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On-Farm Evaluation of Variable-Rate Seeding of Cotton in Georgia

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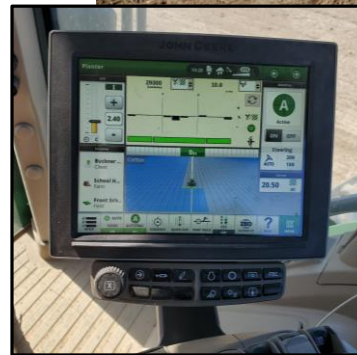
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Introduction

- Seed costs can account for 15-20% of total input costs (increased costs due to technology fees)
- For cotton growers to remain profitable, maximizing crop input-use efficiency and technology potential is important
- Planting technology is advancing rapidly – seed monitor, downforce, electric seed meter, etc.
- Newer technology provide variable-rate capabilities but its potential in cotton needs to be investigated

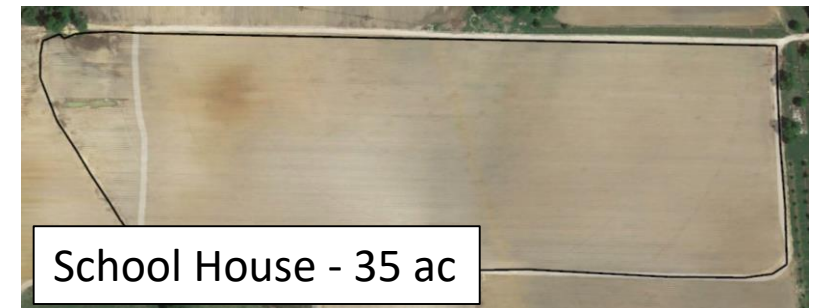
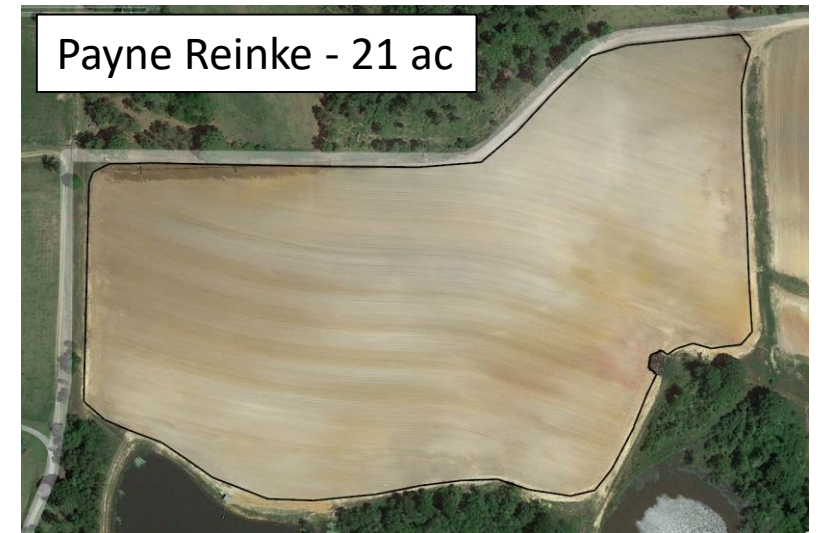


Can seeding rate be adjusted by management zone within the field to improve productivity and profitability?



On-Farm Seeding Rate Trials

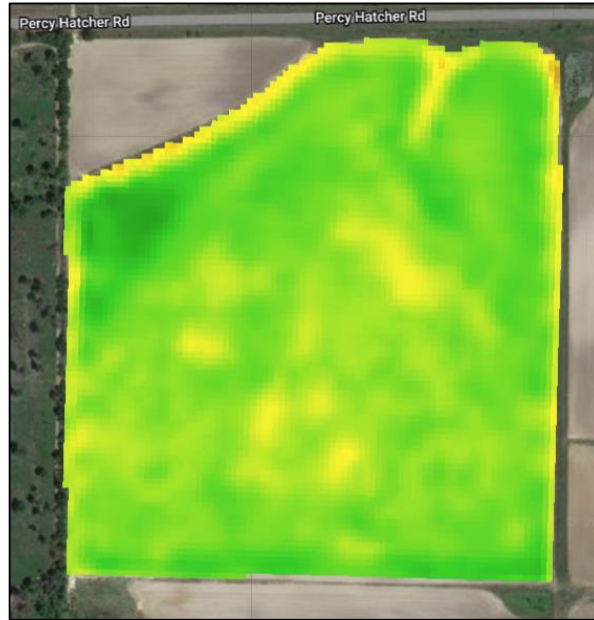
- 2021 & 2022 (Southwest Georgia)



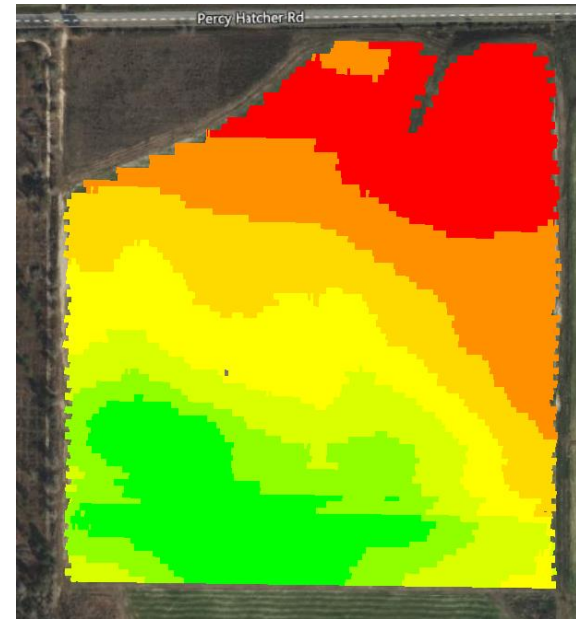
Management Zones



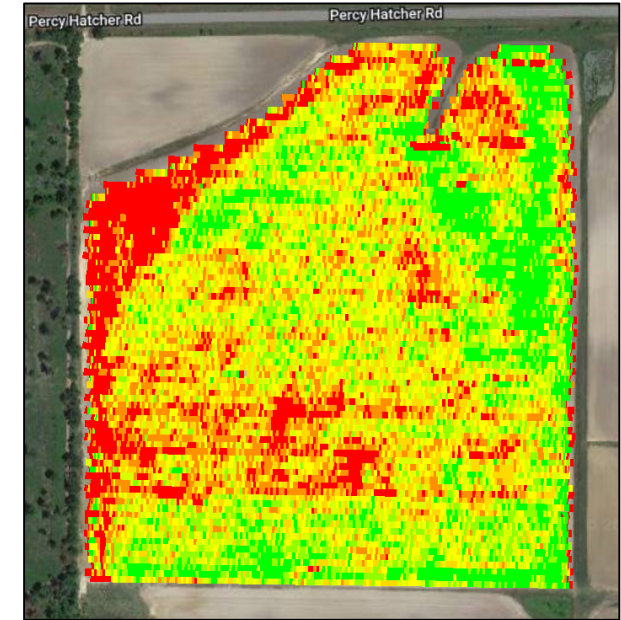
Soil Type or Texture



In-season crop imagery



Elevation

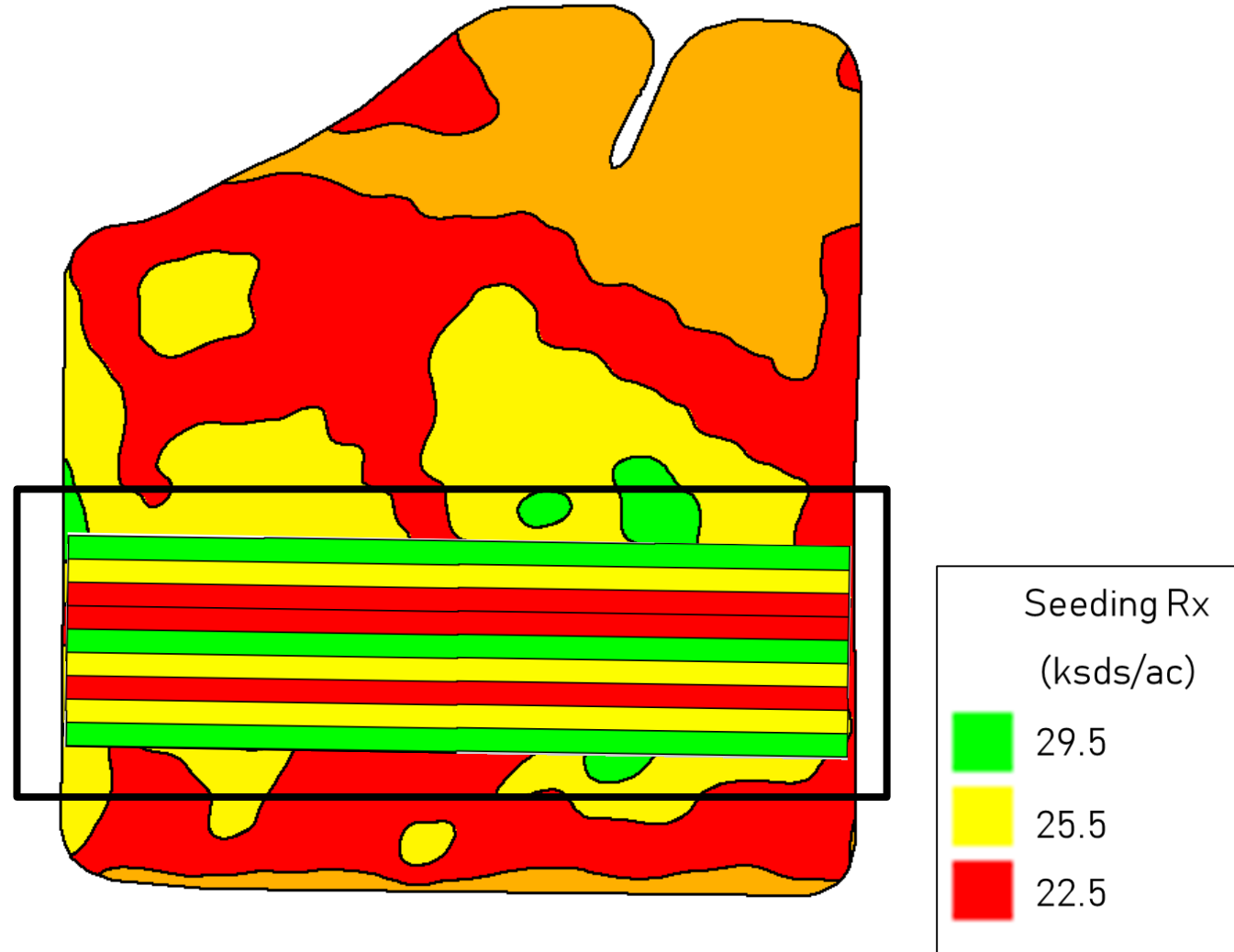


Yield Map

- Management zones were created within each field using different soil and/or crop spatial attributes

Seeding Rate Strips

- Two to three zones in each field
- Three Seeding Rates
 - 22.5 (ksds/ac)
 - 25.5 (ksds/ac)
 - 29.5 (ksds/ac) (*Grower Nominal*)
- Three replications and seeding rates randomized within each replication
- Each pass represented a seeding rate (800 - 1350 ft length)



□ Data Collection

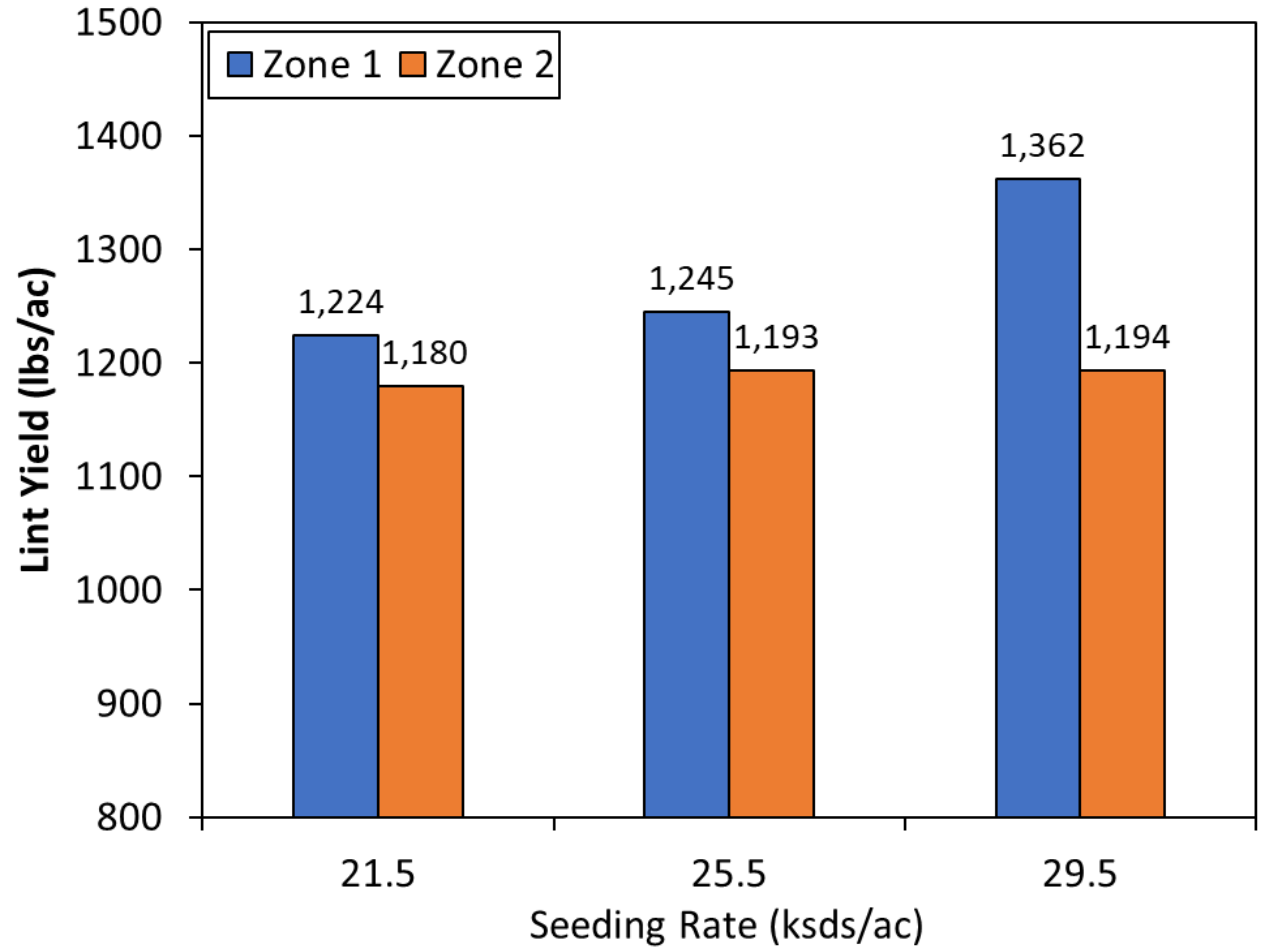
- Emergence (stand counts)
 - *Multiple random locations within each strip (10 ft. of row)*
- Yield
 - *Harvest and weighed each pass separately*
 - *Yield map*



Crop Emergence and Yield

Field – Miles Middle

Zone	Target Rate (ksds/ac)	Population (plants/ac)	Emergence* (%)
1	21.5	16,590 a	77%
1	25.5	19,494 b	76%
1	29.5	22,506 c	76%
<hr style="border-top: 1px dashed black;"/>			
2	21.5	17,935 a	83%
2	25.5	21,780 b	85%
2	29.5	24,119 c	82%



Cotton Seeding Rate Vs Yield Economics

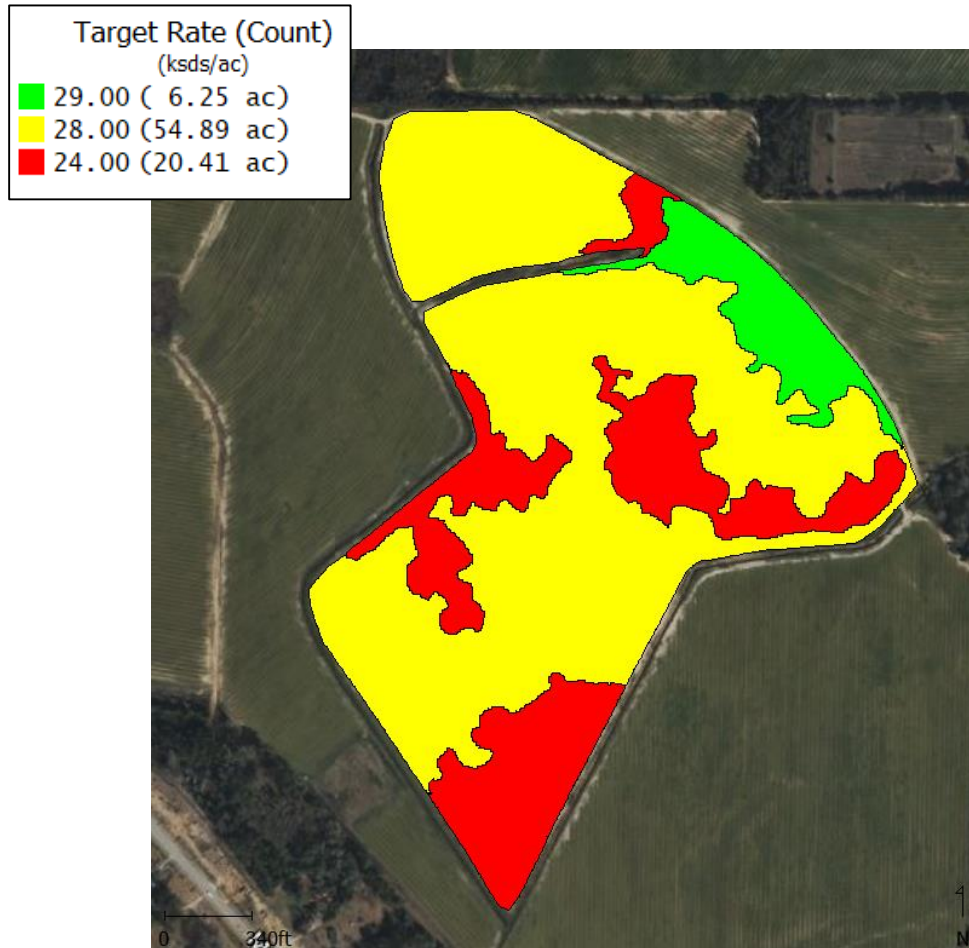
Field – Miles Middle

Zone	Seeding Rate (seeds/ac)	Lint Yield (lbs/ac)	Gross Rev. per acre	Seed Cost (\$/ac)	Net Rev. per acre
1	22.5	1,224	\$1,004	\$62	\$942
1	25.5	1,245	\$1,021	\$70	\$951
1	29.5	1,362	\$1,117	\$81	\$1,035
2	22.5	1,180	\$968	\$62	\$906
2	25.5	1,193	\$978	\$70	\$908
2	29.5	1,194	\$979	\$81	\$898

*UGA Cotton Enterprise Budget: \$2.76/1000 seeds
Cotton price: \$0.82/lb

VR Seeding Rate Studies - 2023

Field 1 – Miles Middle



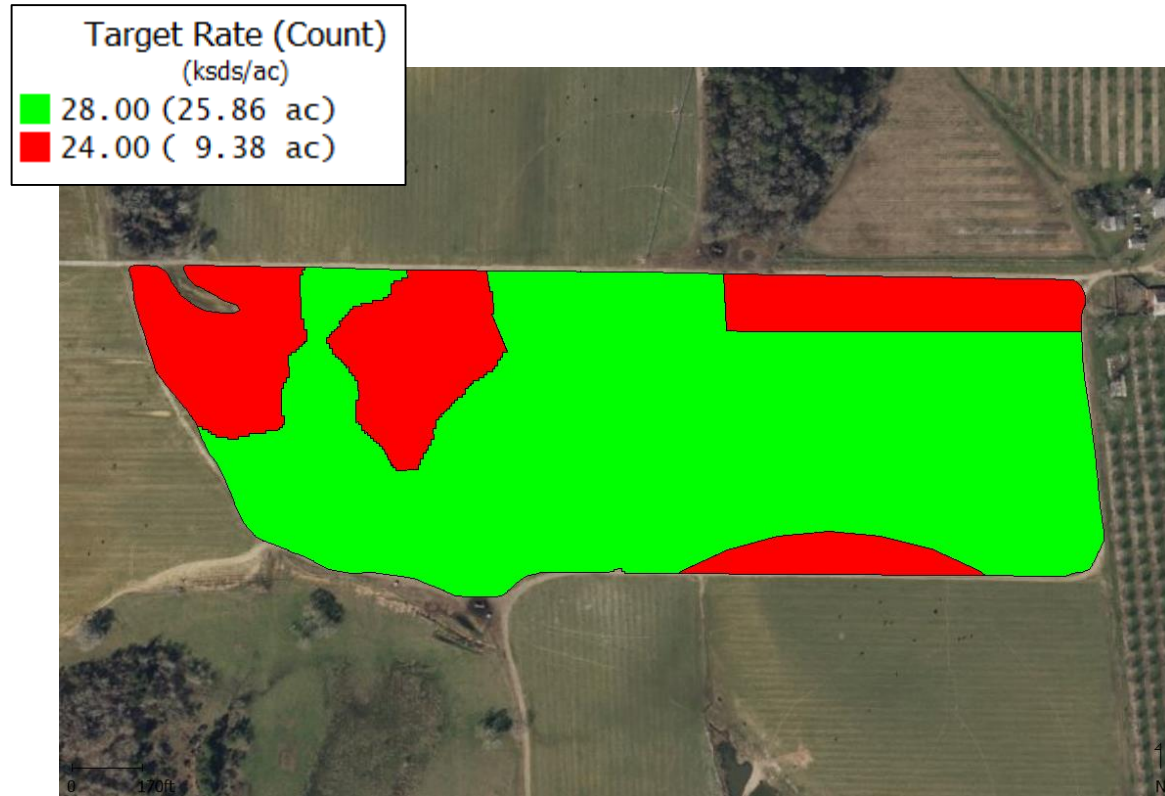
VR Seeding Prescription (Rx) Map



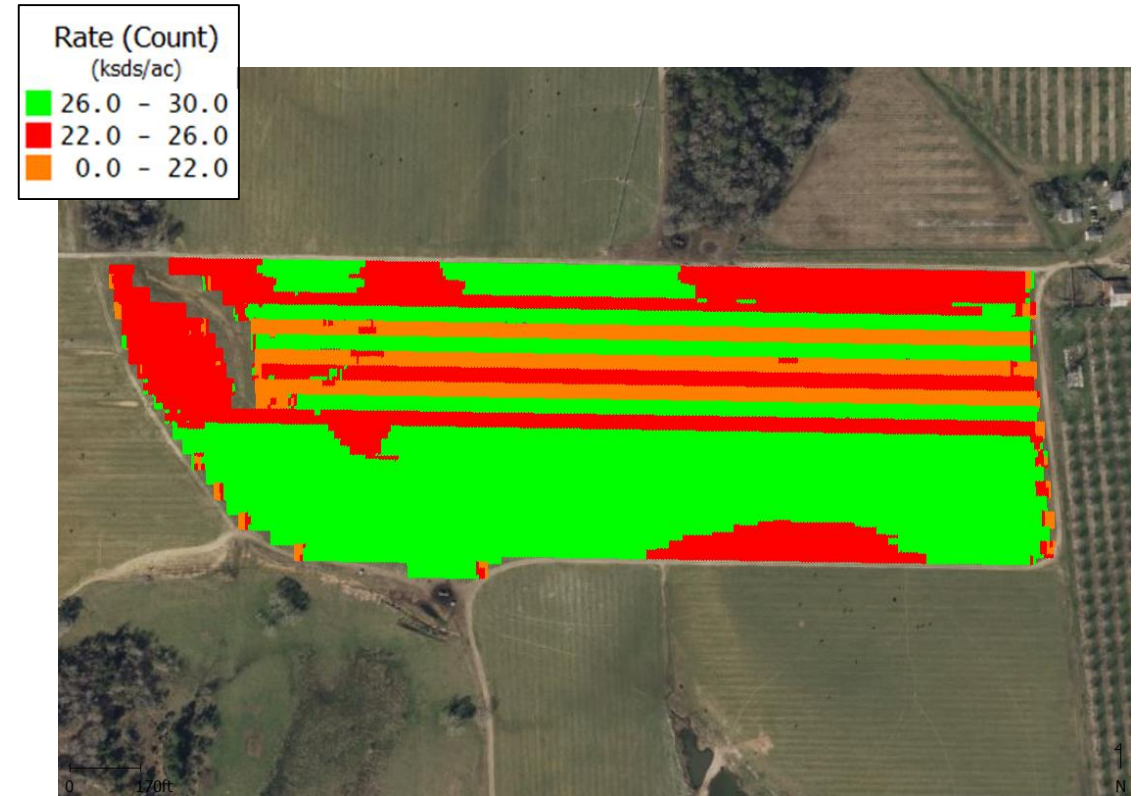
As-Applied (Planted) Map

VR Seeding Rate Studies - 2023

Field 2: School House



VR Seeding Prescription (Rx) Map



As-Applied (Planted) Map

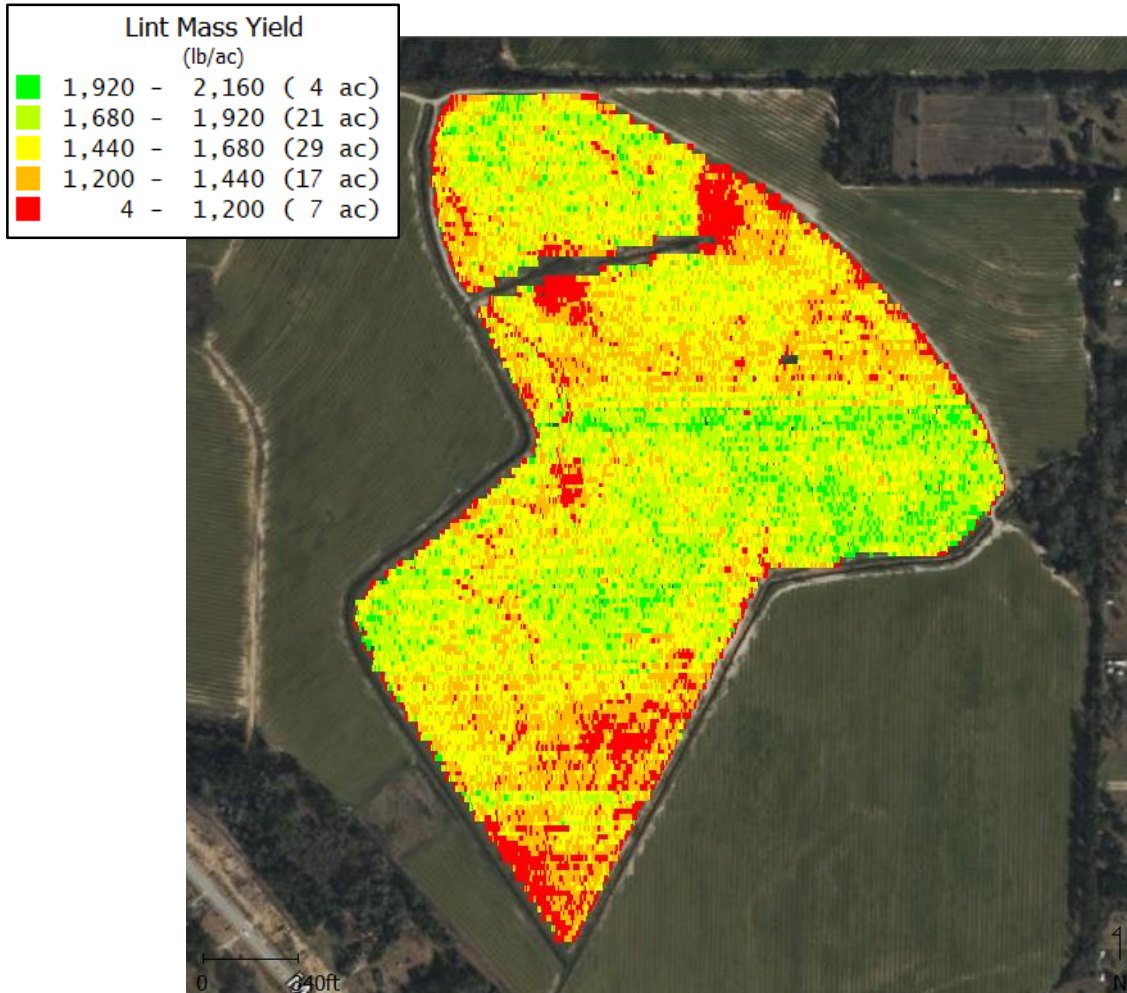
Field 1 – Miles Middle

Population by Management Zone

Zone	Seeding Rate (ksds/ac)	Population (plants/ac) x 1000	Emergence (%)
1	24.0	19.9	82.9
2	24.0	21.2	88.3
3	24.0	21.0	87.5
4	24.0	20.8	86.6
5	28.0	24.2	86.4
6	28.0	24.4	87.1
7	29.0	25.6	88.2

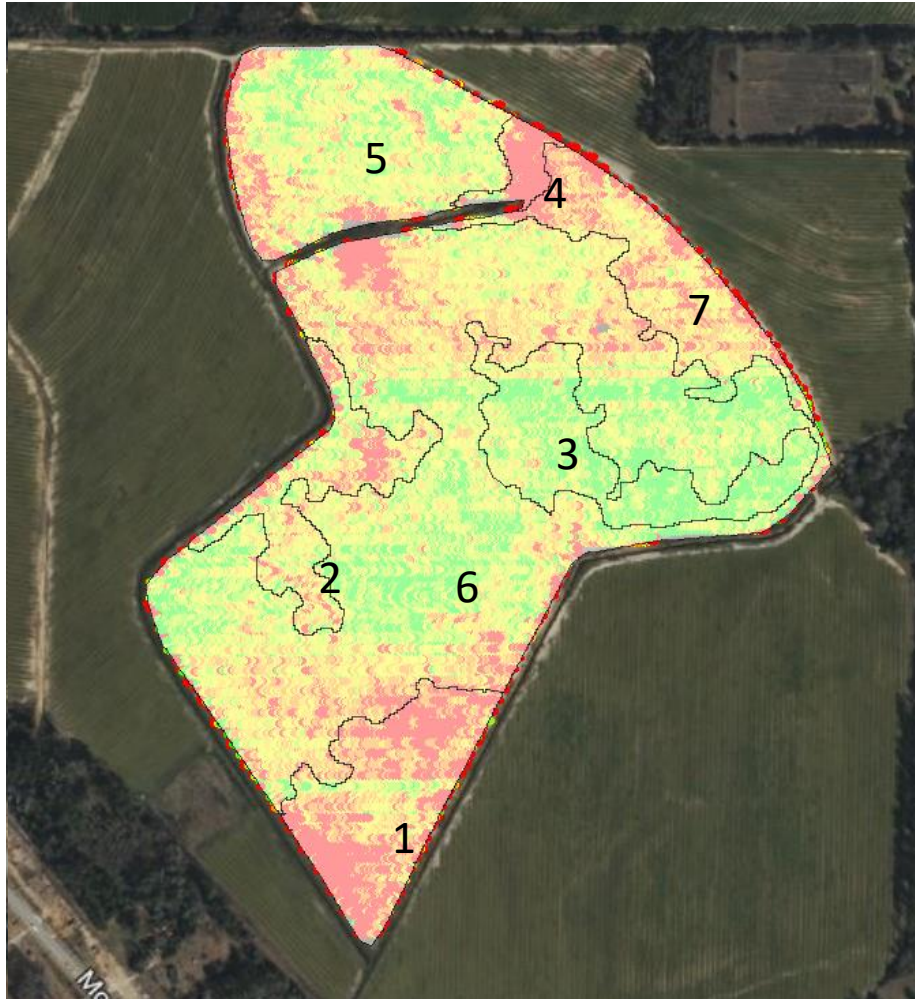


Cotton Yield



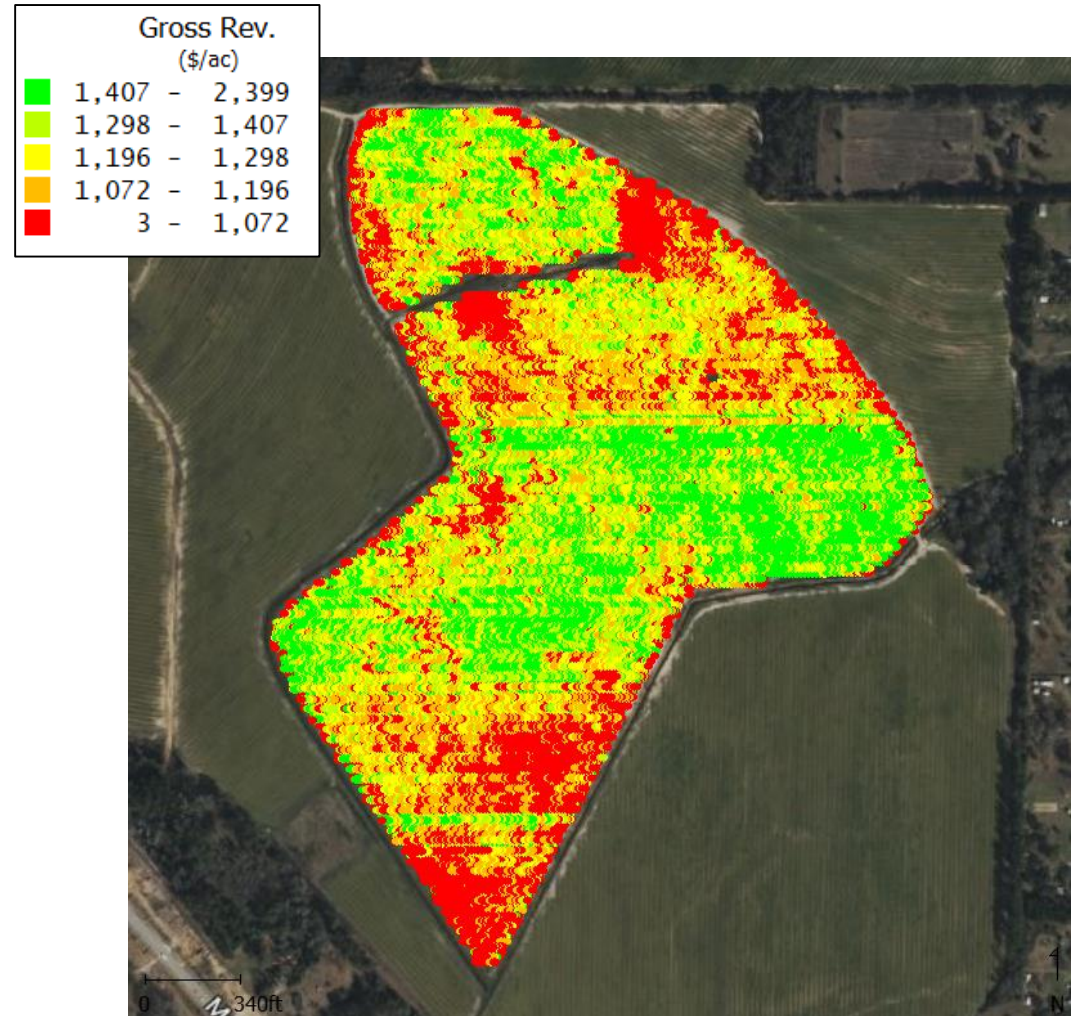
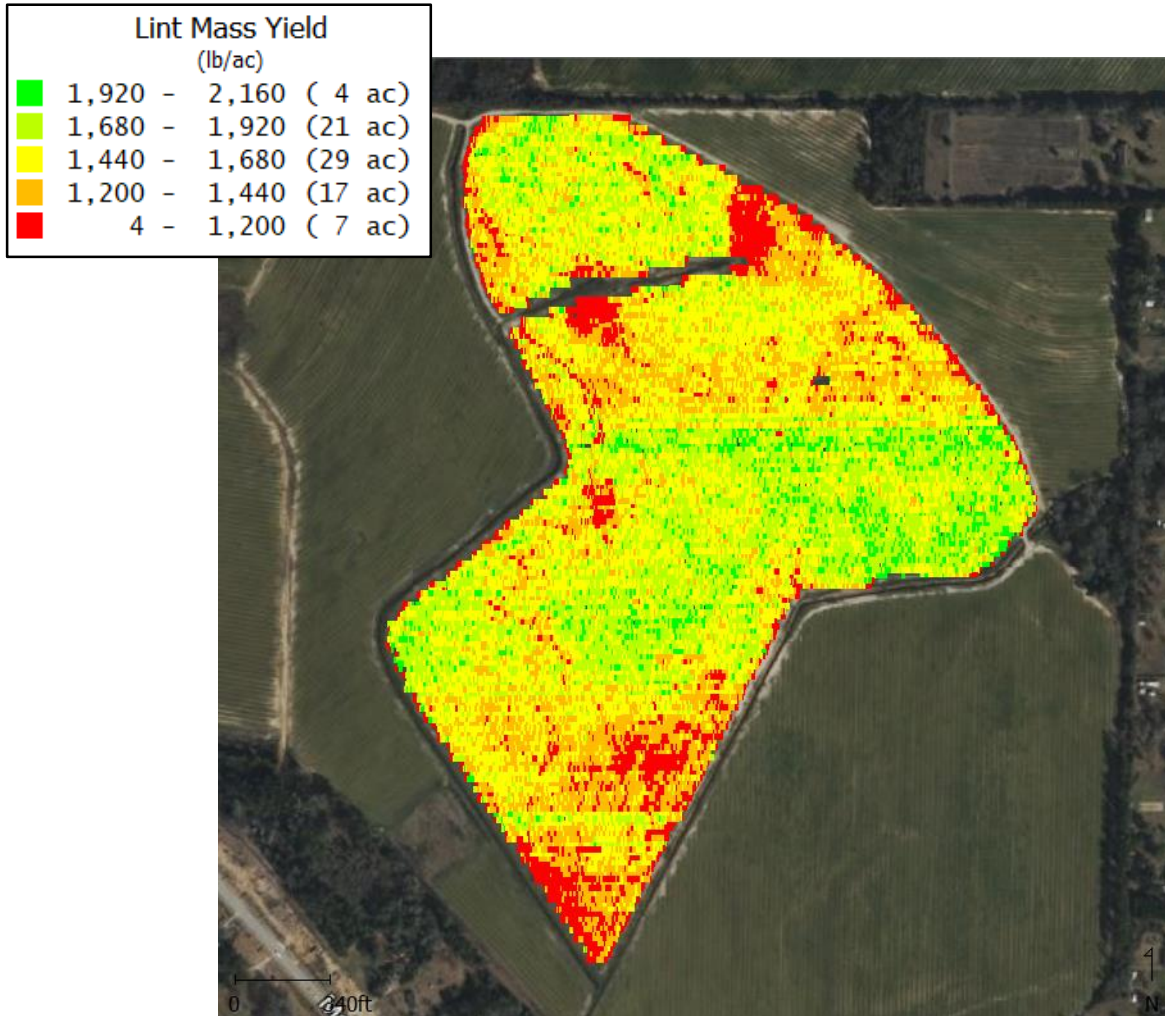
Lint Yield (lb/ac)	Area (ac)
0 - 280	0.4
241 - 480	0.2
481 - 720	0.4
721 - 960	1.3
961 - 1200	4.8
1201 - 1440	17.5
1441 - 1680	29.4
1681 - 1920	20.9
1921 - 2160	4.3

Yield by Management Zone



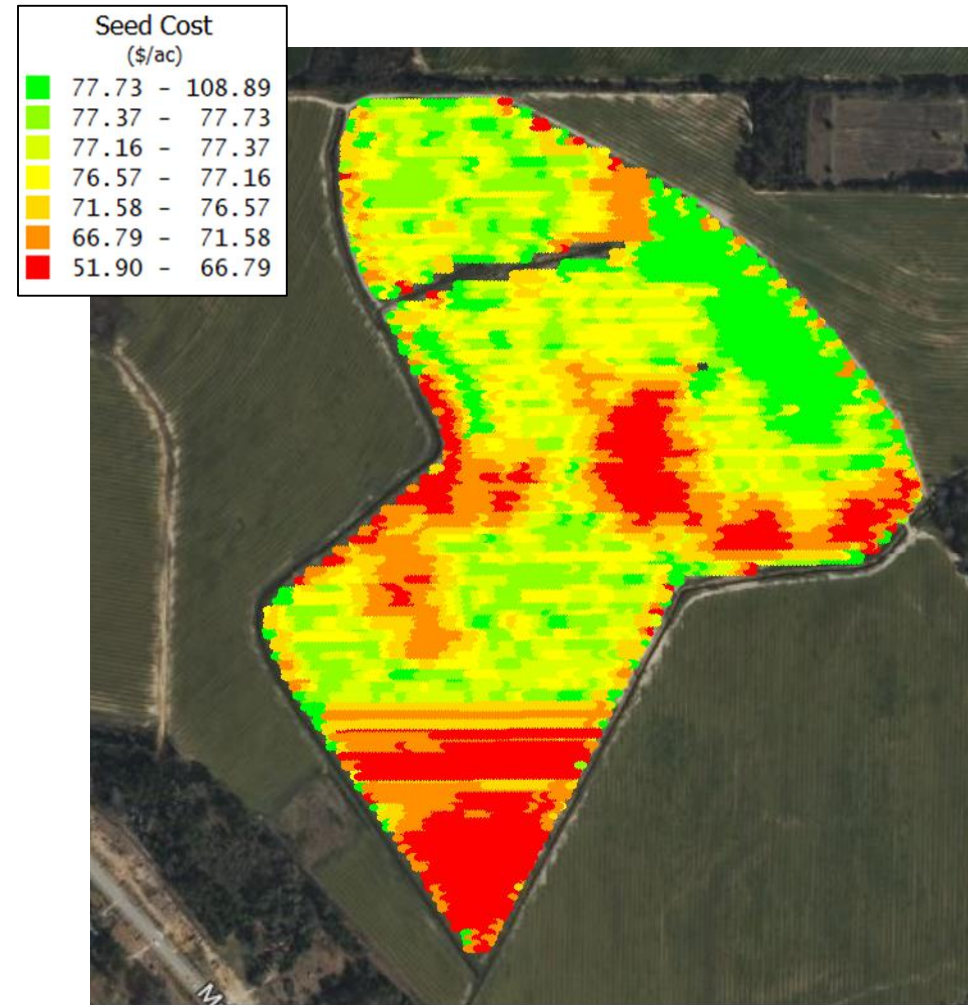
Polygon	Lint Yield (lb/ac)	Area (ac)
1	1276 ± 274	7.5
2	1460 ± 289	5.0
3	1752 ± 195	6.8
4	1063 ± 321	1.1
5	1570 ± 255	12.0
6	1587 ± 252	42.9
7	1399 ± 255	6.2
24.0	1475 ± 340	20.4
28.0	1583 ± 253	54.9
29.0	1399 ± 255	6.2

Gross Revenue across the Field



**Using Cotton price of \$0.80/lb*

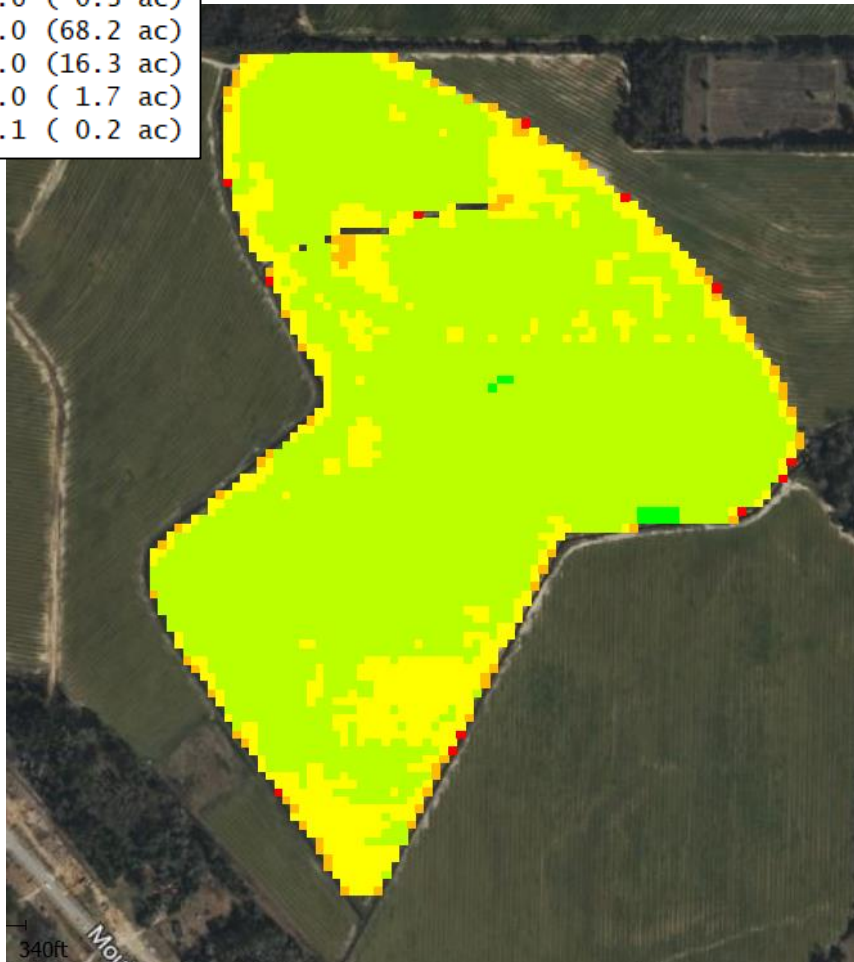
Seed Cost Per Acre



*UGA Cotton Enterprise Budget: \$2.76/1000 seeds
1 seed bag = \$635 (2,30,000 seeds)*

Profit and Loss Analysis for VR Seeding

Net Rev.	
(\$/ac)	
1,500.0 - 2,325.6	(0.3 ac)
1,000.0 - 1,500.0	(68.2 ac)
500.0 - 1,000.0	(16.3 ac)
0.1 - 500.0	(1.7 ac)
-77.2 - 0.1	(0.2 ac)



Profit
Break Even
Loss



UGA Cotton Enterprise Budget: \$972.55/ac

Summary/Considerations

- ❖ Proper delineation of management zones is critical for VR seeding implementing (*two to three zones only*)
- ❖ Seeding rate strips (checks) are important in each field before implementing any sort of VR seeding (*yield response to seeding rate within each management zone*)
- ❖ The potential of VR seeding will vary from field to field depending on the amount of variability (*seeding rate accuracy becomes more important for lower rates*)

Future Work

- Continue evaluation of different spatial layers for delineating management zones for VR seeding
- Measure success of VR seeding in multiple fields through yield and economical analysis

Thanks!

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