

**Virginia Peanut Growers Association**  
**Final Report**  
447777

2007  
PID 205  
SFD VA-16  
BFD 453

**Title:** An Examination of Sod-based Rotations in Cotton and Peanuts

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## 2007 Data Summary

### Soil Quality Parameters

#### **Resistance to root penetration.**

Untimely rainfall has provided limited opportunities to measure resistance to root penetration due to the requirement of field capacity moisture status at the time of sampling. To date one complete data set for resistance to root penetration has been collected during the 2007 season. Each data set consists of 6 measurements per plot (24 reps per treatment), with resistance logged in kPa to a depth of 45 cm in increments of 2.5 cm.

Statistical comparisons were made between penetration resistance logged at each depth for the following eight rotations; cotton-cotton-cotton-cotton (ct-ct-ct-ct), cotton-corn-cotton-peanut (ct-c-ct-p), cotton-peanut-cotton-peanut (ct-p-ct-p), fescue-fescue-cotton-peanut (f-f-ct-p), orchardgrass-orchardgrass-cotton-peanut (o-o-ct-p), fescue-fescue-fescue-peanut (f-f-f-p), orchardgrass-orchardgrass-orchardgrass-peanut (o-o-o-p), and soybean-cotton-cotton-peanut (s-c-c-p). Interestingly in shallower depths rotations ct-ct-ct-ct, f-f-f-p, and o-o-o-p behaved similarly with statistically greater resistances at depths of 2.5 cm and 10 cm to 25 cm. At depths 5 cm and 7.5 cm the latter rotations were numerically greater but statistically similar to other rotations. At depths greater than 25 cm all rotations are statistically similar to a depth of 35 cm. From 35 cm to 45 cm the trends in resistance reverse, particularly for rotations ct-ct-ct-ct and f-f-f-ct. These rotations had statistically lower resistances at these depths. Rotation o-o-ct-p was also statistically similar to the latter rotations. Trends in resistance to penetration from this sample set are better visualized in figure 1.

#### **Collection of surface water pooling during rainfall events.**

In 2006 during heavy thunder showers differences were observed in water pooling in the middles of rows in different rotations. Particularly those rotations which had remaining grass residue or living grass (f-f-ct-p, o-o-ct-p, f-f-f-p, and o-o-o-p) showed no surface water pooling compared to all other rotations. To measure differences pipe collectors were designed and fabricated. Each collector consists of 10 PVC rings graduated from 0.5 cm in depth to 10 cm. Each ring was attached water tight to an acrylic plate which was staked flush with the soil surface between cropping rows in two locations per plot. Roofs were installed above each device to prevent direct rainfall from entering. Design problems were seen however as water splashing off the surface or rain falling at an angle

entered the rings, making it difficult to tell what rings were flooded by surface water. As peanut rows close preventing splash and rain entry at an angle there may be greater chance for accurate results.

### **Soil profile moisture measurement.**

A Dynamax PR2 profile probe and corresponding data logger were recently purchased for repeated measures of soil moisture at depths of 100 mm, 200 mm, 300 mm, 400 mm, 600 mm, and 1000 mm. Due to the cost of access tubes, measurements will be limited to each replication of rotations ct-p-ct-p, f-f-ct-p, and o-o-ct-p.

### **Other remaining soil measurements.**

Water stable soil aggregates.  
More resistance to penetration data.  
Stratified C:N samples by the inch.  
Pressure plate analysis for plant available water.

### **Disease Evaluation**

#### **Fall sampling for parasitic nematodes and microsclerotia of *C. parasiticum*.**

Rotations f-f-f-p and o-o-o-p had statistically greater numbers of rootknot and stubby root nematodes compared to other rotations although they were statistically similar to several. Rotation f-f-f-p and ct-p-ct-p had statistically greater ring nematodes although f-f-f-p was statistically similar to other rotations. All rotations had statistically similar *C. parasiticum* microsclerotia per gram of soil. See table 1 for detailed means separations of soil pathogen counts.

#### **In season disease ratings.**

Ratings of disease occurrence during the growing season has not shown any disease incidence. Dry weather may be preventing extensive growth of pathogenic fungi.

### **Peanut Growth and Development**

#### **Rate of vegetative growth.**

Weekly counts of total nodes on the main stem (cotyledon branches = node 0, last node with expanded leaf = node n) were made on 20 plants per harvested rows beginning after all treatments had emerged. Peanut following three years of either perennial grass displayed a 4 day delay in emergence compared with other rotations. This was likely due to deeper planting depth required to place the seed in strip tilled grass residue as well as cooler soils due to greater moisture content. Despite slower emergence following grasses, by the second measurement of total nodes peanut following 3 years of either grass showed statistically equal total nodes compared to all other rotations. By the third

and fourth measurements peanut following 3 years of grass displayed numerically greater but statistically similar total nodes compared to other rotations. At the fifth measurement peanut following three years of grass had statistically greater nodes compared with other rotations with this trend continuing into the sixth measurement. At this point measurement of total nodes had to be stopped due to the onset of pegging. Handling the main stems for counting during pegging threatened an accurate determination of yield. See figure 2 for a graphical synopsis of vegetative growth rates with comparisons made between combined means of peanut following 2 years grass +1 year cotton, 3 years grass or a conventional rotation.

### Rate of row closure.

In order to continue to measure peanut growth without affecting pegging, measurements of row closure were taken. Distance between the closest leaves to touching at 5 locations between the harvest rows in each treatment in peanut were taken. To date this measurement has only been made twice. Rotations including 3 yrs of grass followed by peanut tended towards less exposed soil between rows compared to other rotations although o-o-ct-p is statistically equal to f-f-f-p on both sampling dates. Rotation o-o-o-p was statistically similar to rotations f-f-ct-p, o-o-ct-p, and s-ct-ct-p on both sampling dates as well. Rotation ct-p-ct-p numerically had the greatest remaining exposed soil on both dates but was statistically similar to ct-c-ct-p. See table 2 for means separation of row closure data to date.

### Leaf tissue analysis for nutrient content.

Leaf tissue analysis was conducted on 40-50 leaves sampled from each plot. The leaves of peanut following three years of grass had statistically lower S %, Mg %, Ca %, as well as ppm B compared to other rotations. However leaves of peanut following three years of grass had greater ppm Mn compared to other rotations. This latter result was not surprising as all plots with the exception of those following three years grass were showing signs of Mn deficiency at the time of sampling. All plots were fertilized with Mn following sampling. Another interesting finding was much higher measurements of Al ppm following rotations which were not in grass the previous year. These differences, though extreme numerically, were not statistically significant. Aluminum levels may indicate contamination of the plant samples with soil. Reasons why this may not have occurred in rotations following grass are not clear at this time. See table 3a and 3b for mean separations of tissue nutrient status.

### Tables:

	Nematodes per 500 cc soil								<i>C. parasticum</i>	
	Rootknot		Stunt		Ring		Stubbyroot		ms / g soil	
Ct-Ct-Ct-Ct	5	c	37.5	a	65	bc	85	bcd	4.5	a
Ct-C-Ct-P	10	c	52.5	a	60	bc	87.5	bcd	5.3	a
Ct-P-Ct-P	72.5	a	2.5	a	162.5	a	30	d	7.8	a
F-F-Ct-P	7.5	c	32.5	a	20	c	70	cd	4.8	a
O-O-Ct-P	22.5	bc	32.5	a	62.5	bc	187.8	bcd	4.8	a

F-F-F-P	72.5	a	37.5	a	30	c	202.5	ab	5.8	a
O-O-O-P	60	ab	82.5	a	120	ab	312.5	ab	6.5	a
S-Ct-Ct-P	20	bc	125	a	62.5	bc	102.5	bcd	4.3	a

Table 1. Nematodes per 500 cc soil and average *C. parasiticum* microsclerotia per gram of soil.

Means followed by the same letter are not significantly different at  $p \leq 0.05$ .

Remaining Exposed Soil Between Harvest Rows (in)		
Rotation	19-Jul-07	25-Jul-07
Ct-C-Ct-P	8.75 ab	6.00 ab
Ct-P-Ct-P	11.08 a	7.49 a
F-F-Ct-P	8.21 bc	4.04 bc
O-O-Ct-P	7.00 bcd	3.18 bcd
F-F-F-P	4.28 d	0.89 d
O-O-O-P	5.89 cd	1.65 cd
S-Ct-Ct-P	7.61 bc	4.60 abc

Table 2. Remaining exposed soil between harvest rows.

Means followed by the same letter are not significantly different at  $p \leq 0.05$ .

Treatment	N %	S %	P %	K %	Mg %	Ca%
Ct-C-Ct-P	4.2 a	0.4 a	0.4 a	3.7 a	0.5 a	1.3 ab
Ct-P-Ct-P	4.2 a	0.4 a	0.4 a	3.7 a	0.5 a	1.5 a
F-F-Ct-P	4 a	0.4 a	0.4 a	3.6 a	0.6 a	1.4 a
O-O-Ct-P	4 a	0.4 a	0.4 a	3.8 a	0.5 a	1.3 ab
F-F-F-P	3.2 a	0.3 b	0.3 a	3.6 a	0.4 b	1.1 c
O-O-O-P	3.5 a	0.3 b	0.3 a	3.5 a	0.4 b	1 c
S-Ct-Ct-P	3.9 a	0.4 ab	0.4 a	3.8 a	0.5 a	1.2 bc

Table 3a. Nutrient concentration in peanut leaves by %.

Means followed by the same letter are not significantly different at  $p \leq 0.05$ .

Treatment	B ppm	Zn ppm	Mn ppm	Fe ppm	Cu ppm	Al ppm
Ct-C-Ct-P	32.3 a	43.3 a	13.8 b	135.5 a	17 abc	235.8 a
Ct-P-Ct-P	35 a	37.3 a	12.8 b	164.3 a	17.5 ab	295.3 a
F-F-Ct-P	33.3 a	38.8 a	18.5 b	236.5 a	19.8 a	325.3 a
O-O-Ct-P	32 a	39.3 a	14.3 b	136.8 a	16.3 bcd	132.8 a
F-F-F-P	26.5 b	39.5 a	27.5 a	92.8 a	13.8 d	89.5 a
O-O-O-P	26.5 b	42.5 a	30 a	87.8 a	14.3 cd	62 a
S-Ct-Ct-P	33.5 a	38.5 a	15.8 b	129.3 a	17.3 ab	184.8 a

Table 3b. Nutrient concentrations in peanut leaves by ppm.

Means followed by the same letter are not significantly different at  $p \leq 0.05$ .

Figures:

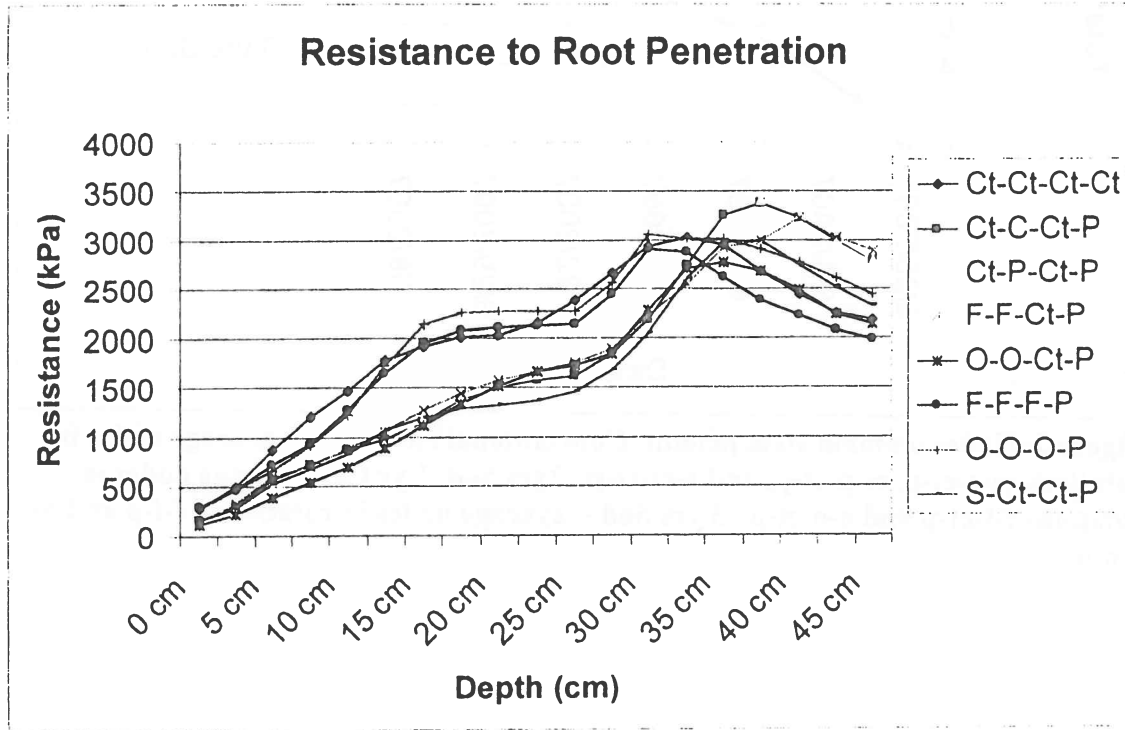
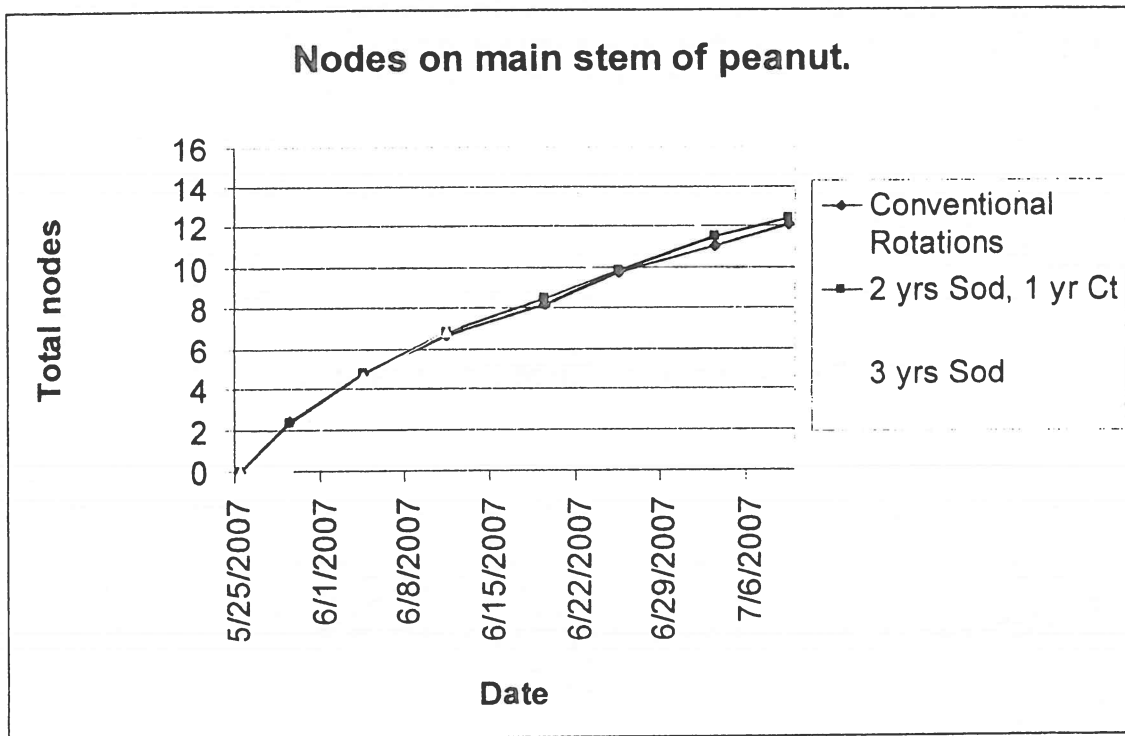


Figure 1. Resistance to root penetration.



**Figure 2. Nodes on main stem peanut. Conventional Rotations = average nodes in rotations ct-c-ct-p, ct-p-ct-p, and s-ct-ct-p. 2yrs Sod, 1 yr Ct = average nodes in rotations f-f-ct-p and o-o-ct-p. 3 yrs Sod = average nodes in rotations f-f-f-p and o-o-o-p.**