates

# P Forms Taken Up by Plants

- ✓ P must be in the soluble orthophosphate form ,  $\text{HPO}_4^{2-}$  or  $\text{H}_2\text{PO}_4^-$ , to be taken up by plants.
- ✓ Soil solution pH  $< 6.8$ , P form is
- ✓  $\text{H}_2\text{PO}_4^-$
- ✓ Soil solution pH 6.8 and above, P form is  $\text{HPO}_4^{2-}$  and  $\text{H}_2\text{PO}_4^-$

# Forms of Iron, Fe, in the Soil

- √ The two main forms of iron, Fe, affecting Fe uptake are Fe<sub>3+</sub> and Fe<sub>2+</sub>.
- √ Iron is taken up by roots in the Ferric form, Fe<sub>2+</sub>. The compounds containing the Ferrous form, Fe<sub>3+</sub>, are low in solubility and this limits availability.

# What happens to Soil P when soil is flooded?

- ✓  $\text{Fe}^{3+}$  is reduced to  $\text{Fe}^{2+}$  and P is released from insoluble Fe and Al compounds.
- ✓ This increase in P availability will take about 30 days after flooding.
- ✓ Some P is released from Ca phosphates.

# What Happens When Rice Fields Dry Out?

- ✓ Fe and Al compounds, that are soluble under flood, react with soil and fertilizer P, to form insoluble P compounds. In some soils concretions of Ferrous  $\text{PO}_4$  can be seen.
- ✓ These compounds will exist until the field is flooded for about 30 days.
- ✓ The effects of the reduced P availability can show up for several years on dry land crops like corn and wheat.
- ✓ This can be called the "Rice" effect.

# The “Rice” Effect

- √ The “rice” effect may also be related to poor soil physical conditions, limited rooting and mycorrhizal colonization of dry land crops.

## Effect of P additions on Soil Test P following crops

<b>v 1998 P2O5</b>	<b>1999 Soil P test, lbs</b>	
<b>v <u>rate, lbs/A</u></b>	<b><u>Rice</u></b>	<b><u>Soybeans</u></b>
♣0	11	22
♣20	11	28
♣80	13	42
♣120	13	45
♣40	11	30

♣ Univ. of Ark.

♣ Soil Sampled in Spring, Mehlich 3 extratant.

# The Solution for the "Rice" Effect

- ✓ 1. Build soil P to medium or high.
- ✓ 2. Apply at least 40 to 60 lbs. P<sub>2</sub>O<sub>5</sub>/A on the rotation crop, such as; corn, cotton or grain sorghum. Higher rates may be better on low testing soils.
- ✓ 3. For corn, apply a starter. Use 5 gals. of 10-34-0 or 11-37-0.

# Lime Needs for Corn in a Rice/Corn Rotation

- ✓ Rice fields seldom need liming because of the chemistry effect of flood on soil pH. However, if corn or another dry land crop is in rotation with corn, consider liming the fields if pH is below 5.7

# Lime on Corn with Rice in Rotation

pH

Tons of lime

> 5.7

0

♣ 5.2 to 5.7

1

♣ 5.0 to 5.2

1.5

♣ < 5

2

♣ Univ. of Arkansas

# Effects of Flooding on pH

- ✓ After flooding soil pH will approach pH 7, regardless of original pH.
- ✓ pH of alkaline soils declines and pH of acid soils increases.
- ✓ Change after flooding may take several weeks, depending on several factors like, soil type, OM, temperature, etc.

**Any Questions?**

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