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2013

National Peanut Board / Southeast Peanut Research Initiative

EXECUTIVE SUMMARY for 2013 NPB Project # 298, entitled "Cropping Systems Research for Peanut" – Univ. of Georgia, by R. Scott Tubbs.

The single most important management decision a farmer can make to reduce pest incidence and maximize long-term yield goals is to establish efficient cropping systems that incorporate balanced rotations. Thus, it is imperative to have timely experiments with reliable data to support good trends in peanut production and refute bad ones. The all-encompassing nature of cropping systems research provides opportunities to research alternatives to conventional rotations which could provide opportunities for expanding available acreage for peanut production, such as rotating with vegetable crops. If suitable alternative rotations are identified, there would also be greater potential for longer rotation periods between peanut on the same cropland, which has been shown to increase yields and minimize pest incidence.

In 2013 rotation trials, peanut yields were lowest when grown continuously with no rotation (less than 2700 lb/ac) while all other rotations whether 2, 3, or 4-years between peanut crops, regardless of whether corn or cotton or some combination was grown between all resulted in yields in excess of 4000 lb/ac. Likewise, incidence of leaf spot diseases were drastically higher in continuous peanut. Similarly, continuous peanut had lowest yields and highest leaf spot incidence in another rotation trial, especially when following two or three years of corn. In a rotation trial where peanut followed several winter brassica vegetable species and two spring cucurbit vegetable species, peanuts yielded and graded highest when following wheat compared to several winter vegetable species, especially canola and mustard. Also yields and grades were lower when peanut followed a spring vegetable crop of squash or cucumber compared to not having the spring vegetable in the rotation.

In a trial evaluating cover crop biomass production and the performance of peanut produced with various cover crop management of rye, there was little impact on yield and grade of peanut regardless of the cover crop biomass and management of that cover crop. However, there were some differences noted in the overall biomass production and weed control depending on cover crop planting date and management. Biomass production of rye was greatly reduced with each successive planting date (one month apart from October through December), and when no N fertilizer was applied to the cover crop. Weed escapes of southern crabgrass were more prevalent with a December planted rye crop and when no N fertilizer was applied to the rye. Also, southern crabgrass was more present when the rye was terminated from both a herbicide application and rolling the cover crop compared to only spraying with a herbicide without rolling. The additional soil disturbance from rolling likely caused more weeds to emerge and escape the herbicide applied.

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NATIONAL PEANUT BOARD / SOUTHEAST PEANUT RESEARCH INITIATIVE

FINAL REPORT - 2013 funding cycle for work done under project agreement entitled: "Cropping Systems Research for Peanut".

NPB Project # 298
BID # 1261
SID # GA-129
UGA Account #25-21-RF328-021

INSTITUTION: University of Georgia

Principle Investigator: Dr. R. Scott Tubbs

EXPIRATION DATE: 31 December 2014

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FINAL REPORT:

1) ***Cropping Systems and Rotations*** –
a. Lang Farm – A cover crop of 'Wrens Abruzzi' rye (90 lb/ac) was planted to all plots except for weedy fallow plots on 28 Nov. 2012. Peanut (Georgia-06G) was planted 10 May 2013, dug on 8 Oct. and harvested on 15 Oct. 2013.

Rotation of this project is scheduled as follows:

No.	2008	2009	2010	2011	2012	2013	2014	PN Rotat (Yrs)	'13 PN Pod Yld (7% lb/ac)	'13 Lint Yld (Bales/ ac)	'13 Grain Yld (15.5% bu/ac)
1	**PN**	**PN**	**PN**	**PN**	**PN**	**PN**	**PN**	**1**	**2671 d**		
2	CT	**PN**	CT	**PN**	CT	**PN**	CT	**2**	**4585 abc**		
3	MZ	**PN**	MZ	**PN**	MZ	**PN**	MZ	**2**	**4590 abc**		
4	CT	CT	**PN**	CT	CT	**PN**	CT	**3**	**5804 ab**		
5	MZ	MZ	**PN**	MZ	MZ	**PN**	MZ	**3**	**5138 abc**		
6	CT	MZ	**PN**	CT	MZ	**PN**	CT	**3**	**4350 bc**		
7	MZ	CT	**PN**	WF	WF	**PN**	WF	**3**	**4051 bcd**		
8	MZ	**PN**	CT	CT	CT	**PN**	CT	**4**	**5050 abc**		
9	CT	**PN**	MZ	MZ	MZ	**PN**	MZ	**4**	**5036 abc**		
10	CT	**PN**	CT	CT	MZ	**PN**	CT	**4**	**4298 bcd**		
11	MZ	**PN**	MZ	MZ	CT	**PN**	MZ	**4**	**6103 a**		
12	CT	**PN**	CT	WF	WF	**PN**	CT	**4**	**4031 cd**		
13	MZ	**PN**	WF	WF	**PN**	**PN**	WF	**4**	**5086 abc**		
14	CT	CT	**PN**	CT	**PN**	CT	**PN**	**2**			
15	MZ	MZ	**PN**	MZ	**PN**	MZ	**PN**	**2**			**105.6 a**
16	**PN**	CT	CT	**PN**	CT	CT	**PN**	**3**			

17	**PN**	MZ	MZ	**PN**	MZ	MZ	**PN**	**3**			**104.1 a**
18	**PN**	MZ	CT	**PN**	CT	MZ	**PN**	**3**			**106.8 a**
19	**PN**	WF	WF	**PN**	WF	WF	**PN**	**3**			
20	CT	CT	**PN**	CT	CT	CT	**PN**	**4**			
21	MZ	MZ	**PN**	MZ	MZ	MZ	**PN**	**4**			**78.0 b**
22	CT	MZ	**PN**	CT	CT	MZ	**PN**	**4**			**97.6 a**
23	MZ	CT	**PN**	MZ	MZ	CT	**PN**	**4**			
24	MZ	CT	**PN**	CT	WF	WF	**PN**	**4**			
25	CT	MZ	**PN**	WF	WF	**PN**	**PN**	**4**	**4821 abc**		

PN = peanut, CT = cotton, MZ = corn, WF = weedy fallow
Means followed by the same letter in a column are not statistically different according to pairwise t-tests.

Continuous peanut = 2671 lb/ac
Average of 2 YR rotations = 4588 lb/ac
Average of 3 YR rotations = 4836 lb/ac
Average of 4 YR rotations = 4904 lb/ac

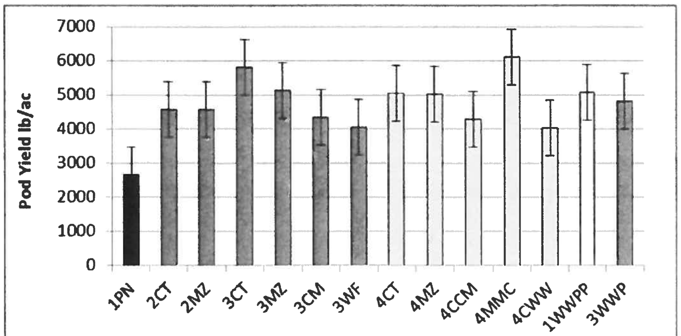

Fig. 1. Peanut yield for various crop rotations, 2013.

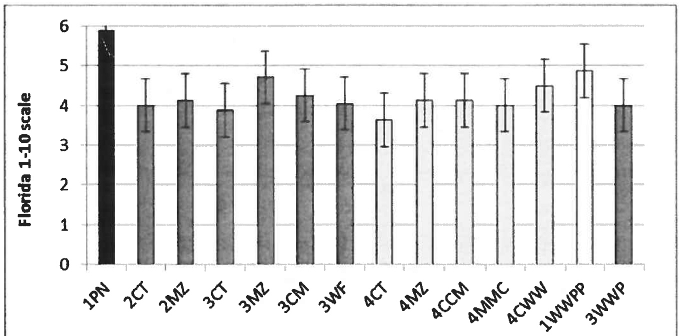

Fig. 2. Leaf spot incidence on peanut for various crop rotations, 2013.

Yield was lowest in continuous peanut (Table 1; Fig. 1). There were not many statistical differences among other rotations, although group comparisons need to be made over rotation length, and combined with an additional cycle of data. Leaf spot incidence (primarily late leaf spot – *Cercosporidium personatum*) was likewise highest in continuous peanut (Fig. 2). Leaf spot incidence in peanut following 3 years of cotton was also lower than when peanut was grown for a second year after two years of weedy fallow.

b. Gibbs Farm –

Corn plots were planted to 'DKC67-97' (1.9 seed/ft [SPF]) on 16 April 2013. On 15 May, 'Georgia-06G' (6.0 SPF) was planted in all peanut plots. Soybean plots were planted on 26 June with Pioneer '95Y20' (8.7 SPF).

The cropping sequences are listed below:

No.	2009	2010	2011	2012	2013	2014	PN Rotat. (Years)	'13 PN Pod Yld (7% lb/ac)	'13 PN Leaf Spot (FL 1-10 scale)
1	**PN**	**PN**	**PN**	**PN**	**PN**	**PN**	1	**1185 b**	**9.8 a**
2	**PN**	SY	**PN**	SY	**PN**	SY	2	**2424 ab**	**9.8 a**
3	**PN**	MZ	**PN**	MZ	**PN**	MZ	2	**2375 a**	**8.4 ab**
4	**Fal**	**PN**	SY	MZ	**PN**	SY	3	**2970 a**	**7.5 bc**
5	**PN**	**PN**	MZ	SY	**PN**	MZ	3	**1984 ab**	**7.8 ab**
6	**PN**	**PN**	MZ	MZ	**PN**	MZ	3	**2869 a**	**7.1 bc**
7	**PN**	MZ	MZ	MZ	**PN**	MZ	4	**3019 a**	**5.9 c**
8	**PN**	MZ	SY	MZ	**PN**	MZ	4	**2310 ab**	**7.4 bc**
9	**PN**	MZ	BG	BG	**PN**	MZ	4	**2261 ab**	**8.4 ab**
10	**PN**	**PN**	SY	**PN**	SY	**PN**	2		
11	**PN**	**PN**	MZ	**PN**	MZ	**PN**	2		
12	**PN**	MZ	**PN**	SY	MZ	**PN**	3		
13	**Fal**	SY	**PN**	MZ	SY	**PN**	3		
14	**PN**	MZ	**PN**	MZ	MZ	**PN**	3		
15	**PN**	**PN**	MZ	MZ	MZ	**PN**	4		
16	**PN**	**PN**	MZ	SY	MZ	**PN**	4		
17	**PN**	**PN**	MZ	BG	BG	**PN**	4		

PN = peanut, SY = soybean, MZ = corn, BG = bahiagrass

Peanut rotations with corn only, or where peanut immediately followed corn if soybean was involved in the rotation, had higher yields than continuous peanut. Yields were suppressed in this trial due to heavy incidence of late leaf spot where nearly complete defoliation occurred in many treatments. Because of the frequency, quantity, and timing of rainfall events, it was difficult to maintain a standard fungicide spray program, causing leaf spot to be rampant in the plots. However, the 4-year rotation of peanut following corn-corn-corn had substantially less leaf spot and defoliation in comparison to many other treatments, including all continuous and 2-year rotations of peanut. In summary, all rotations that included soybean with the exception of the SY-MZ-PN rotation were statistically equivalent to continuous peanut in terms of yield. It is not recommended to rotate peanut with soybean, and especially not peanut immediately following soybean due to increased pest incidence. Another cycle of this rotation reaches full completion in 2014.

c. <u>Vegetable-Peanut Rotation</u> - A potential biorational approach for management of plant diseases is crop rotation with non-host crops and use of bioactive cover crops, such as Brassica species, as green manure for soil amendment prior to planting. Brassicaceous plants are reported to contain significant amounts of glucosinolates, and glucosinolate degradation products (e.g. isothiocyanates) have broad-spectrum biocidal activities. In addition to disease suppression, crop rotation and soil amendments with winter cover crops may provide benefits to following crops and to farming systems in general including maintenance of soil cover and soil integrity, reduced erosion, greater soil organic matter and soil structural improvements. This study was conducted to evaluate the effect of alternative cropping systems, involving winter cover crops, vegetable crops in spring, and peanut in summer and fall, on crop yield and disease development.

Field experiments were conducted at University of Georgia Coastal Plain Experiment Station (Lang Farm) in Tifton, Georgia, since winter 2011/spring 2012. Brassicaceous crops grown in winter include mustard, collards, canola, and broccoli. Squash and cucumber are grown each spring. Summer crops alternate between peanut and cotton, with a staggered cycle for the two fields in this experiment.

For this year of the rotation, peanut was planted on 24 June 2013, dug on 21 Nov. and harvested on 25 Nov. 2013. Late plantings are a consistent domino effect in this trial because of planting conditions for the preceding crop (often related to soil moisture or soil temperature, or sometimes delays in harvest of the crop prior to that also because of weather related delays).

Table 1. Peanut yield and grade (Total Sound Mature Kernels [TSMK]), and winter vegetable number and biomass following winter and spring vegetable treatments at Tifton, GA in 2013.

Preceding Vegetable Crop	Pod Yield	TSMK	Winter Veg.	Winter Veg.
Winter Vegetable[a]	lb/ac	%	plants/m^2	g/plant
Broccoli	4476 ab	66.3 b	1.1 c	4.8 a
Canola	3968 b	66.0 b	17.3 a	0.8 b
Collard	4250 b	70.4 ab	12.9 b	0.7 b
Fallow	4561 ab	68.9 ab		
Mustard	3991 b	67.3 b	12.1 b	0.5 b
Wheat	4970 a	73.1 a		
Spring Vegetable[b]				
Squash	4277 B	67.3 B		
Cucumber	4106 B	66.2 B		
Fallow	4724 A	72.5 A		

[a] Data pooled over rep and preceding spring vegetable plots. Means within a column followed by the same lowercase letter are not significantly different at P=0.05.
[b] Data pooled over rep and preceding winter vegetable plots. Means within a column followed by the same uppercase letter are not significantly different at P=0.05.

White mold (*Sclerotium rolfsii*) was rated for all plots, and all rotations resulted in 2% or less total incidence. There was statistically more white mold when peanut followed wheat and canola compared to mustard, but with such low incidence, this would not be enough information to support whether one crop suppressed or flared white mold into peanut. There was also very poor emergence and growth of winter crop species, especially broccoli. Surviving broccoli plants were scattered in the plot, and thus each individual plant that survived grew to a very large size with no competition for resources. In addition, there was discoloration and atypical appearance of the cucumber plants going into the spring vegetable crop. It is speculated that one of the preceding chemical applications to the cotton crop the previous summer coupled with soil temperatures at planting might have caused some residual issues to these vegetable crops, although it could not be determined exactly what caused these problems to occur this year.

With regards to yield and grade, peanut produced better when following wheat compared to most of the winter vegetable crops (Table 1). Likewise, peanut did not yield or grade as well following a spring vegetable compared to the fallow area. There are no supporting data as to why this occurred. Combination of data analyses over years is needed to determine consistent or long-term effects on disease incidence and yield/grade of peanut.

2) ***High vs. Low Residue Cover Cropping*** –

Rye was planted (90 lb/ac) in mid-October, mid-November, and mid-December, and fertilized one month later in appropriate plots to generate a planting date x fertilization effect on biomass production of the rye cover crop. Termination of the cover crop was by either herbicide alone or rolling + herbicide (Herbicide applied as Roundup at 32 oz/ac on 29 April 2013). All planting date x fertilizer x termination treatment combinations were represented. Peanut (Georgia-06G) was planted on May 20, 2013. All plots were dug on October 12, 2013. Two different rainfall events after inversion caused a delay in harvest of these plots until October 25, 2013.

Table 2. Rye biomass, Peanut yield and grade (TSMK), peanut row width (7/19/13), and end of season southern crabgrass (SCG) control for rye cover crop variables, at Tifton, GA in 2013.

Rye Cover Crop Variables	Rye Biomass	Pod Yield	TSMK	Row Width	SCG Control
Rye Planting Date[a]	DM lb/ac	lb/ac	%	inches	%
October	3781 A	5954 a	75.3 a	24.5 B	87.2 AB
November	2322 B	6074 a	75.3 a	24.4 B	90.8 A
December	771 C	5833 a	75.3 a	27.2 A	81.0 B
Fallow	0	6147 a	76.1 a	28.1 A	87.8 AB
N Fertilization[b]					
No	1877 B	5851 a	75.5 a	25.9 a	82.5 B
Yes	2706 A	6056 a	75.1 a	24.7 a	90.2 A
Rye Termination[c]					
Herbicide Only	2333 A	5867 a	74.7 B	25.0 a	89.8 A
Herbicide and Roll	2250 A	6040 a	76.0 A	25.7 a	82.9 B

[a] Planting occurred on or as close to the 15th of each month (2012) pending weather. Data pooled over rep, fertilization, and termination effects. Means within a column followed by the same

uppercase letter are not significantly different at P=0.05. Means within a column followed by the same lowercase letter are not significantly different at P=0.10.
[b] Fertilizer applied as 34-0-0 (Ammonium nitrate) at rate of 20 lb N/ac. Data pooled over rep, planting date, and termination effects. Means within a column followed by the same uppercase letter are not significantly different at P=0.05. Means within a column followed by the same lowercase letter are not significantly different at P=0.10.
[c] Herbicide applied as Roundup at 32 oz/ac. Data pooled over rep, planting date, and fertilization effects. Means within a column followed by the same uppercase letter are not significantly different at P=0.05. Means within a column followed by the same lowercase letter are not significantly different at P=0.10.