Results of field studies on lowering pH of alkaline and calcareous soils with sulfur

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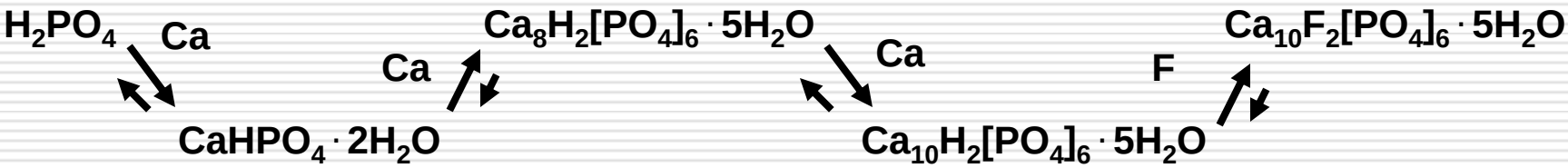
Soil Test P

- Soil test results are extractable nutrients
  - ✓ An index of available nutrients
  - ✓ Not a measure of plant-available nutrients
  - ✓ Not be used to calculate available nutrients
- Extractants used in soil test
  - ✓ Water extracts only nutrient in solution (not available)
  - ✓ Mehlich 1 and 3 best results on soils below pH 7.2
  - ✓ Mehlich 3 can be used on higher pH soils
  - ✓ Bray 1 can only be used for soil with pH below 7.4 (not suitable for calcareous soils)
  - ✓ Olsen should only be used for calcareous soils

Soil Phosphorus



- Reduced Availability (pH = 7.0 to 8.3)
- "Fixed" by soil calcium
- Available to plant for short period of time
- Accumulates over time in-soluble forms

- Soil test measures "extractable" P and not "total" P
- "Extractable" P may contain P not available to the plant

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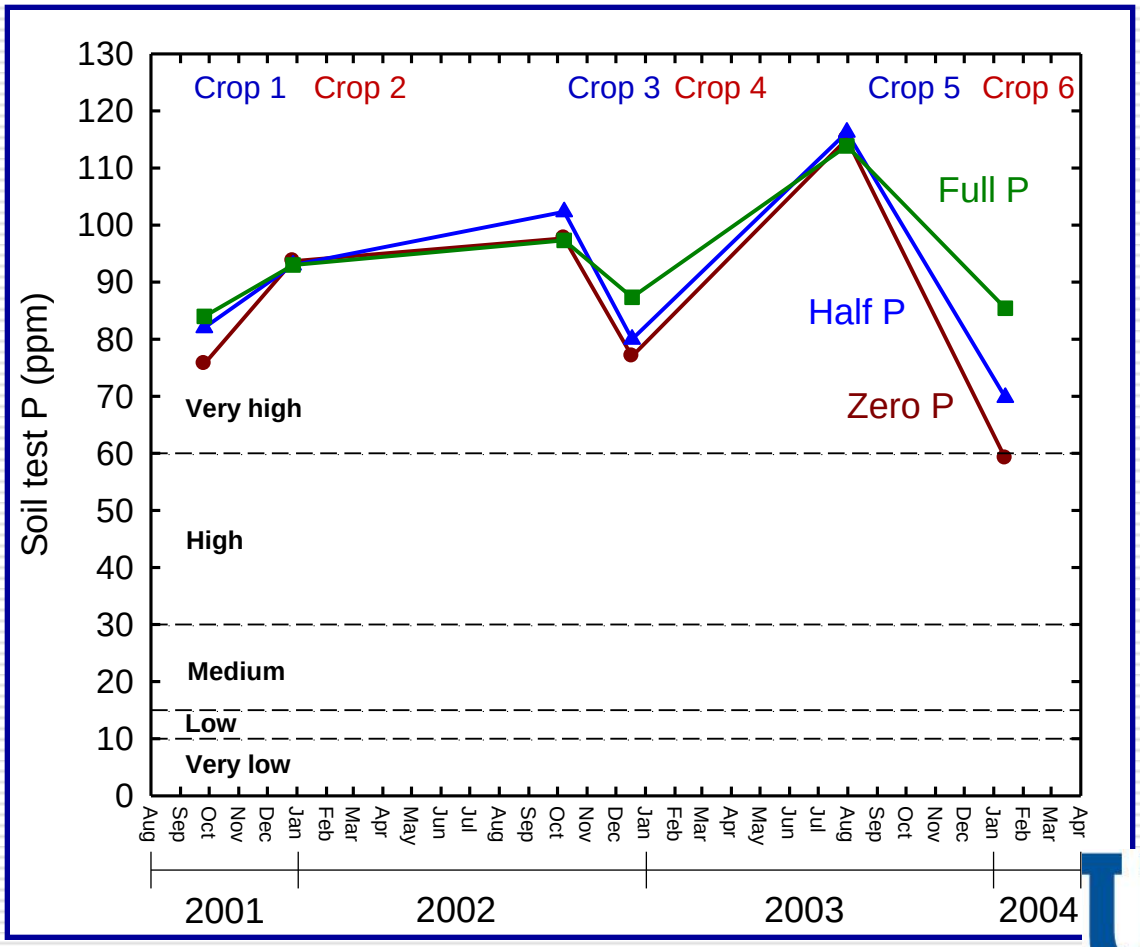
Change in Soil Test P Over Time



- Soil test P can remain high for years even when no P is added
- Indicting that more "available" P exists in the soil to be "extracted"

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Current Soil P Index Study

- Conducted on four farms and five cooperators
- Duration = Five years
- Crops = tomato, peppers, and green beans

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Soil Tests Results

	Soil P (ppm)	Soil Ca (ppm)	Soil pH
Tomatoes			
Farm 1	**101**	**1265**	**6.8**
Farm 3	64	1117	7.3
Farm 4	32	1299	7.0
Green Beans			
Farm 2	40	1778	7.6
Farm 3 (fall)	**95**	**783**	**6.8**
Farm 3 (spring)	41	1500	7.2

- Most plots have lower P than previous study
- All soil P values in the high to very high P index
- Soil Ca very high (>400) in all plots
- Higher P values associated with lower pH (BOLD) suggesting greater P availability

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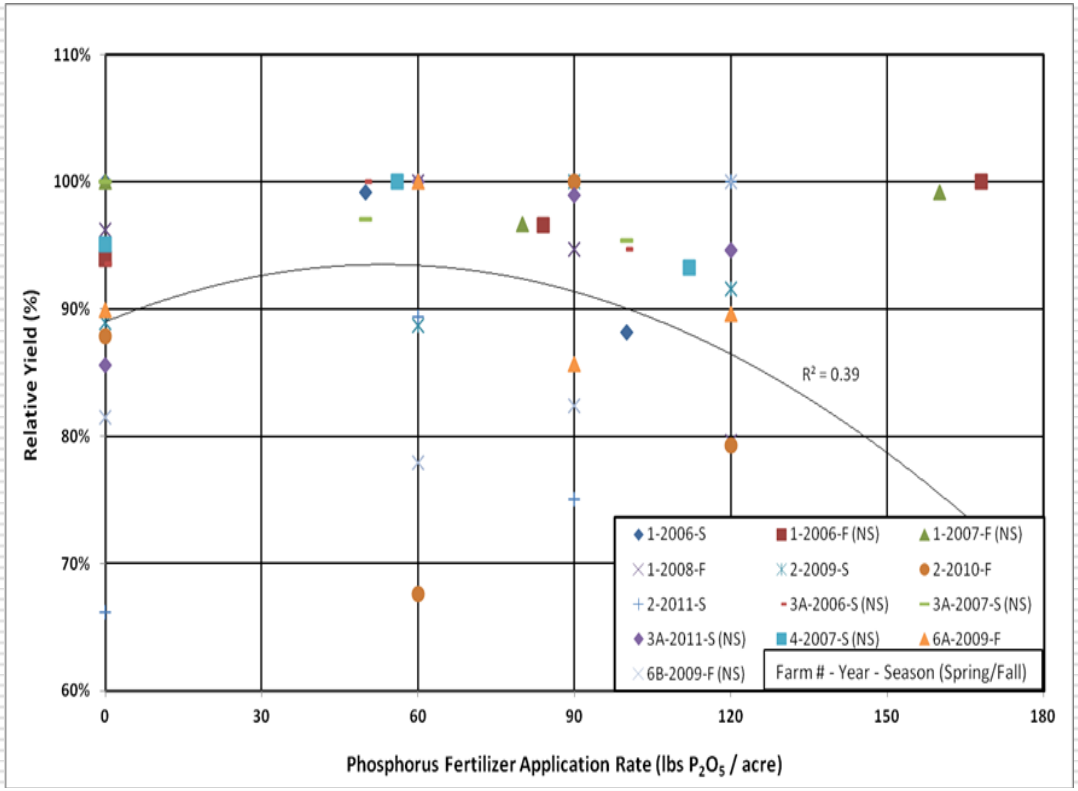
Tomatoes – Yield



- No significant difference in fruit yields by size
- Trend for higher yields of medium (6x7) and large (6x6) fruit at first harvest with lower fertilizer P
- Trends were higher yield of large (6x6) fruit with increased fertilizer P
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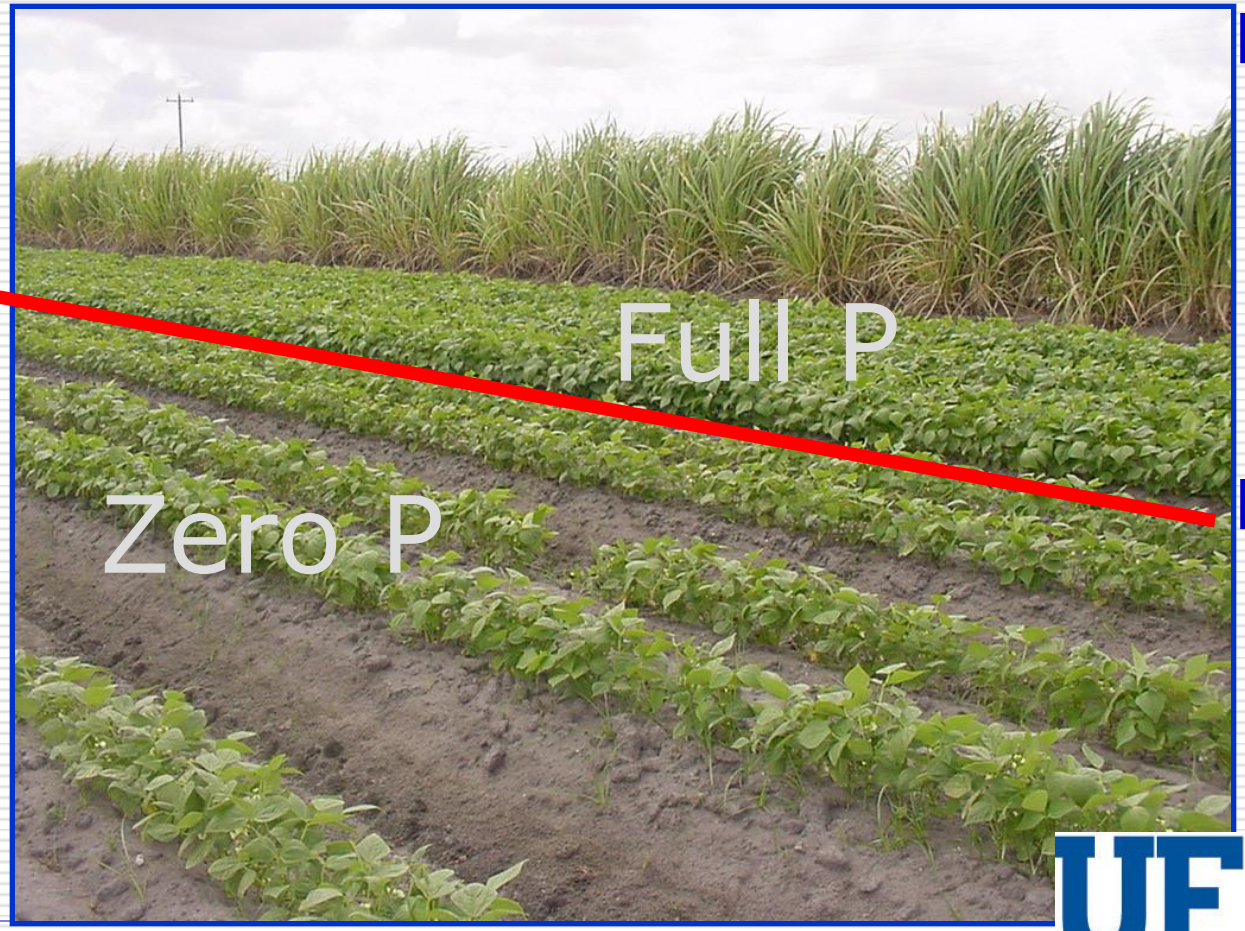
Effect of P Application on Green Bean Growth



- Dramatic reduction in plant growth with reduced P
- No difference in leaf P concen-trations

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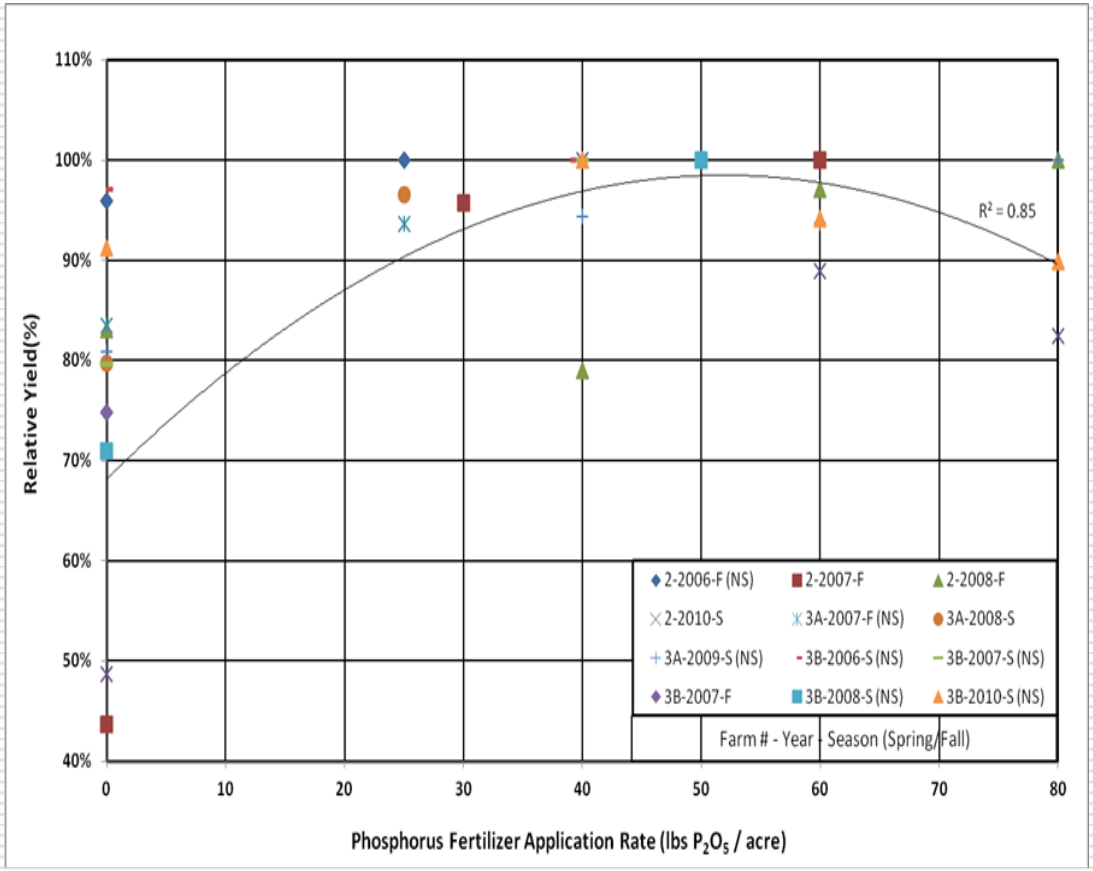
Green Bean – Yield



- 3 of 4 crops had significantly greater biomass at 30 days with increased fertilizer P
- 4 of 4 crops had significantly greater biomass at 60 days with increased fertilizer P
- 4 of 4 crops had significantly greater yield of 4 to 6 inch long beans and total yield with increased fertilizer P

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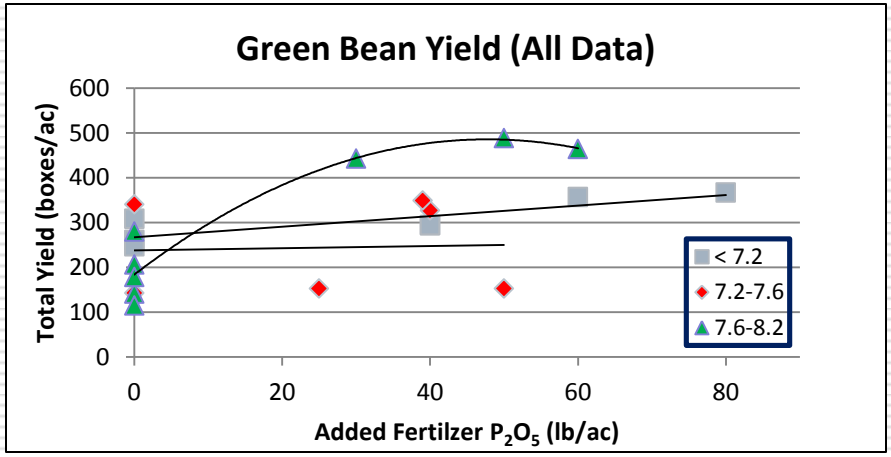
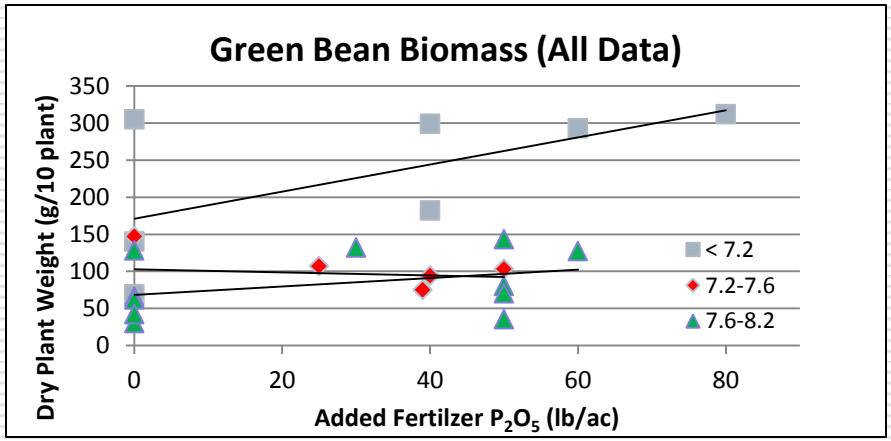
Green Bean Response to Soil pH





- Increase in green bean yields and biomass with added P as soil pH increased
- Greatest affect at pH >7.6

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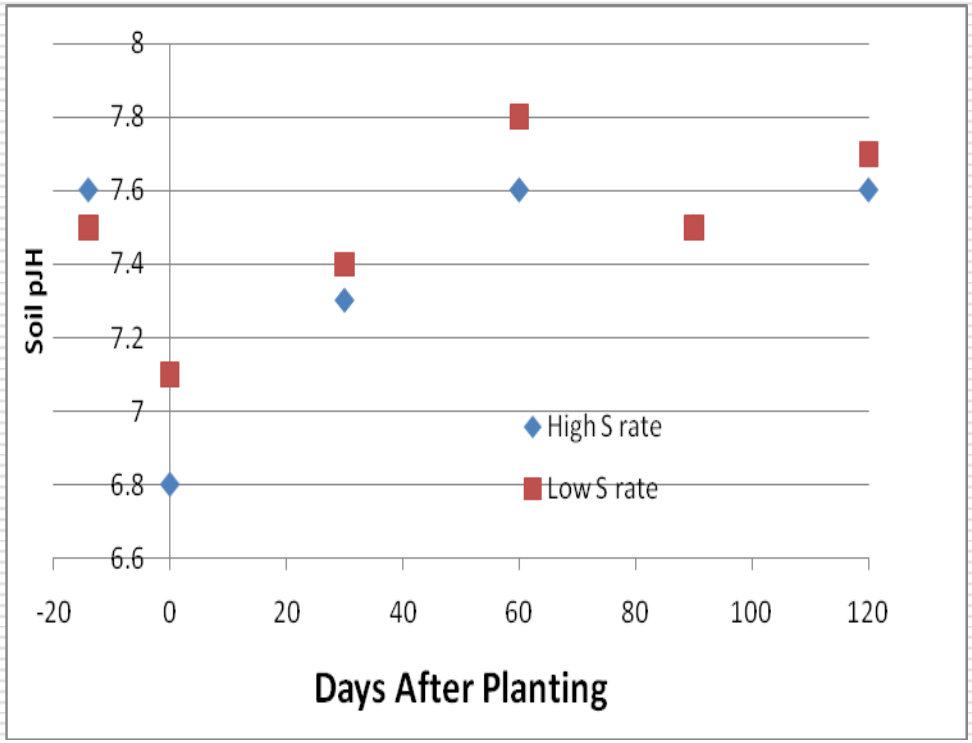
Soil pH Reduction With Sulfur



- At sulfur application of 500 and 1000 pounds per acre, pH returns to beginning levels within 60 days.
- plant growth and leaf P concentration increased with reduction of soil pH at 30 days but not at 60 days after planting
- No significant affect of residual soil P on green bean yield

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Tomato Response to Soil pH

Fertilizer P (lb ac^{-1})	Biomass dry weight (oz/plant)			Fruit Fresh weight (lb/plant)			Leaf P (%)		
	Elemental S Applied (lb ac^{-1})								
	0	233	467	0	233	467	0	233	467
30 Days after planting									
0	0.47	0.41	0.38	-[z]	-	-	0.340	0.348	0.333
24	0.43	0.44	0.48	-	-	-	0.339	0.293	0.348
37	0.49	0.55	0.52	-	-	-	0.347	0.349	0.342
49	0.51	0.53	0.51	-	-	-	0.351	0.359	0.345
Significance (p)	0.321	0.056	0.012	-	-	-	0.491	0.564	0.605
60 Days after planting									
0	7.63	8.03	7.24	2.67	4.49	5.67	0.350	0.346	0.345
24	8.21	8.15	7.36	2.73	4.13	6.48	0.355	0.357	0.338
37	7.20	8.13	7.97	2.93	8.91	7.49	0.297	0.399	0.345
49	6.78	8.31	8.13	2.45	7.90	7.29	0.353	0.355	0.350
Significance (p)	0.309	0.563	0.509	0.522	0.753	0.178	0.436	0.543	0.268
120 Days after planting									
0	11.06	10.15	11.62	17.6	18.4	21.0	0.309	0.435	0.300
24	10.97	11.55	12.85	17.4	20.8	23.5	0.300	0.360	0.293
37	11.33	11.70	12.97	19.3	22.5	25.9	0.383	0.231	0.334
49	12.47	11.41	13.36	24.7	16.4	27.7	0.294	0.332	0.300
Significance (p)	0.333	0.653	0.534	0.563	0.834	0.754	0.561	0.758	0.790

Summary

- Importance of P as a primary nutrient is related to P-soil interaction.
- P soil tests suggest that P can accumulate and remain available for years.
- Under S. Florida soil conditions (high Ca and high pH) P availability varies by crop.
- Effect of soil pH moderation on crop growth is limited to the time that pH remains lowered resulting in no significant affect on final yield
- Soil tests should be counted on to guide P fertilization. New Index for high Ca and high pH soils need to be evaluated for S. Florida

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