Inoculants and Rhizobial Research in Peanut

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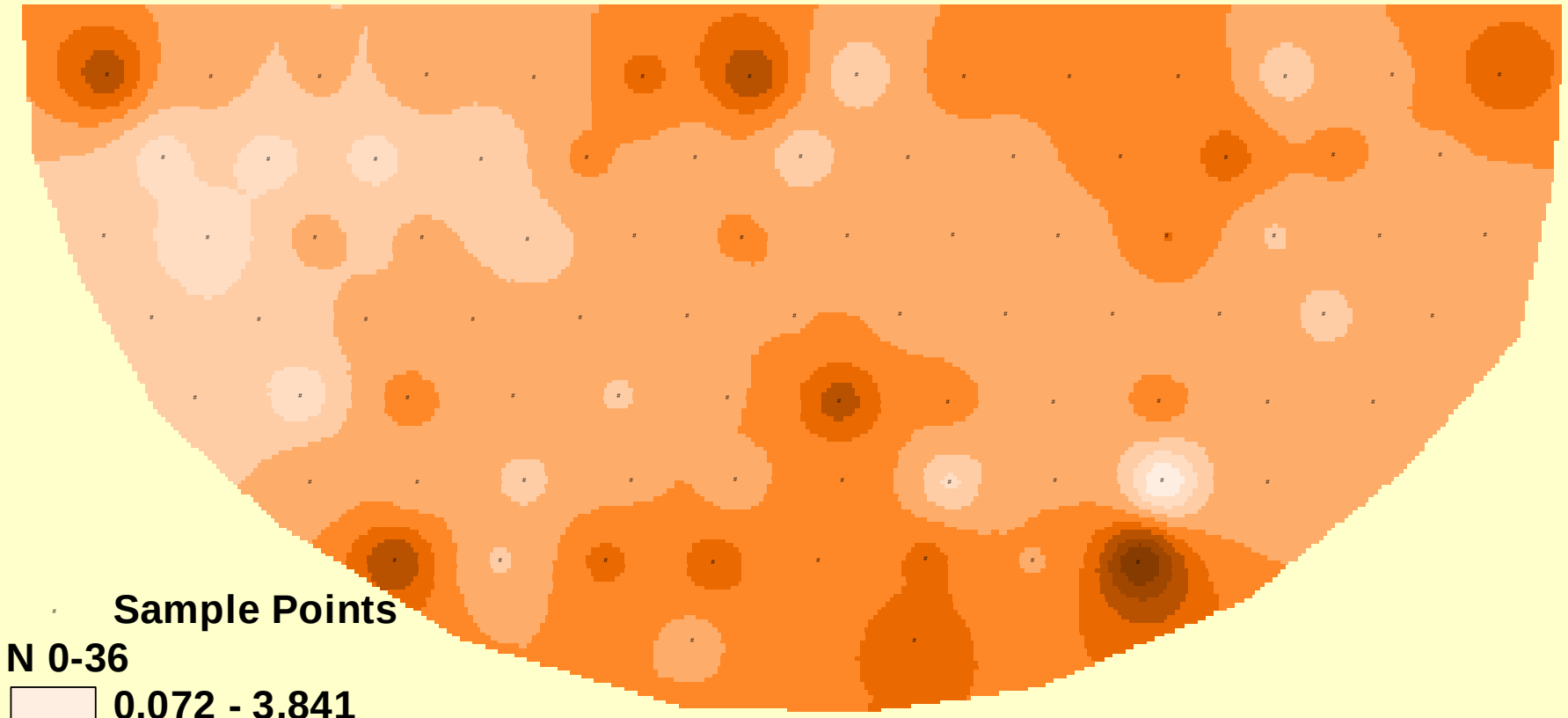
Know Your Nitrogen Costs

- Nitrogen costs for in 2024 for your area; these are examples from Texas in 2024)
  - 32-0-0, $540/ton or $0.85 per unit of N
  - Other N sources, especially urea, 46-0-0?

  - For legume crops like peanuts the first $10-12/acre of "nitrogen fertility dollars" you spend should be crop-specific Rhizobial inoculant

General nutrition

- Peanuts respond better to residual fertility than direct fertilization
  - fertilization of immediate preceding crop is important
  - develop a uniform high level of fertility through the root zone
  - many nutrients best applied before land preparation



Know your current soil N

PPM Soil Nitrate, 0-36”

Gaines Co., TX

Much of field, >150 lbs. **N**/A

N & P Fert., AG-CARES

No N response due to high residual soil N

N Rate lbs./A	P2O5 rate lbs./A	Yield lbs./A
0	0	5,394 a
0	25	5,901 a
0	100	5,666 a
100	0	4,971 a
100	25	5,470 a
100	100	5,273 a

Numbers in column followed by same letter are not significantly different at 0.05.

Nutrient requirement for peanut (lbs. per 1000 lbs./yield)

- N: 70 lbs./A
- P: 8 (e.g. 18 lbs. P_2O_5/A)
- K: 24 (e.g. 29 lbs. K_2O/A)
- Ca: 21
- Mg: 9
- S: 5 to 6

“Cost” of Peanut Hay

- Estimate N content of peanut have at ~1.25%, or 25 lbs. of N per ton of hay that leaves the field
- At $0.70/lb. of actual N, then that’s $17.50 per hay ton of N leaving the field
  - Rule of thumb—figure all other nutrients at ~50% of the value of the N, hence $26/ton
- Factor this cost in on peanut hay—the income isn’t completely “free”

Bradyrhizobium Inoculant Type and Mid-Season N Fertilizer Effects on Peanut Yield, Gaines Co., Texas

Rhizobium & Other Crops—West Texas

- Soybean & Black-eyed Pea
  - Standard recommendation is to inoculant if field hasn't had soybeans/BEP in five years
  - Peanut inoculants are same *Rhizobium* strain for BEP
- Guar
  - A soil builder? Not if it isn't nodulated!
  - No successful nodulation to date with commercial products
- Alfalfa
  - Reduced nodulation from north (Dalhart) to south (Pecos)

N Suggestions and *Bradyrhizobium* Status

- Disagreement between growers and research/Extension about the need for N fertilizer
- Little to no attention paid to *Bradyrhizobium* nodulation status of peanut
- Deep soil N largely unknown or ignored
  - In some cases soil available N @ 3’ depth > 120 lbs./A

Nodulation of Field Peanut

- Not a guarantee; prior peanut fields have minimal carryover nodulation

- 1999-2001 field observations suggest 25% of South Plains fields were undernodulated (none to maybe 10-20 nodules/plant)


What happened here?
Hockley Co., Texas field of Virginia peanut.

Yellow rows: 9 *Bradyrhizobium* nodules per plant.
Adjacent green rows: 73 nodules per plant.

The inoculant application plugged up in this repeated pattern across the field.

Peanut Yield Response to Fertilizer N?

- On-farm results in West Texas with significant response to fertilizer N (alpha = 0.10)
  - 2000-2001: Positive, four of four sites
  - 2002-2003: No response, six of seven sites (rarely even a trend)

Objectives—Inoculant Tests

- Evaluate yield effect of:

- Different granular and liquid in-furrow inoculants
- At-plant & in-season N fertilizer
- Inoculant and fertilizer N combinations

Bradyrhizobium X Nitrogen Trial, Western Peanut Growers Assn. Research Farm,
Gaines Co., Texas

Guarding against shallow planting--desiccation of the inoculant.

Ensuring that *Bradyrhizobium* contacts the seed.

Results: Inoculant Type & Multiple Inoculants @ 1X *Rhiz.*

Inoculant Type*	Inoc. Rate	Nodules/ plant	Yield (lbs/A)	Net Yld. (lbs/A)
Control (4)	0X	6	2,715 c	---
Seedbox (8)	1-6X	5	2,679 c	-34
Granular (10)	1X	22	3,661 b	+948
Liquid (14)	1X	40	4,367 a	+1,652

Four years of results from WPG Farm, Gaines Co., 2001-2004.

Results: 1X vs. 2X Inoculant Rate

Inoculant Type*	Inoc. Rate	Nodules/ plant	Yield (lbs/A)	Net Yld. (lbs/A)
Granular	1X	21	3,679b	---
Granular	2X	28	3,983a	+304
Liquid	1X	42	4,519a	---
Liquid	2X	39	4,322a	-197

Significant differences at *P* = 0.10.

Rhizobium Product Testing

- Yields among product types: Liquid > Granular >> Seedbox = Controls
- Double rate inoculant appears favorable for granular inoculant
- Mid-season N tends to further increase yield though nodulation decreases

Rhizobium Inoculant Type and Seeding Depth

Western Peanut Growers Farm, 2004

Planted April 28 into moist soil, irrigated 2X in 6 days

	----------	-- Nodules per plant ----------		
	June 15.	June 15.	Aug. 10.	Aug. 10.
Seed-ing Depth	Liquid (1X rate)	Granular (1X rate)	Liquid (1X rate)	Granular (1X rate)
1"	5.1	10.3	16.9	34.0
2"	17.4	11.0	59.3	40.1
3"	16.6	13.4	60.8	45.0

Suggestions to Producers

- Within inoculant type: Application & planting practices probably more important than product choice

Bradyrhizobium Comments for Growers

- Take care of your inoculant!
- Deeper planting (now ~2” vs. 1.0-1.5”)
- Evaluate nodulation 5-6 weeks after planting--“Checking peanut nodulation should be part of a comprehensive crop scouting program”
- “Questions and Answers” information
- Consider adjusting mid-season N based on nodule load

Conclusions—Early Assess

- Development of early-season "Nodulation Index" to guide mid-season N application decisions,
  - For example, at six weeks after planting
    - 0-5 nodules per plant, NONE to POOR
    - 6-10, FAIR
    - 11-15, GOOD
    - 16-20, VERY GOOD
    - 21+, EXCELLENT

reddish color. This means the nodules are actively fixing N.

Liquid Inoculant Equipment

- How much cost per row to equip your planter to put out liquid, in-furrow inoculant?
- You can justify the cost!

Soil testing

- Why?
  - evaluate fertility needs
  - identify and manage potential problems
  - control costs
- Producers may never see soil test results or make decisions based on soil testing (fertilizer dealer, consultant)
  - If someone is taking soil tests for you as a courtesy, but sure to get a copy of the results.

Soil test results--State vs. Private

- Public recommendations tend to be lower than private labs.
- This is based on different philosophies
- Each has its merits.

Soil test results--State vs. Private

- Fertilize the crop vs. fertilize the soil?
- "Crop maintenance"—provide what the crop needs this season for yield
- "Build and Maintain"—for nutrients other than Nitrogen; keep a higher level of residual fertility.

Soil Sampling, Yield Goal, and Your Recommendations

- Does someone collect your soil samples, and provide your recommendations?
- If so, and you receive fertilizer recs. without having given a yield goal, you need to ask how the recs. were derived
- Do you know the soil test philosophy behind your recommendations?
- Did you receive a copy of the soil tests?

- An error to watch for: the planter is not closing the furrow well enough. This leads to drying out and desiccation of the applied *Bradyrhizobium* bacteria.

Looks good?

Nodules on peanut lateral roots are not necessarily from applied inoculant. Might be native in the soil, but check to see if they are pink or red inside (active).