Fertilization and Nutrient Management Trials in Peanut (NPB 255)
Final Report: for 2009 Field Season (Submitted September 30, 2010)

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Objectives and Research Approach:
The overall objective of this research was to evaluate how peanut responds to fertilization treatments and determine the most cost effective way to manage nutrients in a peanut cropping system. The cost of fertilizer is currently at an all time high and growers are desperate to get the most out of their fertilizer dollars.

Calcium nutrition was the main focus for this year’s research. With the shift from small-seeded runner to large-seeded runner peanut cultivars, there is a lot of interest in Ca nutrition in large-seeded runner peanut varieties. Field research was conducted in 2009 to determine the proper rate of gypsum to provide Ca to these new large seeded runner varieties. Field plots were followed through to yield, grade, germination and level of calcium in the seed. Studies to look at sources of calcium, including different gypsums, lime and “liquid calcium” were also conducted.

Results and Discussion

I. Gypsum Rate Studies

Four gypsum (calcium) rate studies were conducted in 2009 to compare the calcium requirements for small-seeded vs. large-seeded peanut cultivars grown in the southeast. All studies were conducted using 6 foot wide by either 30 or 40 feet long beds, gypsum was applied by hand and a randomized complete block with 4 replications experimental design was used. Gypsum rates are 0, 500, 1000 and 1500 lb/a using USG 500 gypsum. Peanut varieties at 3 of the 4 locations were Georgia Green vs. Georgia 06G. At one location (Ponder Farm) FL 07 and Tifguard large-seeded varieties were also used.

1) Ponder Farm (Tifton) – Planted 5/12/09
2) RDV Pivot (Tifton) – Planted 5/14/09
3) Paulk Farms(Turner County) – Planted 5/19/09
4) Stripling Irrigation Park (Camilla) – Planted 6/3/09

Four replications were used at each site and plots were mechanically harvested. After weighing for yield, subsamples were taken for grade and to be shelled for both germination testing and for analyzing calcium content in the nuts.
a) Yields:

Yield data for the four rate studies are shown below, in order from the lowest pegging zone calcium site to the highest. Comments about each study can be found below each graph. This information was also printed in the 2010 UGA “Peanut Update” that was distributed to county agents and peanut growers during ‘winter meetings’ this year.

This is the only study where there was adequate space to include FL 07 and Tifguard in addition to GA 06G. Note that Georgia Green, FL07 and Tifguard did not seem to respond to increasing gypsum rates. However, GA06 G did seem to respond. This is on a Norfolk soil type, irrigated.
Based on this data, the requirement of 500 lb/a pegging zone calcium appears to be adequate, i.e. it may not be required to raise it to 700 lb/a as previously thought. This is a Tifton soil, irrigated.
This another site with 700 lb/a pegging zone calcium like the one above, also on a Tifton soil, but this is a dryland site. Notice the yield level is about half as much as the irrigated site above.

This site had the highest pegging zone calcium level at 950 so no response was expected. However, it appears that both Georgia Green and GA 06 G had a yield response up to the 1000 lb/a gypsum rate. This may be explained due to the soil type on this site being a Lucy deep sand. In addition, notice that he 1500 lb/a gypsum rate did not result in increase yield and in fact decreased yield slightly. One possible explanation for this decrease in yield at the highest rate of gypsum may be a slight potassium and or magnesium deficiency caused by the increase in calcium from the gypsum. This will need to be verified by taking plant tissue samples in the future.

b) Grades:
Grades generally increased as gypsum rate increased, especially above the zero rate. Grades leveled off at the 500 lb/a gypsum rate for Georgia Green but increased with the higher rates for the all three of the large-seeded runner varieties. Overall Ga 06G had the best grades at this location and had the highest grade of 80 at the highest gypsum rate of 1500 lb/a. These response were also expected since the pegging zone calcium was less than 500 lb/a.
There was basically no response in grade to increasing gypsum rates at this location that had an above 500 lb/a pegging zone level. This location is also irrigated which may explain the lack of response.

This location is very similar to the one above as far as a lack of response to increasing gypsum rates in terms of grade.
There seemed to be a slight increase in grade for the Georgia green when going from zero to 500 lb/a gypsum, but not with Ga 06G. This is opposite of what was expected. Note that Ga06G does have overall higher grades than Georgia green at this location, much like the other locations though.

c) Germination and % Calcium in Seed

Germination and % calcium in the seed for all four “rate” studies is shown below.

Germination for this site was very high for all four peanut varieties. Even with a pegging zone calcium level near 500 lb/a germinations were 90 % and above. Note that the GA 06 G responded best to increasing gypsum rates as far as germination.
Calcium content in seed also responded to increasing gypsum rates for all four varieties as expected. Note, that again, the Ga 06G stands out compared to the other varieties and in this case had the lowest calcium content in seed at each rate.

**Calcium (ppm) Content and Seed Germination**

Ponder Farm 2009

The correlation of calcium content in seed and germination was not as strong statistically at this site but also had a good number of data points in the high seed calcium/high germination range.
Germination did not increase much at all for Georgia Green with increasing gypsum rates, and for GA 06 G it only increased when going from the 0 to 500 lb/a gypsum treatment. This result is likely due to the higher pegging zone calcium level at this site.
Even though the germinations did not increase much with increasing gypsum rates with both peanut varieties, calcium content did increase. This shows that as long as you are above the 300 ppm critical level, there is not much increase in germination.

**Calcium (ppm) Content and Seed Germination**

RDC Pivot 2009

\[ y = -1E-05x^2 + 0.0229x + 86.777 \]

\[ R^2 = 0.0353 \]

The graph above really illustrates the high calcium content in seed/high germination relationship.
The response in germination to increasing gypsum rates at this site was very similar to the RDC Pivot site which also had a pegging zone calcium level of 700 lb/a. Same goes for the % calcium in seed and the correlation found in the next 2 graphs below.
Calcium (Gypsum) Rate
Paulk Farm (Turner County, GA – 2009)
Pegging Zone Ca- 700 lb/a

Calcium in Seed (ppm)

Georgia Green  GA 06G

Interaction = ns

Calcium (ppm) Content and Seed Germination
Paulk Farm Turner County GA 2009

Germination (%)

\[ \begin{align*}
  y &= -0.0002x^2 + 0.2473x + 27.078 \\
  R^2 &= 0.4385
\end{align*} \]

Seed Calcium (ppm)
**Calcium (Gypsum) Rate**  
**Stripling Irrigation Park - 2009**  
**Pegging Zone Ca - 950 lb/a**

**Germination (%)**

<table>
<thead>
<tr>
<th></th>
<th>Georgia Green</th>
<th>GA 06G</th>
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<tbody>
<tr>
<td>0</td>
<td>97</td>
<td>92</td>
</tr>
<tr>
<td>500</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>1000</td>
<td>96</td>
<td>95</td>
</tr>
<tr>
<td>1500</td>
<td>96</td>
<td>95</td>
</tr>
</tbody>
</table>

Interaction = .0001

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**Calcium in Seed (ppm)**

<table>
<thead>
<tr>
<th></th>
<th>Georgia Green</th>
<th>GA 06G</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>633</td>
<td>508</td>
</tr>
<tr>
<td>500</td>
<td>627</td>
<td>506</td>
</tr>
<tr>
<td>1000</td>
<td>683</td>
<td>532</td>
</tr>
<tr>
<td>1500</td>
<td>720</td>
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Interaction = ns
Gypsum Source Studies

Three gypsum source studies were established to compare the effectiveness of different gypsum sources for providing calcium to the pegging zone.

1) RDC Pivot (Tifton) – Planting date, varieties, plots size and experimental design were all same as for the gypsum rate study described in part I. above. Gypsum sources evaluated include USG 500, PCS Wetbulk, Agrical, and Vertagro and lime as well as an untreated check.
For Georgia Green, USG 500, AgriCal and VertaGro had the numerically highest yields. However these were not statistically significant. For Ga06G, none of the calcium treatments (including lime) yielded as well as the untreated check (numerically). This research needs to be repeated on a low pegging zone calcium, responsive site.

2) Lime vs. Gypsum – The study below was conducted to look at the affect of lime applied at planting vs. gypsum applied at bloomtime. Another treatment included both lime applied at planting followed by gypsum at bloomtime. An untreated check was also included.
Note that this study was conducted on the Ponder farm site which is a Norfolk soil, irrigated with a 450 lb/a pegging zone calcium level. There were no significant yield differences when averaged across the four peanut varieties, indicating that both pH and pegging zone calcium levels were already adequate.

3) Stripling Irrigation Park (Camilla) – In conjunction with the gypsum rate study at this site, “liquid calcium” in the form of calcium thiocarbonate was evaluated as a calcium source as an alternative to gypsum. Two applications of 15 gal/a and three applications of 10 gal/a were applied during the growing season using a liquid applicator to simulate an application thru a center pivot irrigation system. An untreated check and a 1000 lb/a USG 500 gypsum treatment were used for comparison.
Although not statistically significant, the 2 application treatment of calcium thiosulfate through the pivot seemed to out yield the 3 application treatment and the gypsum. This is encouraging as far as the possibilities of using very soluble liquid calcium through center pivot irrigation to supply calcium to the pegging zone. This research also needs to be repeated to confirm this method will work.

**Summary of Results, Application and Conclusions**

Based on the results from the calcium rate studies described above, the UGA recommendation for gypsum applications on peanuts actually does not change. This is the main thing that growers are interested in and find a little hard to believe. However, even though the recommendations do not change, the importance of using gypsum on the new larger seeded varieties and the awareness has definitely increased. Also, these studies are being repeated in 2010. Since 2009 was a fairly wet year in terms of rainfall during the growing season, the results may be different in the dryer year we have had in 2010.

The germination data has also been of great interest to the peanut seed companies as they look for a critical value of how much calcium needs to get into the new large-seeded cultivar seed for proper germination. Based on results of this study, the critical value appears to be between 300 and 400 ppm Ca in the seed.
Results from the calcium source studies were fairly inconclusive due to being on sites with higher pegging zone calcium levels. It appears that any of the available gypsum sources and the lime method work adequately, at least as far as yields. Liquid calcium applied though the pivot also may be a potential option.