Seeding Depth: Plant into consistent moisture up to a maximum depth of 3 inches assuming good seed quality. Under good moisture conditions, 1.5" depth is ideal and there is no need to plant shallower unless the seed have very poor vigor. Planting shallower than 1.5" will increase the risk of Valor injury and also increase risk of inoculant failure in marginal soil moisture.

Row Spacing: Conventional row spacing is 36 - 38", but twin-rows (7" on 36-38" centers) help to reduce tomato spotted wilt virus by covering the ground more quickly. **Twin rows** can increase yield even in the absence of TSWV, but a GPS guidance system is recommended to allow digging of twin-row virginia types. On each twin row plant 3 seed per row ft.

FERTILITY
J. W. Chapin and J. J. Camberato

pH: The traditional recommended pH range for liming peanut land is 5.8 - 6.2. However given the critical need for Ca in virginia type peanuts we recommend a bias toward 6.2. A 6.4 pH increases the probability of Mn or B deficiency, but decreases potential Zn toxicity problems. Mn or B needs can be met with foliar application where needed.

N and Inoculants: Peanut is a legume and as such can get most of its N needs from nitrogen-fixing bacteria (Bradyrhizobium) colonizing the plant's roots. To provide these needed bacteria you absolutely must inoculate all "new" peanut land, and should also inoculate strip-tillage fields and land that has been out of peanut production for 3 years. **Use a liquid in-furrow inoculant**. In-furrow granular inoculants are less effective than liquids and usually stop-up in the delivery tube. Seed treatment inoculants are not recommended due to having much lower bacterial counts. Seed treatment inoculants have been much less effective and consistent than in-furrow liquids. Inoculants are living organisms; treat them with care. Make sure the inoculant is not out-of-date.

Inoculant Rules:

- Use only liquid in-furrow inoculants. Granulars & seed treatments are less reliable.
- Do not expose to heat.
- If inoculant sits in the tank overnight, treat it as water and add a fresh batch.
- Use a minimum of 5 gal water per acre; 8 gal probably better.
- Make sure the inoculant stream hits exactly in the center of the open furrow, not the dry furrow walls. Tips knocked out of alignment cause yellow peanuts. Trash caught in strip tillage rigs can deflect the inoculant stream.
- Don't plant too shallow (less than 1.5"). Inoculant must hit moist soil or it will die.
- Do not use chlorinated water.
- Apply with a steady stream, not a pulsing pump.
- Twin rows require a full inoculant rate in each row (on new land).
- On new land, consider using a "fail-safe" backup plan – add a half rate of a different brand of liquid inoculant, or add a granular in-furrow inoculant.

Poorly inoculated fields usually will not show any yellowing until about 45 DAP. Inoculation can be checked by using a shovel to uproot plants. Simply pulling up plants will cause the lower taproot to break off and result in a low count. The presence of large (1/8" or larger) nodules on the taproot indicates successful inoculation. An average of 15 large nodules per taproot at 45 DAP is considered good; less than 10 per taproot is marginal and less than 5 indicates poor inoculation. If only small

(1/16") nodules are present and these are mostly on the lateral roots rather than on the taproot, the plant has probably only been colonized by native Rhizobium bacteria, not the applied inoculant.

Broadcast ammonium nitrate (375 lb/ac of 34% = 127 N units) or ammonium sulfate (600 lb/ac of 21% = 126 N units) can be used if the inoculant totally fails, but yield will probably not equal a properly inoculated crop. **On new land, inoculant failure can reduce profit by $200/ac even when 120 lb topdress N is applied!** If the canopy has not closed liquid N can be dripped in the row middle. Foliar nitrogen applications are not cost effective and often cause unacceptable leaf burn.

SEE THE FOLLOWING FERTILITY CHECK LIST FOR COMPLETE FERTILITY GUIDELINES

P and K: Phosphorus and potash should be applied to the previous crop by soil test to the high level. Peanuts respond best to residual fertilizer, and typically **no additional fertilizer is needed when the previous crop has been properly managed**. Excess potash in the pegging zone can potentially interfere with Ca uptake and can cause pod rot, so avoid potash application unless soil test levels are below guidelines in the following Fertility Checklist table.

Calcium: Calcium is critical for pod development and high quality peanuts. Adequate Ca uptake increases peanut yield and grade by reducing pod rot (Pythium), and preventing unfilled pods or **"**pops". Calcium also reduces the risk of aflatoxin. On seed peanuts, calcium is important to improve germination and seedling vigor. **Peanuts will not respond to foliar calcium application.**

Calcium can only enter the kernel by direct diffusion through the pod wall. It can not move downward into the pod through the peg phloem tissue. Also, no matter how high the soil Ca level, pods can not absorb Ca in a dry soil. Irrigation is a hedge against Ca deficiency because a moist soil keeps Ca available to the pods. If adequate calcium is not available in solution in the top 3 inches of soil when needed, we lose yield and grade. Virginia type peanuts require higher levels of soil calcium. The larger pod of a virginia type has a lower surface to volume ratio, so the calcium concentration surrounding the pod must be higher to compensate. Small runner type peanuts like Georgia Green usually do not respond to gypsum application when soil test calcium is over 600 lb/ac. In contrast, virginia types have often shown a significant yield response to gypsum even at soil calcium levels of 1,000 lb/ac. Large runner varieties such as Ga. 03L, Ga. 06G, TifGuard, and Fl-07 have an intermediate need for calcium compared to virginias and small runners.

The critical period for calcium absorption begins about 20 days after pegs first enter the soil and extends for at least 40 days after that. The first 10 days of this interval are particularly critical. Peanuts first peg at about 45 DAP, so before 60 DAP we want calcium already available in soil solution. **Better early than late with land plaster.**

Apply 300 – 400 lb/ac of Ca (1500 – 2000 lb land plaster) at first bloom to all virginia type varieties. Half this amount can be used if it is applied in a band over the pegging zone. Fall liming is beneficial in maintaining at least 600 lb Ca/ac and a 3:1 Ca to K ratio in the pegging zone. Ideally we would like to have an 800 lb Ca/ac soil test for virginia types if it can be obtained without driving pH over 6.4. On runner peanuts, use 200 lb/ac Ca (1000 lb land plaster) if soil Ca is less than 600 lb/ac, if Ca to K ratio is less than 3:1, on small seeded runners (Ga. green and Ga. Greener). **Apply 1,000 – 1,500 lb Ca per ac on all large seeded runners and small runners grown for seed.**

Boron: Boron is needed to prevent "hollow heart" - a condition where the internal surfaces of kernel halves are dark and sunken. Boron deficiency is more likely on deep sands with high pH. A soil test B level below 0.4 lb/ac (0.2 ppm) indicates a potential need for boron. Apply 0.3 - 0.5 lb B/ac (1.5-2.5 lb/ac Solubor or 2.0-3.0 lb boric acid) in the first herbicide (PPI,PRE, or POST) or fungicide application.

Liquid boron applications are more convenient but not any more efficient than dry formulations. Make sure liquid formulation use rates are adequate to meet the nutrient requirement. See table below for equivalent liquid rates.

Amount of Product Needed to Supply Equivalent Amounts of Elemental Boron.

Source	Amounts needed to supply 0.3-0.5 Boron per acre
Boric acid	**1.8 – 3.0 lb**
Solubor	**1.5 – 2.5 lb**
***Liquid 10% B**	**38 oz - 2 quarts**
***Liquid 5% B**	**2.4 quarts - 1 gal.**
***Liquid 1% B**	**3 – 5 gal.**

***Assumes weight of approximately 10 lb/gal.**
Excessive foliar boron is toxic to peanuts. Never exceed a seasonal total of 0.5 lb B/ac.

Manganese: Mn deficiency shows up as yellowing between leaf veins in the top of the plant. Mn deficiency is most prevalent on soils limed to 6.4 or higher. Prevent or correct with two foliar applications of 0.5 lb elemental manganese per acre (2 lb/ac manganese sulfate 25% or 1.5 lb/ac Tecmangam 32%, or 1.5 lb/ac ManGro DF 31%). Only foliar treatment is effective and new growth will remain deficient, so repeated applications of 0.5 lb elemental manganese are recommended.

Liquid manganese applications are more convenient but not any more efficient than dry formulations. Make sure liquid formulation use rates are adequate to meet the nutrient requirement. See table below for equivalent liquid rates.

Amount of Product Needed to Supply Equivalent Amounts of Elemental Manganese.

Source	Amounts needed to supply 0.5 lb Manganese per acre
Manganese sulfate 25%	**2 lb**
Tecmangam 32%	**1.5 lb**
ManGro DF 31%	**1.6 lb**
Liquid 10%	**2 quarts**
Liquid 5%	**1 gal.**
Liquid 1%	**5 gal.**

***Assumes weight of approximately 10 lb/gal.**

Magnesium: Peanuts have a low soil test requirement for Mg, but keep an eye on soil test Mg levels following peanut production. Use of layer-house poultry litter or excessive Ca application to peanuts from land plaster can cause Mg to leach out of the rooting zone and lead to potential deficiencies on rotational crops (corn and cotton) which have much higher soil test Mg requirements. If Mg becomes deficient on soils with pH levels which are too high to lime, you get "boxed-in" because the only affordable way to supply Mg is in dolomitic lime. Peanuts only require a 20 lb/ac Mg soil test. But rotational crops require 60 lb/ac Mg with at least 10 % of cation exchange capacity being from Mg. At Mg levels of 120 lb/ac there is no 10 % CEC requirement. If the subsoil is within 15" of the surface, Mg leaching should not be a problem.

Zinc Toxicity: Peanuts are very sensitive to zinc. Beware of recommendations for Zn application in peanut rotations. Stunted, dieing plants with split stems are a sign of zinc toxicity. Check zinc levels on any new land prior to planting, especially old peach orchards, pecan orchards, fields heavily treated with poultry litter or hog lagoon waste, or fields where zinc was repeatedly applied for high yield corn production. Zinc toxicity also occurs on old building sites or around stock pens which had galvanized roofs. Soil test zinc levels of 10 lb/ac can cause toxicity when the soil pH is below 6.0. Liming to increase soil pH can reduce zinc toxicity in contaminated soils. Also make sure the lime source is not contaminated with zinc in fields which already have marginal Zn levels. Fields with Zn levels of 6 - 10 lb/ac should be limed to at least 6.2 pH; fields with Zn levels of 11 to 20 lb/ac should be limed to at least 6.4; and fields with 20 - 30 lb Zn/ac should be limed to 6.5. Given the risk of loss on a high value crop, the difficulty of achieving uniform pH, and the non-uniform distribution of Zn in soils, the maximum Zn level in peanut fields should probably not exceed 30 lb/ac.

Tissue Testing can be useful for diagnosis of potential nutrient deficiencies. To get a representative sample, pick 20 recently mature tetrafoliate leaves from a suspected deficient area and compare to a similar sample from plants without the deficiency symptoms. Leaves should be pulled when dry and placed in a paper bag.

When diagnosing deficiency based on tissue testing always consider soil test evidence and field observations. For example, root stunting from very low pH or herbicide injury causes micronutrient deficiencies in leaves even when the nutrients are sufficient in the soil.

Peanut Tissue Test Sufficiency Levels:

N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (%)
3.50 - 4.50	0.20 - 0.50	1.70 - 3.00	0.50 - 2.00	0.30 - 0.80	0.20 - 0.35
Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)	B (ppm)	
50 - 250	20 - 350	20 - 60	5 - 20	20 - 60	

Nutrient Removal values are occasionally requested for share crop considerations, but N removal can be misleading since the N removed was fixed by peanut and there remains a net increase in soil N for the following crop after nut harvest.

Peanut Nutrient Removal Values (lb/ac):

	Weight removed	N	P_2O5	K_2O	Ca	Mg	S	Cl	B	Cu	Fe	Mn	Zn
nuts	4,000 lb	140	22	35	6	5	10	1	-	.04	.30	.30	.25
vines	3,000 lb	51	11	61	50	12	7	1	.02	.02	.20	.12	-

Nutrient Replacement Cost of Hay Removal: Peanut hay contains approximately 1.7% N, 0.35% P_2O_5, and 2.1% K_2O **(source: Dr. Glen Harris, UGA Extension Fertility Specialist).** Therefore every 1,000 lb of hay removed from a peanut field contains 17 lb N, 3.5 lb P_2O_5, and 21 lb K_2O. Fertilizer prices are very volatile and must be adjusted to the current market, but assuming prices of \$0.42, \$0.52, and \$0.37 per pound for N, P_2O_5, and K_2O respectively, each 1,000 lb of hay would have a nutrient value of \$7.14 + \$1.82 + \$7.77 or **a nutrient replacement cost of about \$16.75 per 1,000 lb bale.**

Poultry Litter: Poultry litter can be used on rotational crops but should not be used the year peanuts are planted. Peanuts do best when using residual fertility from litter previously applied to rotational crops.

Litter nutrient content can vary widely so have analysis from your source. Average litter analysis is about 3 : 3 : 2, so 1 ton of litter contains about 60 lb N : 60 lb P_2SO_4 : 40 lb K_2O. Using availability coefficients of 0.6 – 0.8 – 0.8, the **nutrient value of 1 ton of litter on average is about 36 lb N : 48 lb P_2SO_4 : 32 lb K_2O** (source: Dr. Glen Harris, UGA Extension Fertility Specialist).

Where poultry litter is used in peanut rotations, keep an eye on soil test Zn levels and the Ca to Mg ratio. Litter from layer houses can increase soil Ca levels to the point of causing Mg leaching and Mg deficiency on rotational crops. Mg should be maintained at a minimum of 10 % of CEC (cation exchange capacity) up to 100 lb soil test levels; above 100 lb Mg soil test, Mg levels are sufficient to disregard %CEC. The only affordable way to replenish soil test Mg after leaching is with dolomitic lime, however this option is not available without causing other deficiencies once soils are limed above about 6.4. In other words, very high soil Ca levels from litter are fine for peanuts, but can leave you with no remedy for Mg deficiency on corn or cotton.

PEANUT FERTILITY CHECK LIST

<table>
<tr><th>pH or Nutrient</th><th>Soil Test Sufficiency Level (Mehlich I)</th><th>Recommendations / Comments</th></tr>
<tr><td>pH</td><td>5.8 to 6.5</td><td>Liming to a pH value of 6.4 is useful in maximizing soil Ca levels and reducing Zn toxicity risk where necessary, but Mn deficiency is more likely at high pH levels (see below).</td></tr>
<tr><td>Nitrogen (N)</td><td>---</td><td>Use a liquid in-furrow inoculant on all fields that have been out of peanut production for 3 years.</td></tr>
<tr><td>Sulfur (S)</td><td>---</td><td>Sulfur has not been a limiting factor on peanut on coastal plain soils. Subsoil S and gypsum ($CaSO_4$) applications can provide more than adequate S nutrition.</td></tr>
<tr><td>Phosphorus (P)</td><td>20 lb/ac</td><td>The soil test sufficiency level for both P and K on peanut is much lower than other crops because the peanut plant is very efficient at scavenging these nutrients from the soil. Add 40 lb P_2O_5/ac when soil test levels are medium (11-19 lb P/ac) and 80 lb P_2O_5/ac when soil test levels are low (<11 lb/ac). Peanut phosphorus requirements can always be met by maintaining adequate P levels on rotational crops.</td></tr>
<tr><td>Potassium (K)</td><td>40 lb/ac</td><td>Maintaining adequate fertility on rotational crops eliminates the need for K application to peanut. The soil test sufficiency level for both P and K on peanut is much lower than other crops because the peanut plant is very efficient at scavenging these nutrients from the soil. Excessive K levels can interfere with Ca uptake by pods (see Ca comments).
<table>
<tr><th>Soil Test K (lb/ac)</th><th>K_2O (lb/ac) Recommended</th></tr>
<tr><td>≤ 25</td><td>100</td></tr>
<tr><td>26 - 35</td><td>80</td></tr>
<tr><td>36 - 45</td><td>40</td></tr>
<tr><td>45</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Calcium (Ca)</td><td>600 lb/ac and 3 : 1 Ca to K ratio

(Always use gypsum on virginia types)</td><td>Runner type peanut yields seldom respond to gypsum application when soil test Ca is 600 lb/ac. However, virginia type peanuts have responded to gypsum even when Ca =1,000 lb/ac. Apply 1,500 lb gypsum (300 lb Ca) at bloom to all virginia type peanuts, all seed production peanuts, and to runners with < 400 lb/ac soil test or a Ca to K ratio < 3:1. Apply 1,000 lb/ac gypsum to runners with 400-600 lb/ac soil test. Maintain soil pH with dolomitic lime so both Ca and Mg will remain adequate.</td></tr>
<tr><td>Magnesium (Mg)</td><td>60 lb/ac and Mg at least 10 % of total CEC for rotational crops</td><td>Soil test Mg levels above 20 lb/ac are considered adequate for peanut. However, rotational crops will require Mg soil test levels > 60 lb/ac and Mg at least 10% of CEC. Use dolomitic limestone (contains about 200 lb Mg per ton) to maintain soil Mg levels.</td></tr>
<tr><td>Boron (B)</td><td>0.5 lb/ac</td><td>If soil test B is below 0.5 lb, apply foliar 0.3-0.5 lb B/ac (1.5-2.5 lb Solubor) as a foliar spray in the first fungicide application. Avoid toxicity from excessive B application.</td></tr>
<tr><td>Manganese (Mn)</td><td>
<table>
<tr><th>pH</th><th>Mn lb/ac</th></tr>
<tr><td>5.8</td><td>6</td></tr>
<tr><td>5.9</td><td>7</td></tr>
<tr><td>6.0</td><td>8</td></tr>
<tr><td>6.1</td><td>9</td></tr>
<tr><td>6.2</td><td>10</td></tr>
<tr><td>6.3</td><td>10.5</td></tr>
<tr><td>6.4</td><td>11</td></tr>
<tr><td>6.5</td><td>12</td></tr>
</table>
</td><td>If soil test Mn is below the sufficiency value at the current pH or the target pH when lime is to be applied, apply 0.5 lb Mn (2 lb manganese sulfate 25%, 1.5 lb Tecmangam, or 1.5 lb ManGro DF 31%) with both the 60 and 75 DAP fungicide applications. For pH values above those shown, the Mn sufficiency soil test value is 1 lb higher for each additional 0.1 of a pH unit.</td></tr>
<tr><td>Zinc (Zn)</td><td>Toxicity:
See comments

Deficiency:
1.6 lb/ac</td><td>Soil test Zn levels of 10 lb/ac can cause toxicity when the soil pH is below 6.0. To prevent Zn toxicity, lime to the pH targets listed. Given the risk of loss, the difficulty of achieving uniform pH, and the non-uniform distribution of Zn in soils; fields with Zn levels over 30 lb/ac should probably not be planted in peanuts.
<table>
<tr><th>Zn lb/ac</th><th>Lime to pH:</th></tr>
<tr><td>6 - 10</td><td>6.2</td></tr>
<tr><td>11 - 20</td><td>6.4</td></tr>
<tr><td>21 - 30</td><td>6.5</td></tr>
<tr><td>> 30</td><td>no peanuts</td></tr>
</table>
Zn deficiency is more likely at high pH, high soil Ca, and high soil P levels. A Zn soil test level of 1.6 lb should be adequate even under these conditions.</td></tr>
<tr><td colspan="2">Copper (Cu), Chlorine (Cl), Iron (Fe), Molybdenum (Mo)</td><td>There is no evidence for deficiency of these micronutrients in coastal plain peanut production.</td></tr>
</table>

Jay W. Chapin and James J. Camberato