Crop Emergence and Yield Response at Different Seeding Depths and Planter Downforces for Peanuts Planted in Loamy Sand Soils

Simerjeet Virk

W. Porter, S. Monfort and C. Pilon

Crop & Soil Sciences Department University of Georgia





INTRODUCTION

- □ For row-crops including peanuts, timely and uniform stand establishment helps in maximizing yield potential early in the season.
- Stand Establishment depends on proper seeding rate and accurate seed placement (seed depth, spacing and seed-to-soil contact)
- Recommended seeding rates for peanuts is 6 seeds per foot to attain a uniformly emerged stand of 4 plants per foot (UGA Peanut Production Guide)
- Recommended seeding depth is 2.0 to 2.5 inches (can plant shallower with good soil moisture up to 3 inches deep with good quality seed)



RESEARCH QUESTION

- Due to increased production costs over the years, recent focus has also been on investigating and improving field performance of planting machinery
- □ Seed Depth Fluctuations in seeding depth, especially in varying soil conditions, has been associated with poor crop emergence and loss in yield in some cases (corn; Hanna et al., 2010).
- ❑ Downforce additional load applied on planter row-unit to achieve the desired seeding depth and ensure proper seed-to-soil contact. (optimal downforce for each seeding depth)
- □ Large in-field soil variability in the Southeastern US presents a challenge for optimal downforce selection. In general, there is lack of research on effect of planting parameters in peanuts.

Seed Depth





HYPOTHESIS

Utilizing inadequate downforce to achieve the desired seeding depth can impact emergence and yield in peanuts

OBJECTIVE

Evaluate the effect of different seeding depths and planter downforces on crop emergence and yield in peanuts

METHODS & MATERIALS

Study Year: 2017 - 2019

Location: Southeast Research and Education Center, Midville, GA

Soil Type: Dothan Loamy Sand, 0 to 2 percent slopes Field Conditions: Conventional, Irrigated

Variety: Georgia-06G

Seeding Rate: 87,000 seeds/ac (6 seeds per foot)

Equipment: 4-row Monosem NGPlus Planter

Management: Agronomic recommendations as per UGA Extension



Treatments and Experimental Design

Three Seeding Depths:

- 1.5 inch
- 2.5 inch
- 3.5 inch



Seed Depth Adjustment (0 to 3.5 inches)

Three Downforce:

- 100 lbs (*low*)
- 200 lbs (medium)
- 400 lbs (*high*)



Mechanical Downforce Adjustment (0, 100, 200, 300 & 400 lbs)

Strip-plot Design:

- 4 Replications / treatment
- DF randomized within each depth
- Plots: 4-rows wide (12 ft.) x 35 ft. long

100		•	•
300		•	•
200		•	•
300		•	•
100		•	•
200		•	•
300		•	•

1.5" 3.5" 2.5" 1.5" 3.5"

Data Collection:

- Stand Counts at 7, 14 & 21 days after planting (10-ft section in the middle two rows)
- Yield data by harvesting middle two rows and weighing bags using a calibrated scale
- Stand counts and weights were converted to emergence (%) and yield (lbs/ac), respectively.

Data Analysis:

- Data analyzed separately for each year (yearly variation in weather and field)
- Statistical analysis was performed using SAS 9.4 (SAS Institute, Cary, NC)
- Analysis of Variance using PROC GLM and means comparison using LSD MEANS (p < 0.10)





RESULTS

Crop Emergence - 2017

Seeding		Emergence (%)						
Depth	Downforce	7 [DAP	14	14 DAP		21 DAP	
(in.)	(lbs)	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	
	100	2	2	54	3	52	3	
1.5	200	1	1	53	5	55	6	
	400	1	1	52	5	49	4	
	100	17	3	58	7	58	2	
2.5	200	16	6	59	8	65	5	
	400	18	3	60	5	62	4	
	100	21	9	57	5	59	6	
3.5	200	22	6	53	5	63	8	
	400	15	6	58	1	63	2	

Main & Interaction	Emergence (p-value)					
Effects	7 DAP	14 DAP	21 DAP			
Seeding Depth	<.0001	<.0001	0.0367			
Downforce	0.4740	0.0597	0.6954			
Depth x Downforce	0.4145	0.5550	0.6396			





Crop Emergence - 2018

Seeding		Emergence (%)					
Depth	Downforce	7 [DAP	14 DAP		21 DAP	
(in.)	(lbs)	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	100	48	5	58	6	78	6
1.5	200	45	7	55	9	76	16
	400	53	5	55	5	74	11
	100	41	9	47	8	60	4
2.5	200	41	5	45	5	61	7
	400	41	6	44	2	55	7
	100	29	10	37	9	45	12
3.5	200	21	7	38	1	45	1
	400	22	6	39	4	48	3

Main & Interaction	Emergence (p-value)					
Effects	7 DAP	14 DAP	21 DAP			
Seeding Depth	0.0002	0.0005	0.0011			
Downforce	0.4600	0.8378	0.7866			
Depth x Downforce	0.5765	0.9579	0.7738			





Crop Emergence - 2019



Seeding		Emergence (%)					
Depth	Downforce	71	DAP	14 DAP		21 DAP	
(in.)	(lbs)	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	100	3	4	54	3	55	7
1.5	200	5	3	53	5	57	4
	400	5	4	52	5	59	4
	100	18	7	58	7	70	4
2.5	200	13	6	59	8	72	1
	400	18	11	60	5	67	3
	100	17	18	57	5	64	6
3.5	200	12	14	53	5	69	3
	400	11	10	58	1	67	4

Main & Interaction	Emergence (p-value)					
Effects	7 DAP	14 DAP	21 DAP			
Seeding Depth	0.0562	0.0040	0.0452			
Downforce	0.3377	0.2035	0.6982			
Depth x Downforce	0.3236	0.3070	0.6438			

Weather Conditions

Planting Rainfall (in) – – Min. Temp (F) – Max. Temp (F)



Planting Avg. Air.		Avg. Soil Temp	Avg. Soil Temp.	Avg. Soil Moisture	
Date	Temp.	5 cm	- 10 cm	– 5 cm	
	(F)	(F)	(F)	(%VWC)	
5/11/17	76.6	82.1	81.4	14.2	
5/09/18	70.9	79.7	79.1	14.6	
5/16/19	73.4	79.6	79.1	15.7	

RESULTS

Yield

Seeding		Yield (lbs/ac)						
Depth	Downforce	2	017	20)18	20)19	
(in.)	(lbs)	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	
	100	5623	279	6371	428	6377	997	
1.5	200	5787	532	6017	732	7200	478	
	400	5808	897	6513	649	7472	1038	
	100	5590	1143	6168	689	6386	928	
2.5	200	5040	379	6023	489	6937	118	
	400	5100	305	5611	174	7203	485	
	100	5176	507	5502	781	7232	1422	
3.5	200	5127	386	5499	1115	6516	879	
	400	5152	1315	5996	495	6785	790	

Treatment Effect	Yield (p-value)				
	2017	2018	2019		
Seeding Depth	0.1271	0.0818	0.6854		
Downforce	0.2288	0.7351	0.1492		
Depth x Downforce	0.3147	0.4641	0.1758		



Yield: Seeding Depth x Downforce (all three years)



	Yield (lbs/ac)					
Year	Mean	Std Dev	Min	Max	Range	
2017	5378	712	3654	6861	3207	
2018	5967	681	4017	6994	2977	
2019	6890	846	4925	8422	3497	

Observations & comments on Downforce:

- This study was limited to one soil type/texture (loamy sand soil)
- A certain downforce is required for a given soil texture (100 lbs)
- Usually different soil types are present within the same field
- Each soil texture requires a different optimal downforce





CONCLUSIONS

- Seeding depth had a significant effect on crop emergence in all three years. Deeper planting (3.5 inch) tend to reduce emergence (and yield in 2018).
- Across all seeding depths, planter downforce (100 400 lbs) had no influence on peanut emergence and yield in loamy sand soils.
- ➢ In loamy sand soils, a downforce of 100 lbs was sufficient to achieve the seeding depth required to attain a good stand establishment.

Ongoing and Future Research:

- Quantification of peanut seed depth and measurement of soil properties at different depths
- Investigation of seeding depth and downforce interaction in other soil types including heavy textured soils (such as clay).

ACKNOWLEDGEMENTS

Georgia Peanut Commission

University of Georgia

Dr. Wesley Porter

Dr. Scott Monfort

Dr. Cristiane Pilon

Seth, Cole, Michaela & others

Southeast Research and Education Center





Anthony Black & the SEREC Staff





Simerjeet Virk • svirk@uga.edu • (229) 386-3552 University of Georgia – Tifton Campus

Thank You!

(follow-up questions or comments can also be sent to <u>svirk@uga.edu</u>)

