

Effects of Perennial Grasses on Soil Quality Indicators in Peanut and Cotton Rotations in Virginia

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Why initiate this study in VA?

- Positive results demonstrated by including bahiagrass in rotations in Florida, Georgia, and Alabama.
- Influences soil quality indicators through soil stabilization mitigating soil loss, increased organic matter deposition, greater water infiltration, aggregate stabilization and root penetration.
- Possible benefits from disease suppression.

An aerial photograph of a farm with various fields, a road, and some buildings. The fields are in different stages of cultivation, with some appearing to be planted with crops like cotton. The road is a multi-lane highway that curves through the farm. The background shows more fields and a body of water under a clear sky.

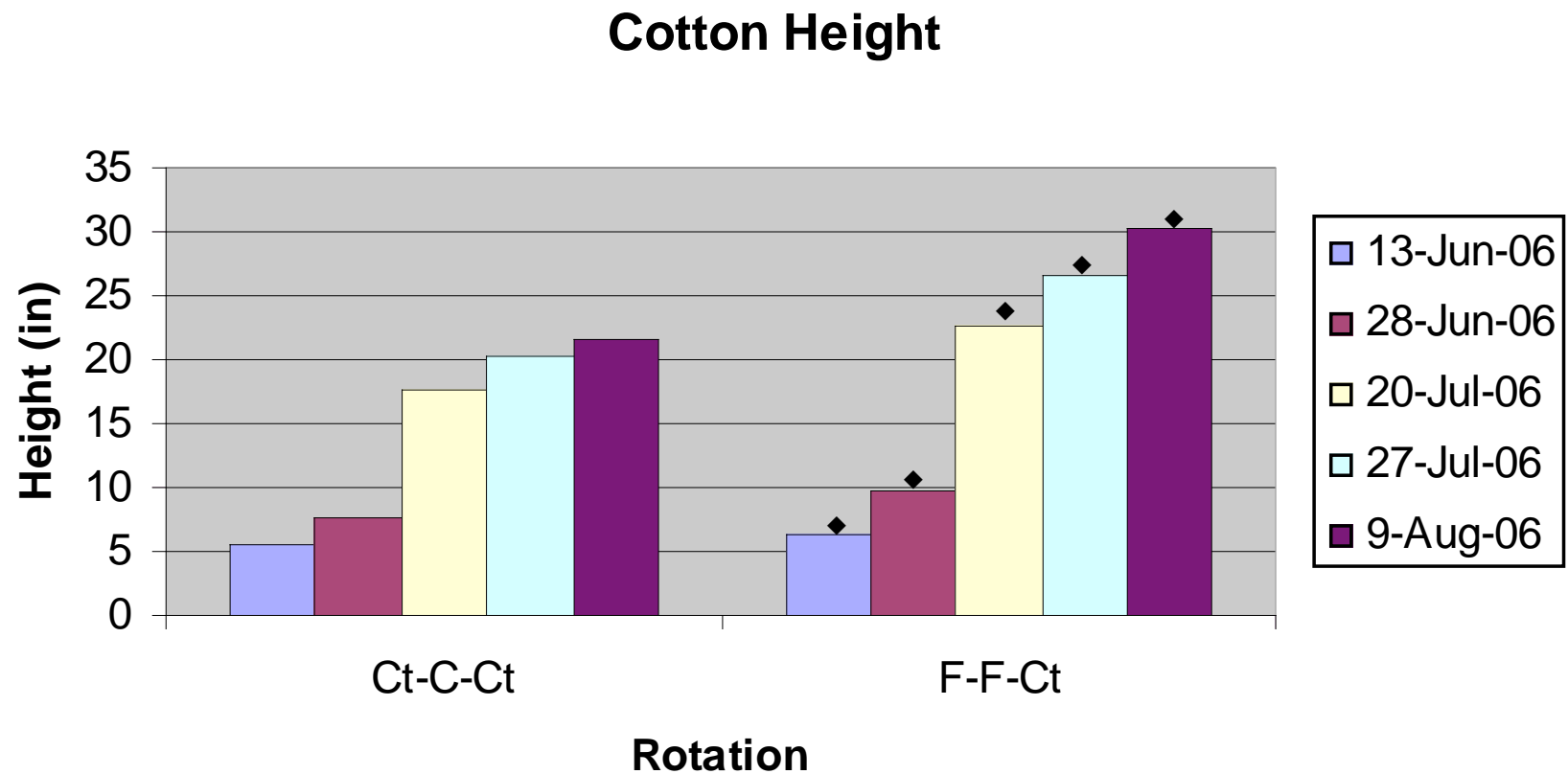
Objectives of Rotation Study

1. Examine shifts in soil quality parameters attributed to the various rotations.
2. Examine changes in disease pressure associated with treatments.
3. Examine cotton growth, development and yield response influenced by rotation and latter soil quality parameters.

Treatments

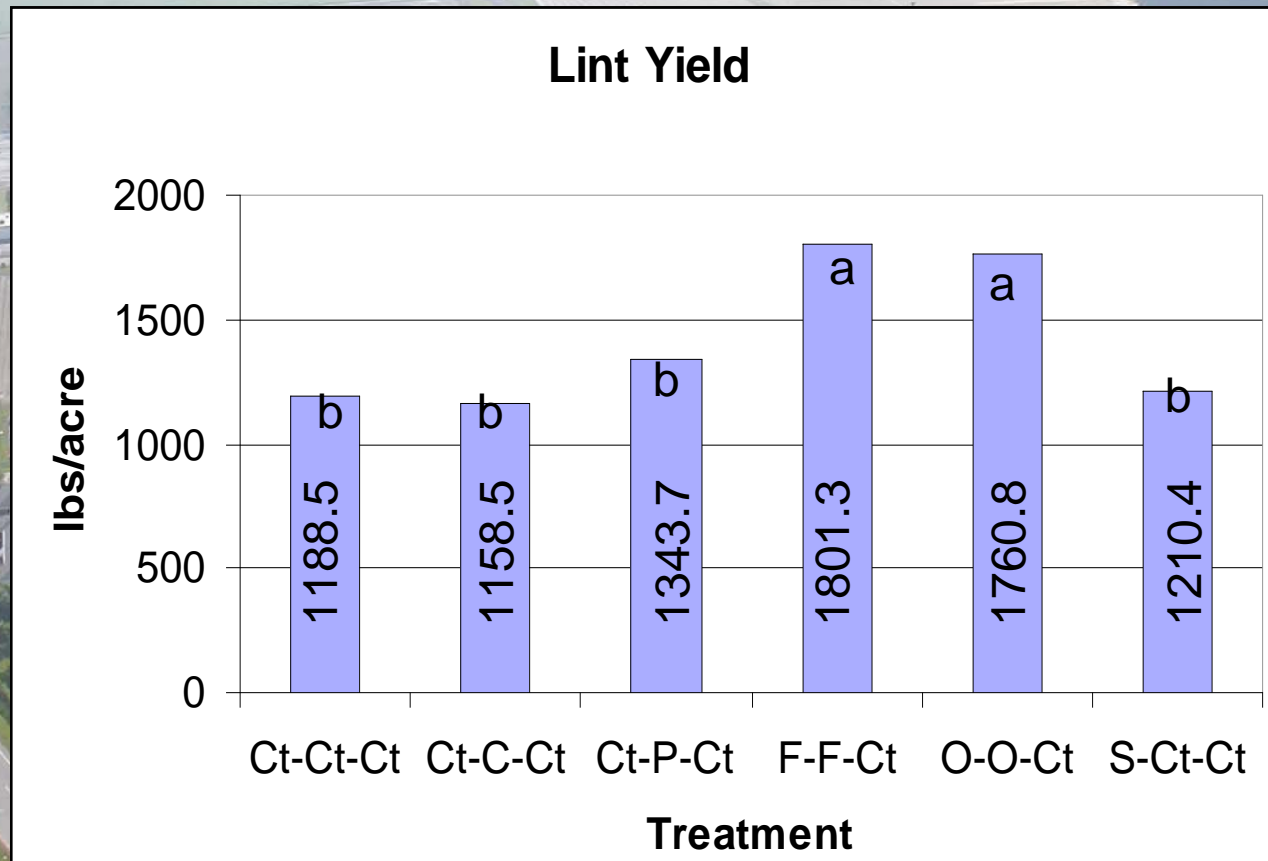
Rotation	2003	2004	2005	2006	2007
1	Peanut	Cotton	Cotton	Cotton	Cotton
2	Peanut	Cotton	Corn	Cotton	Peanut
3	Peanut	Cotton	Peanut	Cotton	Peanut
4	Peanut	Tall fescue	Tall fescue	Cotton	Peanut
5	Peanut	Orchardgrass	Orchardgrass	Cotton	Peanut
6	Peanut	Tall fescue	Tall fescue	Tall fescue	Peanut
7	Peanut	Orchardgrass	Orchardgrass	Orchardgrass	Peanut
8	Peanut	Soybean	Cotton	Cotton	Peanut

2006 Crop Response to Rotation



◆ = significant at P = 0.05

2006 Crop Response to Rotation



Fisher's Protected LSD, $P \leq 0.05$ Level

An aerial photograph of a rural farmstead. A paved road curves through the scene. In the center, there are several farm buildings, including a large barn and smaller structures. Surrounding the buildings are various agricultural fields, some of which appear to be planted with crops like corn. The background shows more fields and a distant horizon under a clear sky.

Soil Measurements Made

- Saturated water infiltration.
- Resistance to root penetration.
- Organic matter content, C & N content.
- Bulk density.
- Available water content.

Potential for Greater Water Infiltration

An aerial photograph of a rural landscape. A multi-lane road curves through the scene. To the left of the road is a green field. To the right is a large, flat, light-colored area, possibly a field or a pond. In the background, there are more fields and a line of trees. The sky is overcast.

- Looser, more porous soil from perennial grass root growth.
- Greater cover protecting soil from rain drop impact and sealing.

Greater Residual Ground Cover



Double Ring Infiltrometer

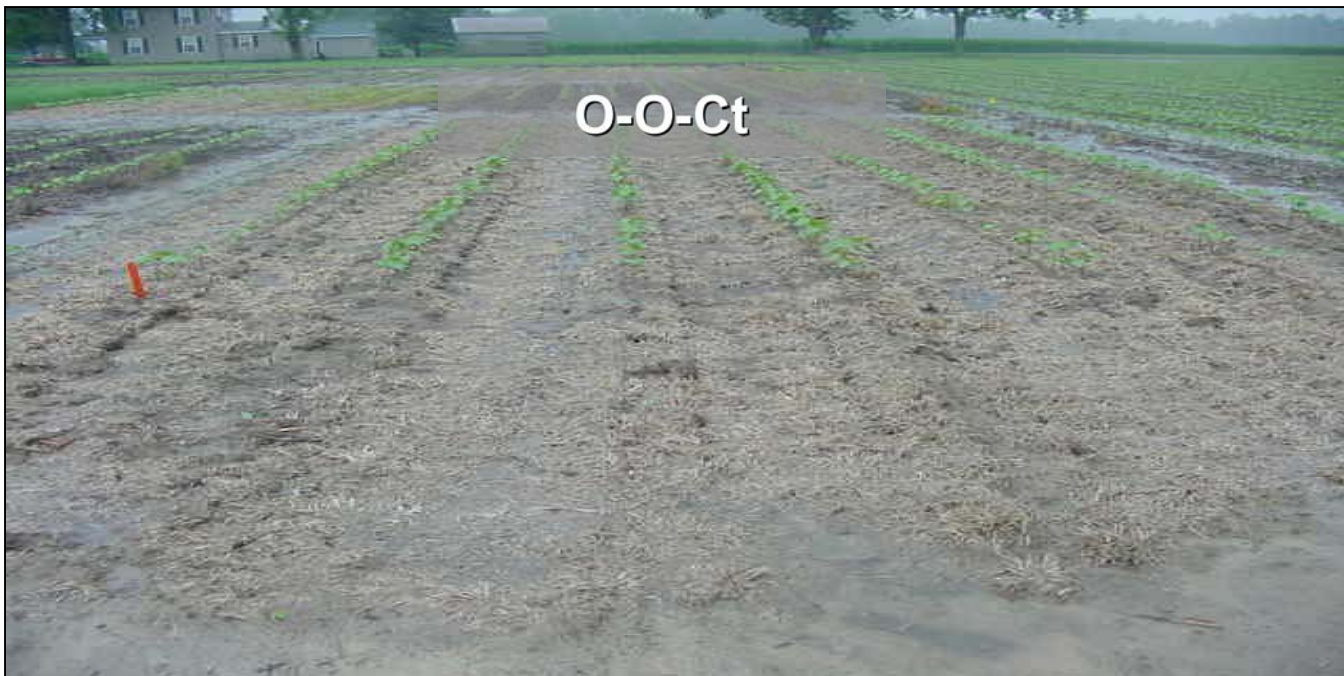


An aerial photograph of a rural landscape. A paved road curves through the scene from the bottom left towards the center. To the right of the road, there is a large, flat, light-colored area that appears to be a field or a construction site. In the background, there are more fields, some with crops, and a small cluster of buildings. The sky is overcast and hazy. The text 'Results from Infiltration' is overlaid in a large, white, bold font with a black outline, centered in the upper half of the image.

Results from Infiltration

- **No measured differences found between treatments for saturated infiltration.**
- **Measurements may not reflect what actually happens during a heavy rain.**







Series of pipes fixed water tight to base graduated from 0.5 cm to 5 cm with a roof to prevent rainfall from falling directly in.

Detecting Infiltration Differences During Rainfall Events



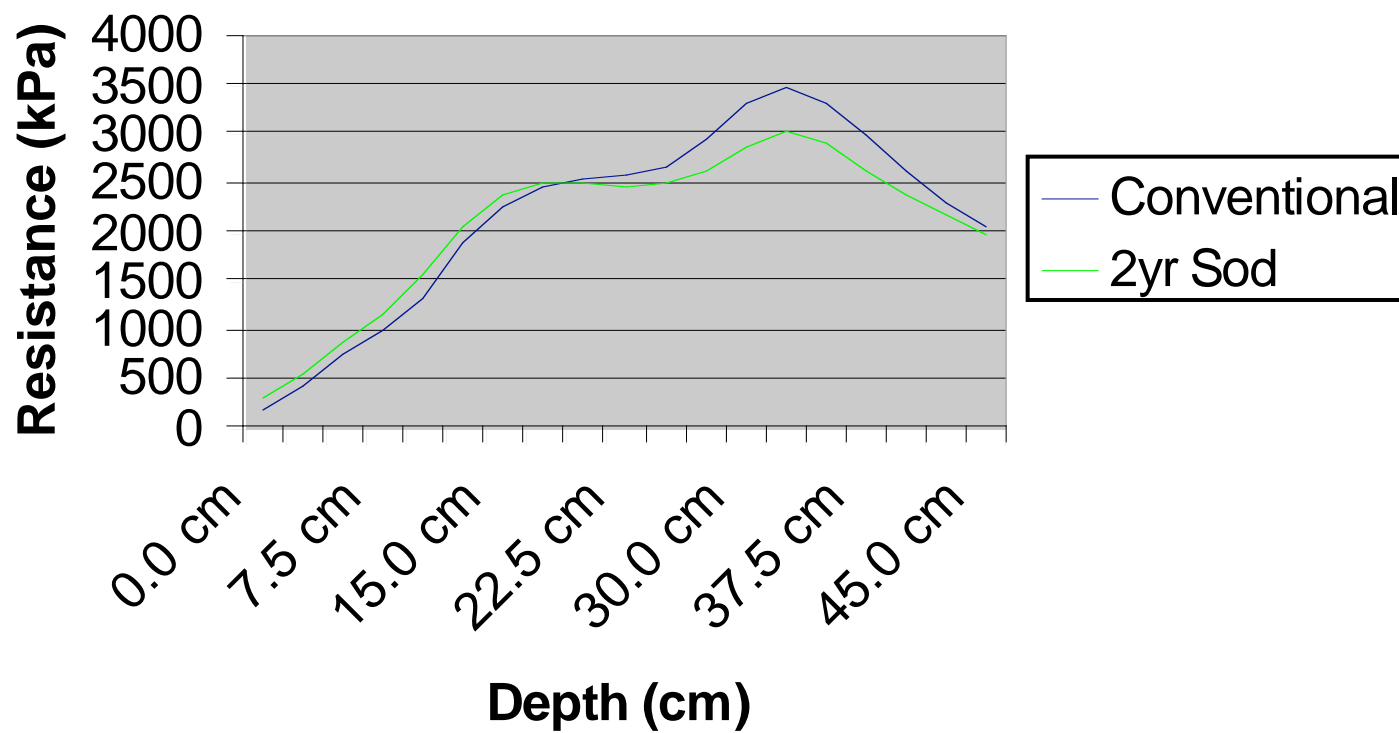
Root Penetration

- Soils are often compacted at depths beyond the reach of typical tillage.
- Multiple years of grass may provide opportunities for roots to penetrate restrictive layers.
- Subsequent annual crops could explore residual root channels left behind allowing for greater access to water and nutrients.

Data Logging Penetrometer



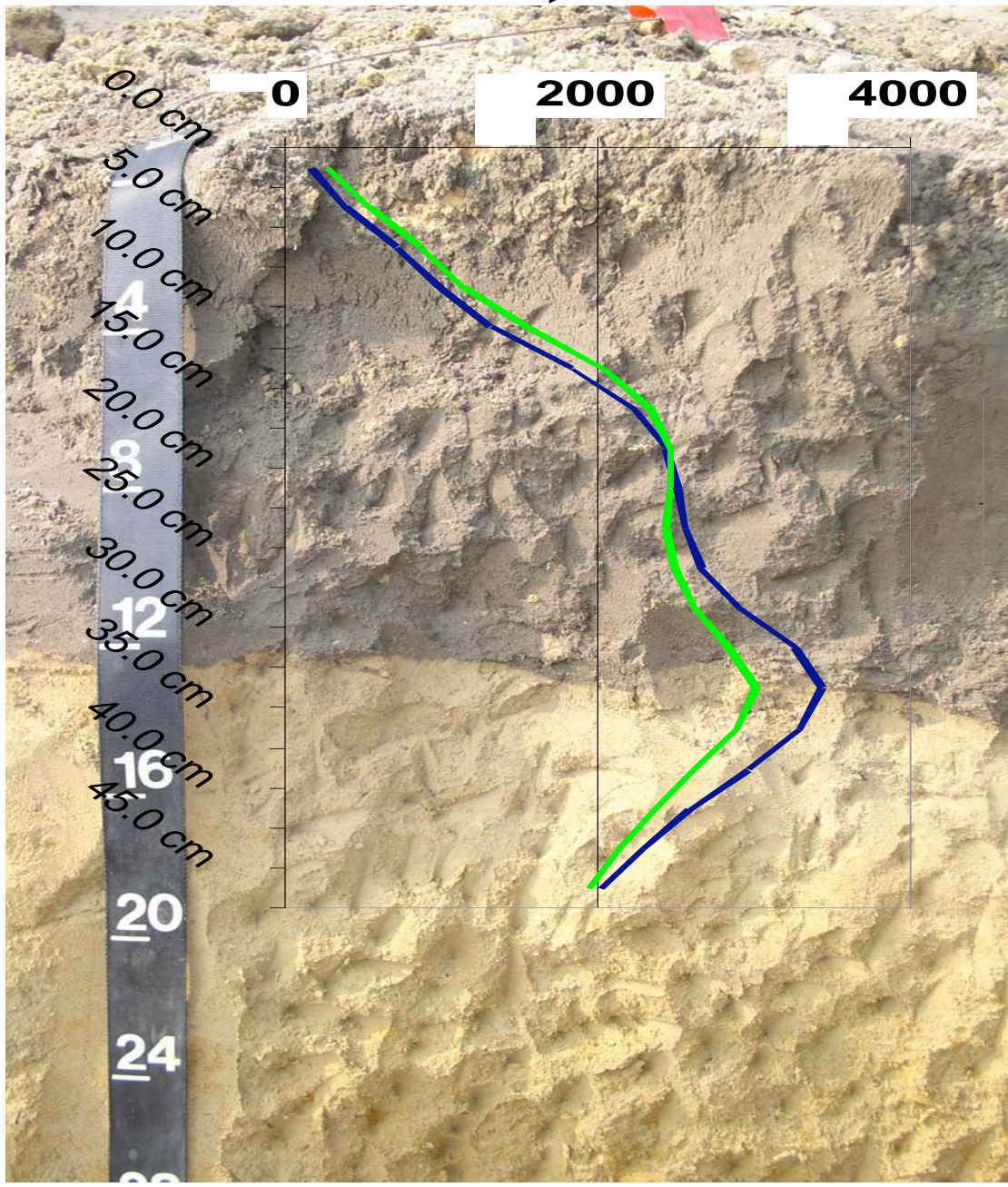
Soil Resistance to Root Penetration



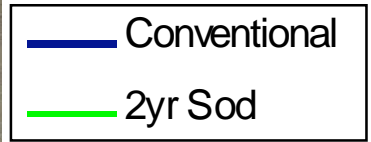
Resistance kPa



0 2000 4000



**Soil
resistance
to
penetration**



Other Differences in Soil Parameters?

- **No difference found in**
 - Soil organic matter
 - Carbon and nitrogen content
 - Bulk density
 - Available water content
 - Measured infiltration
- **Only measured difference in soils between treatments is penetration resistance.**

Conclusions

- **Resistance to root penetration.**
 - Major difference in soil quality parameters.
- **Lower resistance following 2 yrs grass at increasing depths.**
 - Greater soil volume utilized by plant?
 - Yield response seen this year.
- **Inclusion of grasses enhanced yield in 2006.**
 - Yield enhancement may be magnified by lack of rainfall.
- **Perennial grasses may be useful for moving into conservation tillage management plans.**

Future Research Goals

- Continuous measurement of soil moisture content following planting using moisture probes.
- Stratify measurements of organic matter to see if greater changes are seen at shallow depths.
- Determine response of peanut to rotation.
 - Peanut will be planted in all plots except continuous cotton.
 - Disease suppression from rotation of greater importance in peanut than cotton.

Peanut strip tilled into 3 yrs of orchardgrass vs. soybean-cotton- cotton.



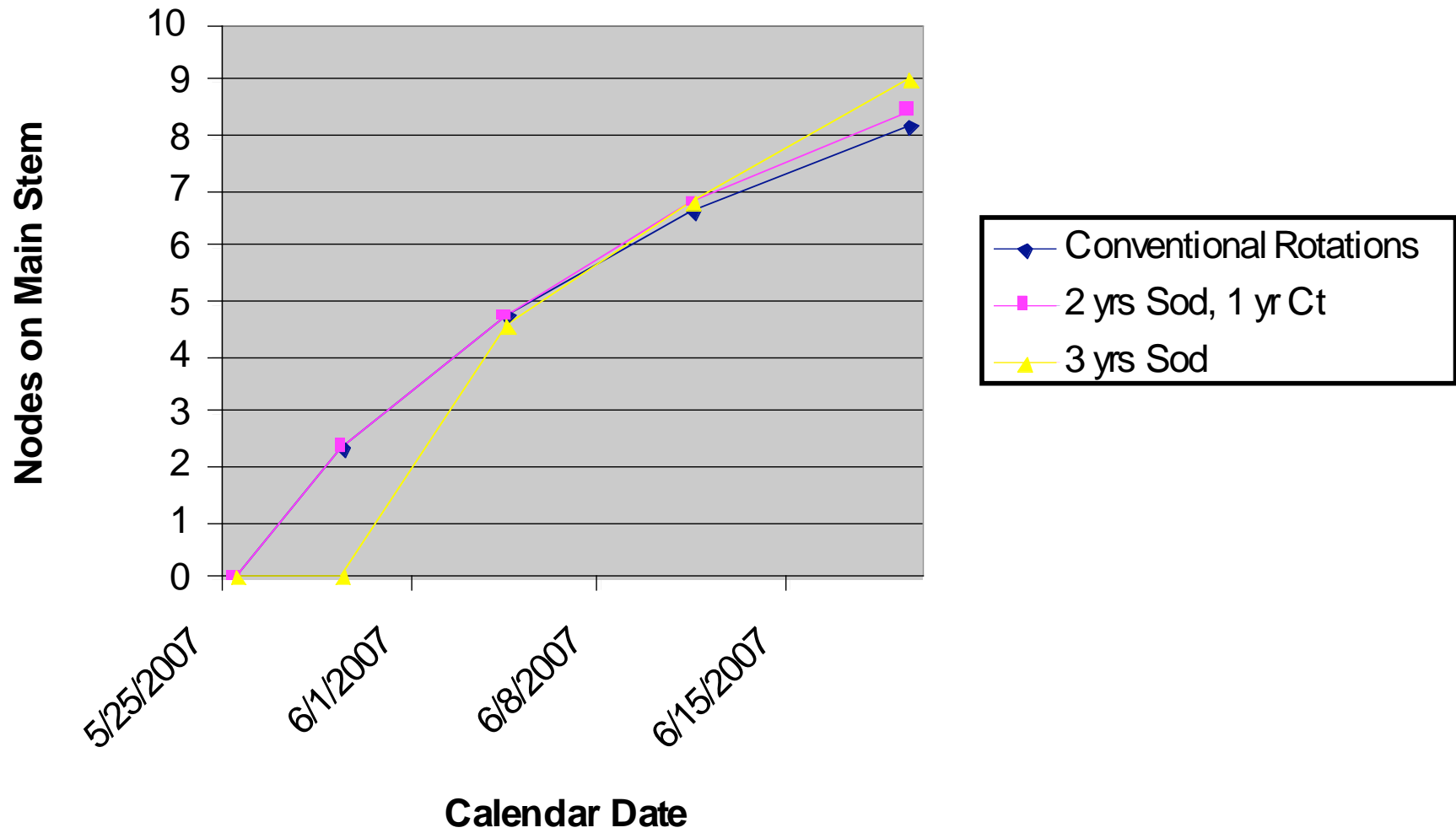
Growth
Stage
V8

Main Stem



Cotyledon
Branches, Node 0

Main Stem Nodes



Questions???

