National Peanut Board

Final Report for 2012

Nutrient Management Trials in Peanut – Glen Harris (UGA-Tifton)

Executive Summary

Recent field research on the calcium needs of large seeded runner peanuts (conducted by this author and funded by the National Peanut Board) resulted in a renewed awareness and interest in better ways to provide calcium to peanut for higher yields, grades and seed quality in terms of calcium levels in the harvested nuts and germination. Going into the 2011growing season, peanut growers had new questions like "which gypsum fertilizers are the best?", "can I put out lime at bloomtime? Or gypsum at planting? Can I split apply my gypsum like I do with nitrogen on cotton? "Are there any calcium materials I can put through the pivot?". And "what about this new TigerCal30 material I read such good things about in the farm magazines?" Results from field research at the same at four locations (3 irrigated and one dryland) in 2012 confirmed a lot of the preliminary findings seen in 2011. These conclusions include, it appears that the"Cadillac" gypsum (USG 500 and the old "wet bulk" gypsum may be slightly more effective than the other gypsum materials tavailable. However, the now popular 'smokestack" is a very adequate gypsum alternative. Lime at planting is not recommended at planting, especially in dryland. However, gypsum at planting in dryland may be more effective. Gypsum at early or mid bloom under irrigation appeared to be the best timing but at planting is too early and late bloom is too late. Split applications of gypsum may be effective but don't appear to be consistently better than early bloom applications. Liquid calciums such as calcium chloride applied through the pivot irrigation during peak pod fill appear to have a fit for providing calcium to the pegging zone but do not replace gypsum applications if you need a lot of calcium (i.e., you are below the recommended 500 lb/a soil test calcium in the pegging zone. And finally, TigerCal30, a new chelated calcium carbonate (aka lime), which was touted in the farm magazines as producing fantastic results, was virtually ineffective and indistinguishable from the untreated check in terms of performance.

Background

Between 2008 and 2010, calcium research on peanut in Georgia concentrated on rates of gypsum needed for new large-seeded runner varieties. This research resulted in showing that while it is more important to provide adequate amounts of calcium to large-seeded runner varieties, the current University of Georgia recommendations for gypsum rates are the same as for the old small-seeded runner varieties. As a result of this research, more interest in sources of calcium and timing of calcium applications on peanuts emerged. Therefore, in 2011 the emphasis of calcium research shifted to looking at sources and timing. This type of research was then continued in 2012.

Materials and Methods

Field trials were conducted at four locations in Georgia: 1) UGA RDC Pivot (Tifton), 2) UGA Ponder Farm (Tifton) 3) UGA Stripling Irrigation Park (Camilla), and ABAC (Tifton). Sites 1-3 are center-pivot irrigated and site 4 was non-irrigated.

Planting dates and varieties for each site are as follows: Site 1) – planted May 2 to Georgia 06G, Site 2) – planted April 26 to Georgia 06G and Georgia Greener, Site 3) - planted May 11 to Georgia 06G, and Site 4) – planted May 21 to Georgia 06G and Georgia Greener. All sites were planted in single rows spaced 36 inches in conventional tillage.

Sources of calcium included four different gypsums (or landplaster, i.e. calcium sulfate): 1) USG 500 (naturally mined), 2) PCS Wet Bulk (by-product of phosphorous fertilizer production), 3) AgriCal (by-product of coal burning power plants, aka "FGD", 'smokestack' or "synthetic") and 4) "Crystal River" another FGD gypsum. Other sources included limestone, TigerCal (a chelated limestone), and liquid calcium chloride and calcium thiosulfate applied thru the pivot.

Timing of calcium applications focused mainly on timing of gypsum. Agrical ('smokestack" gypsum was used for the timing studies since this appears to currently be the most popular source of gypsum. The recommended timing of gypsum application is at early bloom, so this treatment was included and compared to mid-bloom and late-bloom. Split applications of gypsum were also investigated with some applied at planting and some at early bloom as well as other splits. In addition, lime was applied at both planting (recommended) and at bloomtime (not recommended).

Not all treatments were included at all sites due to space limitations. Also, liquid calcium applications through the pivot were not appropriate for the non-irrigated site, but an application of calcium chloride "banded behind the press wheel at planting' was included instead.

All plots at all locations were machine harvested for yield, subsampled for grade (Federal State Inspection) and also shelled and sized for warm and cold germination – and most importantly – calcium content in the but (Georgia Department of Ag, Tifton).

Results and Discussion

1) RDC Pivot

1	Lime at planting (1000 lbs/a)
2	Gypsum (Agri-Cal) at planting (1000 lbs/a)
3	Gypsum (Agri-Cal) Split-500 lbs/a at planting + 500 lbs/a at early bloom (40 DAP)
4	Gypsum (Agri-Cal) at early bloom (1000 lbs/a)
5	Lime at early bloom (1000lbs/a)
6	CaCl through pivot (
7	CaTs through pivot
8	Gypsum (Agri-Cal) at early bloom (1000 lbs/a) + CaCl through pivot
9	TigerCal
10	Untreated Check
11	Gypsum (Agri-Cal) at late bloom (1000 lbs/a) (100 DAP)
12	Gypsum (Agri-Cal) at mid bloom (1000 lbs/a) (70 DAP)

Treatment #	Yield (lbs/a)	Grade	Warm Germ (%)	Cold Germ (%)	Ca in Nut (ppm)
1	6873	78.0 abc	97.8	95.8	668 bcd
2	6666	78.2 ab	98.2	96.8	640 cde
3	7058	78.2 ab	97.0	96.0	679 bc
4	6452	77.5 abc	96.8	97.5	751 a
5	6516	78.5 a	97.8	96.2	686 abc
6	6598	78.2 ab	96.2	96.2	606 def
7	7082	78.0 abc	96.5	94.5	604 def
8	6917	77.5 abc	97.8	95.8	718 ab
9	6735	77.5 abc	95.5	96.0	582 ef
10	7120	77.2 bcd	97.2	95.0	567 f
11	7098	77.0 cd	98.0	97.2	754 a
12	7367	76.2 d	98.5	96.5	725 ab
Significance	NS	0.0228	0.3815	NS	0.0000
CV	9	1	2	2	7

There was no statistical difference in yields at this site with all yields being good i.e, above 6000 lb/a. This is likely due to adequate soil test calcium in the pegging zone to begin with. For grade (TSMK), the highest value was for lime at planting and the lowest was gypsum at mid bloom. Both of these are hard to explain since they go against what was expected. At least most of the calcium treatments were above the untreated check. There was also no statistical difference between treatments for warm or cold germination with all values being extremely high (95 % or better). This may be due to good growing

conditions and proper storage and handling of the peanuts after harvest. Calcium in the nut is the true test of how effective a calcium treatment is and there were statistical differences at this location. Gypsum at early bloom was second highest numerically (behind gypsum at late bloom, which again is hard to explain). The untreated check was the lowest numerically and not statistically different from TigerCal which was second lowest. The two liquid calcium thru the pivot were also near the bottom and did not appear to raise the calcium in the nut significantly. Gypsum applied at planting was also obviously not as effective as when applied at early bloom as recommended. But lime at bloom was more effective than lime at planting which goes against current recommendations and may be due to when rainfall was received at this site.

2) Ponder Farm

1	Lime at Planting (1000 lbs/a)
2	AgriCal at Planting (1000 lbs/a)
3	Agrical (500 lbs/a) at Planting + AgriCal (500 lbs/a) at Early Bloom
4	AgriCal at Early Bloom (1000 lbs/a)
5	Lime at Early Bloom (1000 lbs/a)
6	HiCal liquid
7	CaTs liquid
8	AgriCal (1000 lbs/a) at Early Bloom + HiCal liquid
9	TigerCal liquid
10	AgriCal (1000 lbs/a) at Mid Bloom (70 DAP)
11	AgriCal (1000 lbs/a) at Late Bloom (100 DAP)
12	PCS Wet Bulk (1000 lbs/a) at Early Bloom
13	USG 500 (1000 lbs/a) at Early Bloom
14	Untreated Check

	Yield (lbs/a)	Yield (lbs/a)	Grade	Grade	Warm Germ (%)	Warm Germ (%)	Cold Germ (%)	Cold Germ (%)	Ca in Nut (ppm)	Ca in Nut (ppm)
Treat-ment #	GA 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener
1	6648	6699	77.5	78.2	94.0	96.5	96.2	97.2	610	680
2	6287	6759	78.0	77.5	96.0	97.0	94.0	96.0	613	731
3	7271	6387	78.5	77.5	96.0	97.2	95.8	94.2	630	742
4	7294	6665	77.8	77.8	93.2	97.0	92.5	97.2	646	770
5	7178	6638	75.5	77.8	93.5	96.2	90.5	96.0	568	684
6	6917	6614	76.2	77.8	94.0	95.0	95.8	97.2	569	700
7	7384	6579	76.5	77.5	94.2	95.8	95.5	95.0	568	722
8	7422	6539	77.8	78.5	96.2	96.2	96.8	95.8	693	819
9	6968	6725	76.0	78.8	90.8	96.0	90.8	97.2	526	676
10	6877	6848	76.5	77.5	95.5	97.5	95.5	97.2	645	809
11	6685	6884	75.5	77.8	95.2	97.0	95.5	97.2	636	794
12	7414	7171	78.0	78.2	96.0	96.8	94.8	96.0	617	741
13	6685	6688	78.2	78.5	94.2	95.8	95.2	95.8	668	842
14	7349	6587	74.2	77.5	94.2	96.0	92.8	95.8	578	678
A	0.012		0.0000		0.0001		0.0000		0.0000	
B	0.4450		0.0017		0.2848		0.0852		0.0000	
A x B	0.1709		0.0214		NS		0.0203		NS	
CV	7.5		1.5		2.5		2.4		8.8	

As far as yield at this location, there was a significant difference between cultivars, with Georgia 06G averaging 7027 lb/a to 6674 for Georgia Greener, but there were no statistical differences in yield due to calcium treatments. As far as grade (TSMK) there was a significant cultivar by treatment interaction meaning you need to look at how each cultivar responded to different treatments. For Georgia 06G, gypsums at early bloom or split applications resulted in the highest grades whereas lime at early bloom and gypsum at late bloom resulted in the lowest grades as would be predicted. Lime at planting resulted in better grades compared to lime at bloom for both cultivars. For warm germination, there was a significant difference between cultivars when averaged over calcium treatments with Georgia Greener averaging 96.4% warm germination compared to 94.5 for Georgia 06G.It was also noted that the lowest warm germ for Georgia 06G was when TigerCal was applied. For cold germination there was a cultivar by calcium treatment interaction, with Georgia 06G being more affected than Georgia Greener. Agrical gypsum with calcium chloride added thru the pivot (treatment 8) was the best treatment for helping with cold germination of Georgia 06G. TigerCal resulted in the lowest cold germ for this popular cultivar. For Georgia Greener, a number of calcium treatments resulted in good cold germinations while calcium thiosulfate thru the pivot resulted in the lowest cold germination. Looking at how much calcium got into the peanut seeds or nuts at this location there was a significant difference between cultivars with Georgia Greener averaging 742 ppm Ca in the nuts vs. 607 ppm for Georgia 06G. This is consistent with previous data showing Georgia 06G does not accumulate as much calcium in the nut compared to other varieties due to its large size and possibly some genetic difference in the ability to absorb calcium from the soil solution into the developing nut. There was also a strong statistical effect of calcium treatment when averaged across cultivars (and no interaction) with again the combination treatment of gypsum and calcium chloride thru the pivot (treatment 8) being the highest but USG 500 gypsum at early bloom being very close at the top. The standard treatment of a smokestack gypsum at early bloom also fared well, the untreated check had the lowest calcium content in the nuts which shows this research is being conducted correctly. TigerCal was the second lowest. And even these two lowest treatments contained enough calcium for decent germinations. Also, there was not that much difference between lime at planting vs lime at bloom bit again this could be due to very adequate soil moisture throughout the growing season.

3) Stripling Irrigation Park

1	Agri-Cal 1000 lbs/a
2	Hi-Cal
3	CaTs
4	Agri-Cal 1000 lbs/a + Hi-Cal
5	Lime 1000 lbs/a
6	TigerCal
7	Untreated Check
8	Agrical 1000 lbs/a late bloom

Treatment #	Yield (lbs/a)	Grade	Warm Germ (%)	Cold Germ (%)	Ca in Nut (ppm)
1	8298	78.2	95.8	87.5	667 bc
2	7942	78.8	96.2	88.8	666 bc
3	8330	78.5	95.8	89.2	636 cd
4	8516	78.5	95.8	88.5	708 ab
5	8097	78.2	95.5	89.0	662 bcd
6	8032	78.0	94.8	87.8	655 bcd
7	8227	77.8	95.0	86.8	611 d
8	8138	77.5	95.8	89.8	746 a
Significance	0.2367	NS	NS	NS	0.0018
CV	3.7	1	2	4	6

There were no statistical differences between calcium treatments for yield, grade (TSMK), warm germination or cold germination at this site. There were some differences in the effectiveness of the calcium treatments getting calcium in the seed or nuts however. AgriCal smokestack gypsum at late bloom actually had the highest calcium in the nut, even higher than AgriCal at early bloom. Gypsum plus Calcium chloride thru the pivot was the second highest, proving a consistently good treatment across the irrigated sites. The untreated check had the lowest calcium content in the nut as expected with TigerCal and calcium thiosulfate also being near the bottom in terms of effectiveness.

4) ABAC (dryland)

1	AgriCal)1000 lbs/a) at bloom
2	PCS Wetbulk (1000 lbs/a) at bloom
3	USG 500 (1000 lbs/a) at bloom
4	Gypsoil (1000 lbs/a) at bloom
5	Lime (1000 lbs/a) at planting
6	Lime (1000 lbs/a) at bloom
7	TigerCal 30 at bloom
8	Untreated Check
9	AgriCal (1000 lbs/a) at planting
10	AgriCal "Split" 500 lbs/a at planting + 500 lbs/a at bloo
11	HiCal liquid at planting
12	AgriCal (1000 lbs/a) at late bloom
13	AgriCal (1000 lbs/a) at mid bloom

Treat-ment #	GA 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener	Ga 06G	Ga Greener
1	7827	7235	78.2	79.0	81.2	80.2	78.5	77.5	456	500
2	7723	7341	77.2	78.5	76.0	82.5	73.8	76.0	388	46
3	7348	7469	78.5	79.8	83.2	84.8	76.5	79.8	476	562
4	7605	6897	78.8	79.2	79.2	79.0	80.8	74.2	412	482
5	7505	7201	76.0	75.0	80.8	76.5	73.8	72.2	391	457
6	6913	6625	71.5	75.5	75.2	73.8	75.0	71.0	338	396
7	6532	6146	71.0	72.2	70.0	72.2	69.2	71.2	329	338
8	6318	5794	72.5	70.0	72.2	72.2	73.8	63.2	406	326
9	7623	7097	78.0	78.2	76.8	78.0	74.8	76.0	432	442
10	8022	7292	77.8	79.0	76.2	80.0	79.2	73.5	416	459
11	6132	6572	70.2	75.0	66.0	74.0	58.0	71.8	307	353
12	6986	6473	71.2	77.2	78.8	72.2	74.0	72.5	538	572
13	6110	6069	79.0	72.0	77.2	71.2	74.5	67.5	340	322
A	0.0006		0.0007		NS		0.2723		0.0019	
B	0.0000		0.0000		0.0000		0.0000		0.0000	
A x B	NS		0.0083		0.2265		0.0069		0.1905	
CV	7		2		7		7			

Just like the irrigated site that compared Georgia 06G and Georgia Greener, the yield of Georgia 06G at this dryland site was statistically higher when averaged across calcium treatments (7126 lb/a) compared

to Georgia Greener (6786 lb/a). Unlike that site though which was irrigated, there was also a statistical difference between calcium treatments on yield. In addition, both these sites had very similar yields indicating there was good soil moisture during the growing season. Gypsum applications at early bloom , as well as split applications of gypsum (at planting and early loom) produced the highest yields. The untreated check had the lowest yields showing again this was a "responsive" site to calcium and the research was conducted in a way to pick up differences. TigerCal once again was very similar to the untreated check, this time in terms of yield. Calcium chloride at planting (since it cannot go thru the pivot on dryland) was also not very effective in terms of increasing yield above the untreated check. Lime at planting out yielded lime at bloom as expected and shows this difference is more likely under dryland vs irrigated conditions. Gypsum at bloom also out yielded gypsum at planting. For grades (TSMK) there was a significant interaction between cultivar and calcium treatment. Bloomtime gypsums worked well for both Georgia 06G and Georgia Greener. Calcium chloride at planting was below the untreated check for Georgia 06G whereas the untreated check was the lowest for Georgia Greener. For warm germination there was no significant difference between cultivars but there was between calcium treatments. Use of USG 500 gypsum resulted in the highest warm germination and the calcium chloride at planting was the lowest again below the untreated check. For cold germination there was a significant cultivar by calcium treatment interaction, with one of the early bloom gypsums (Gypsoil) being the highest and calcium chloride at planting being the lowest for Georgia 06G and agrical gypsum at bloom being the highest and the untreated check being the lowest for Georgia Greener. For the all-important calcium in the nut measurements, there was a significant difference between cultivars again with Georgia greener averaging 436 ppm Ca in the nut vs. 402 ppm for Georgia 06G. Averaged over cultivars there was also a significant effect of calcium treatment (and no interaction). The gypsums at bloom and the split application of gypsum were all at the top in terms of getting calcium in the nuts. The calcium chloride at planting and the gypsum at late bloom were the least effective at getting calcium in the nuts at this dryland site and were lower than the untreated check. And once again, TigerCal was very close to the untreated check too. Also, overall, the calcium contents in the nuts were lower for this dryland site compared to the three irrigated sites.