Reduction of Peanut Digging Losses

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DIGGING LOSS INTRO
EFFECTS OF SOIL TEXTURE
AUTOMATED DIGGING DEPTH
EFFECTS OF CONVEYOR SPEED
EFFECTS OF GROUND SPEED
REDUCING SOIL TO BUY POINT
DIGGER OPERATION CONCLUSIONS

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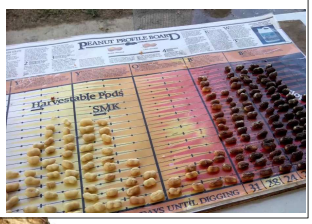
Peanut Harvest Losses

- Majority of peanut harvest losses at digging
  - Weakened peg strength
  - Disease, over-maturity
  - Mechanical actions of soil/digger
- Reducing digging loss
  - Proper digging time
  - Proper digger settings
- Variability in maturity
  - Some pods over-mature
  - Some losses inevitable



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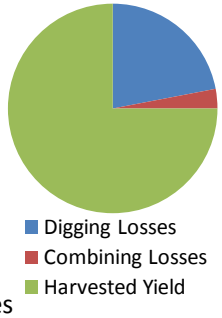
Typical Peanut Digging Losses

- Grichar and Boswell, 1987
  - Favorable soil conditions
  - Proper digger setup
  - 400 lb/ac digging losses
- Kirk et al., 2013
  - Virginia varieties
  - Proper digger settings
  - 580 to 1,200 lb/ac digging losses
    $150/ac to $300/ac
    9 to 22% of total production



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Determining Digging Losses

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Digging Loss Visual Indicators

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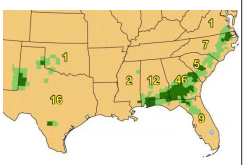
Soil Texture and Digging Losses

- Southeastern coastal plains
  - Large soil texture variability
- Adjustment of digging depth
  - Change in digging angle
  - Top link length sets angle
  - Clay soils = more aggressive angle
  - Sandy soils = less aggressive angle
- Common practice
  - Set digging angle for heaviest soil



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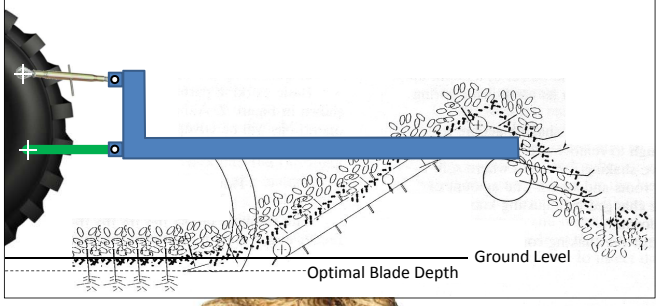
Top Link Adjustment: Proper Setting

Cut taproot just below pods



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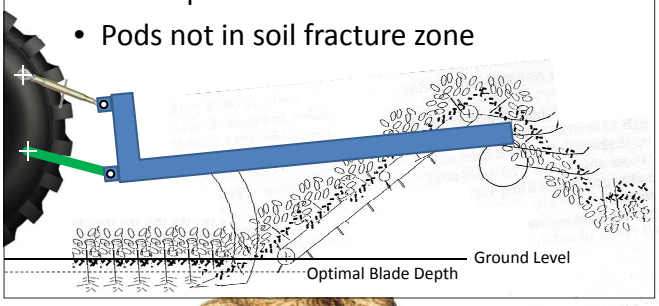
Top Link Adjustment Too Short

- Peanuts dug too deep
- Excessive soil on blades
- Plants pushed forward
- Pods not in soil fracture zone



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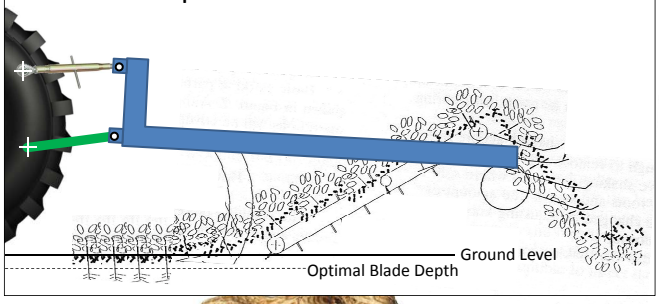
Top Link Adjustment Too Long

- Peanuts dug too shallow
- Some pods sheared
- Some pods left in soil



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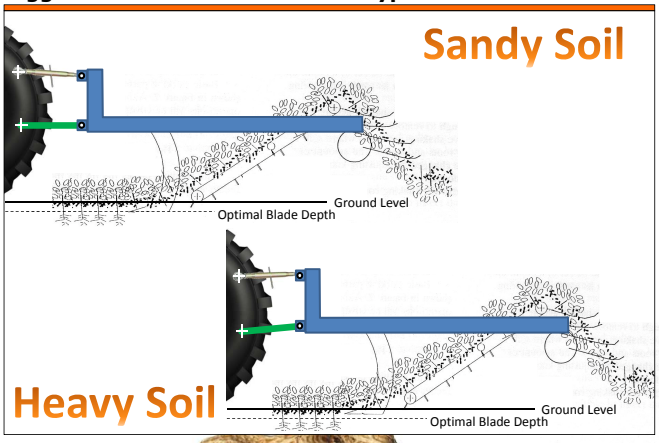
Digger Performance Across Soil Types



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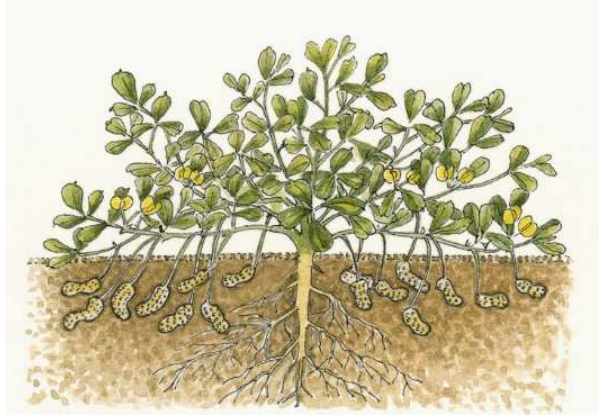
Effect of soil fracturing



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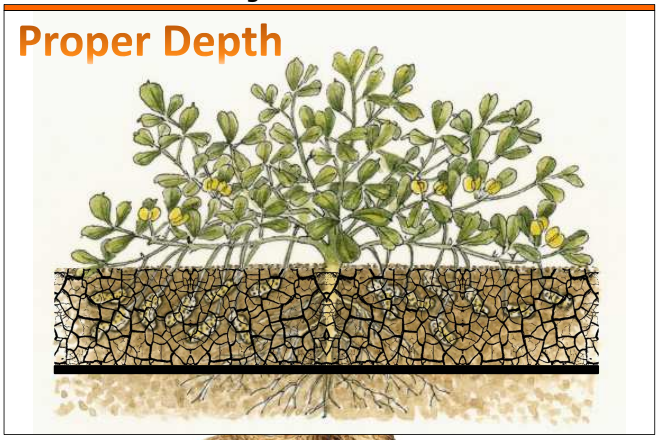
Effect of soil fracturing



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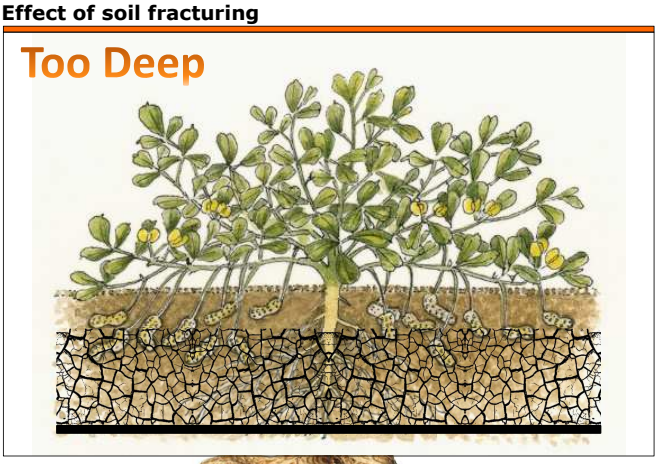
Effect of soil fracturing



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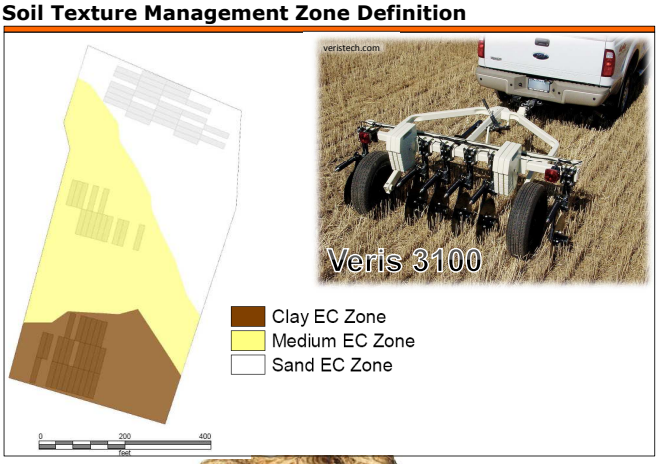
Soil Texture Management Zone Definition



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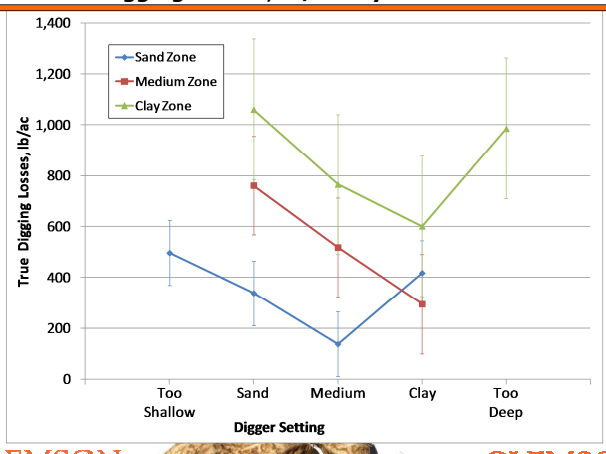
2013 True Digging Losses, lb/ac dry basis



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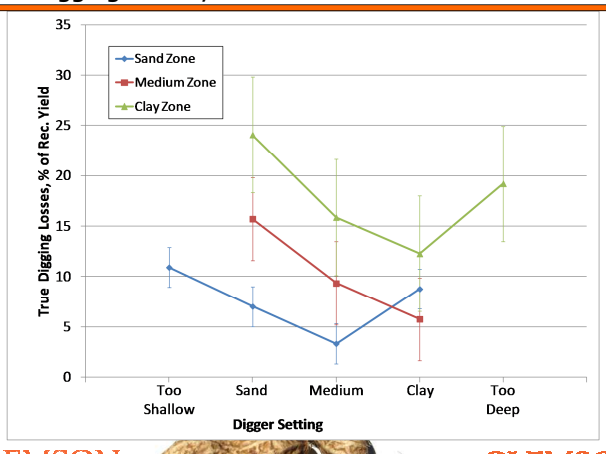
True Digging Losses, % of Recoverable Yield



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Hypothetical Digging Loss Outcomes

Digger Setting	Digging Losses lb ac^{-1}	Revenue Losses $ ac^{-1}
Optimum	344	-
Sand	720	75
Medium	474	26
Clay	437	19

Notes:
- Entire field assumed to be dug at "Digger Setting"
- Revenue losses are as compared to optimum setting
- Assumed peanut value of $400 ton^{-1}

Effect of soil moisture on depth

- Soil moisture makes or breaks need for top link adjustment (auto or manual)
- Dry Conditions: 1.5-2.4% VMC (2013)
  - Optimum top link settings substantially different across textures
  - Total top link adjustment = 1.6 inches
- Wet Conditions: 3.2-5.9% VMC (2014)
  - Optimum top link settings similar across textures
  - Total top link adjustment = 0.2 inches

Effect of soil moisture on losses

- Dry condition digging losses (2013)
  - 3-11% in Low EC (95% Sand)
  - 6-16% in Med EC (93% Sand)
  - 12-24% in High EC (92% Sand)
  - Cost of non-adjustment = **$19-$75/ac**
- Good condition digging losses (2014)
  - 2-3% in Low EC (96% Sand)
  - 9% in Med EC (92% Sand)
  - 6-8% in High EC (88% Sand)
  - Cost of non-adjustment = **$0/ac**

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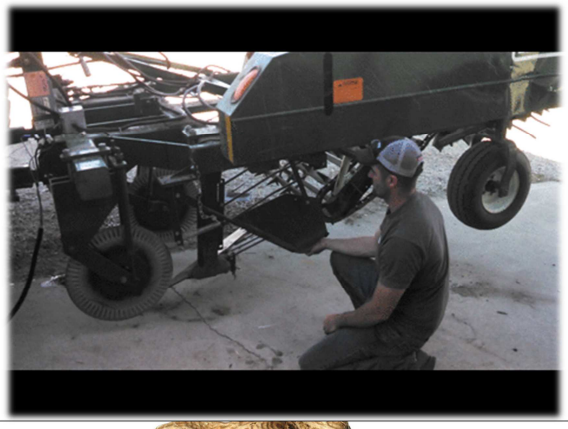
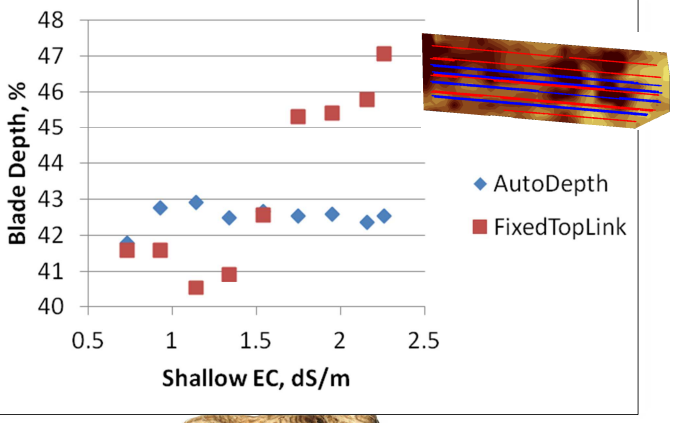
DIGGER OPERATION CONCLUSIONS

Automated Blade Depth Control

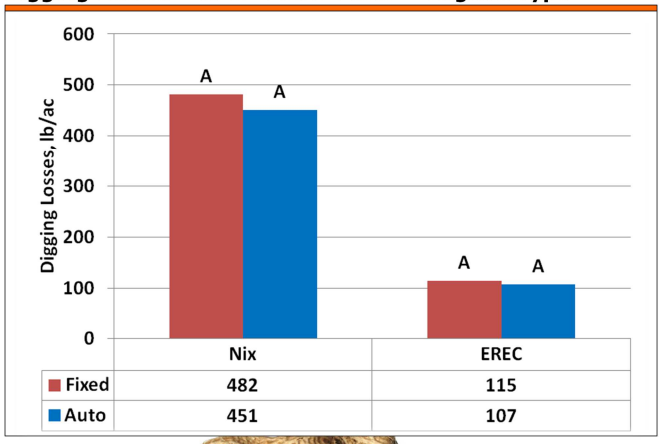


Depth gauge operation

Digger Performance - KMC 2-Row Tests

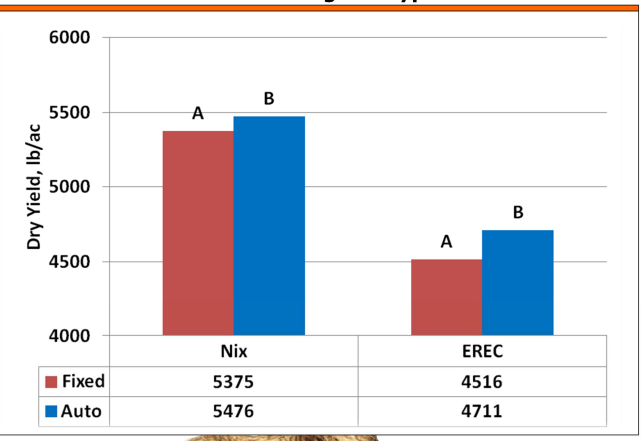


Digging Losses – KMC 2-Row Tests – Virginia Type



	Nix	EREC
Fixed	482	115
Auto	451	107

Yield – KMC 2-Row Tests – Virginia Type



	Nix	EREC
Fixed	5375	4516
Auto	5476	4711

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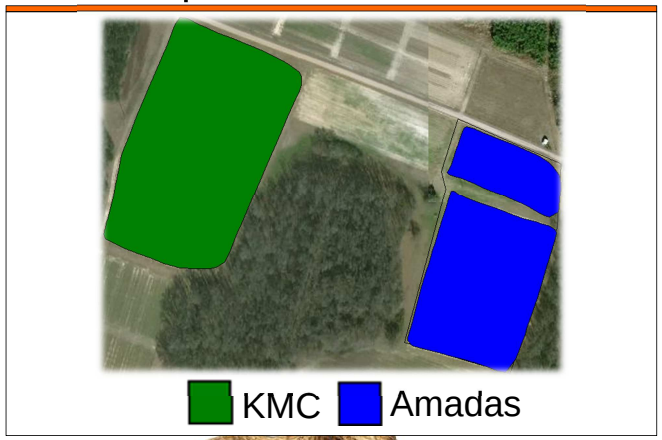
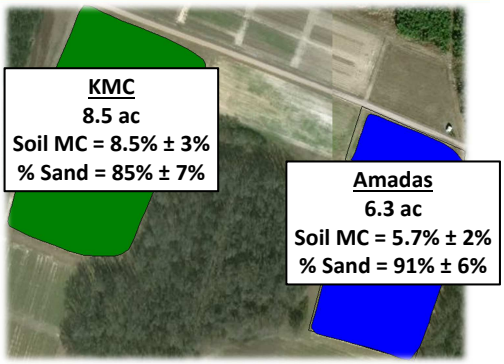
Diggers used in both studies

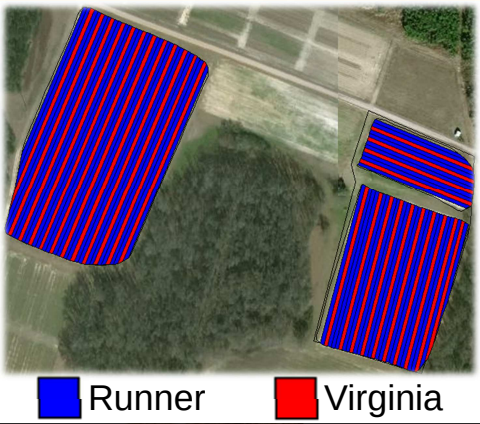
2017 site description



2017 *site description*



2017 planting map



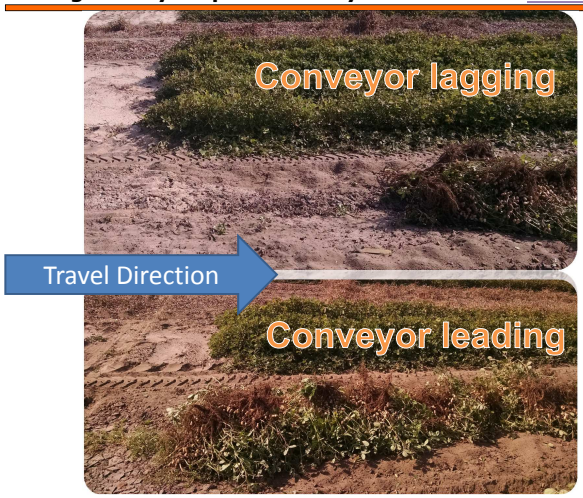
Conveyor Speed Tests

Year	2016	2017
Type	Virginia	Runner + Virginia
Conveyor speeds	80%	70%
	90%	85%
	100%	100%
	110%	115%
	120%	130%

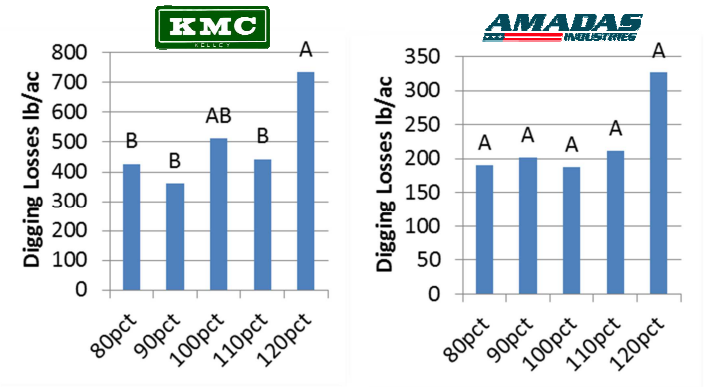
Conveyor speed: Literature

- Amadas
  - Set conveyor to match tractor speed (digital readout)
  - Excessive dirt in windrow = Conveyor too slow?
  - Conveyor stalls excessively = Conveyor too slow?
- KMC
  - Vine flow synchronized with ground speed and conveyor speed
- Bader, UGA
  - Chain speed slightly faster than forward speed to avoid pileup of vines ahead of pickup
- Roberson, NCSU
  - Synchronize to avoid dragging and snatching of plants
  - Optimum shaker speed is slightly faster than ground speed

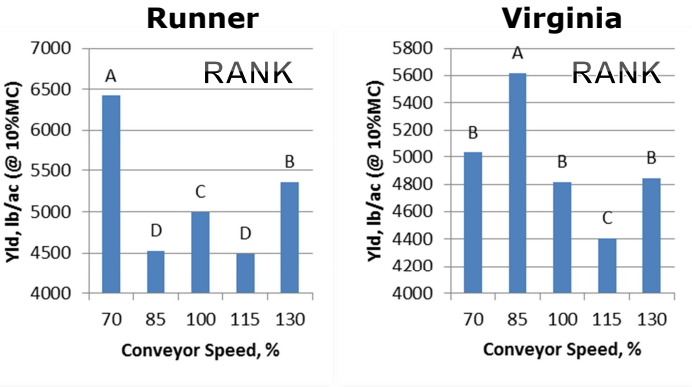
Setting conveyor speed visually



2016 conveyor speed tests - Virginia

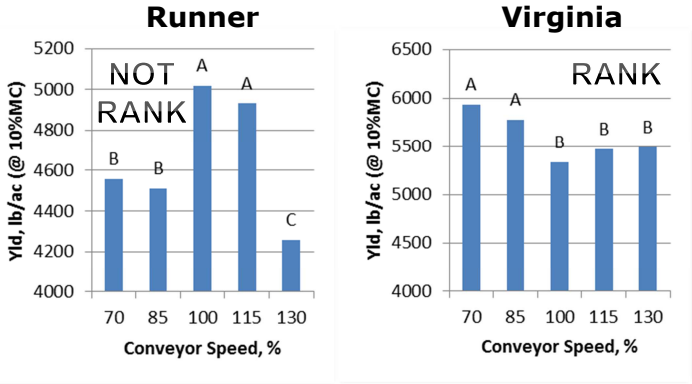


2017 Amadas conveyor speed tests



Effect of choke point at rods

2017 KMC conveyor speed tests



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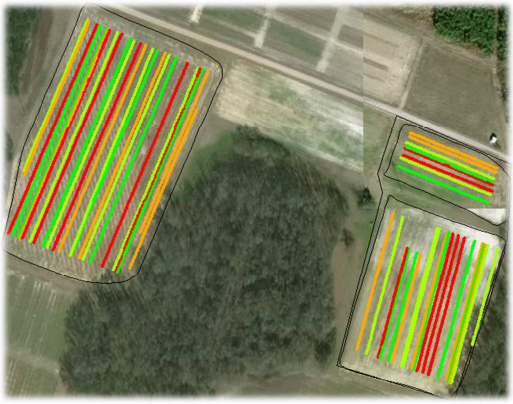
Ground Speed Tests

Year	2016	2017
Type	Virginia	Runner + Virginia
Ground speeds	2 mph	1.5 mph
	3 mph	2.5 mph
	4 mph	3.5 mph
	5 mph	4.5 mph

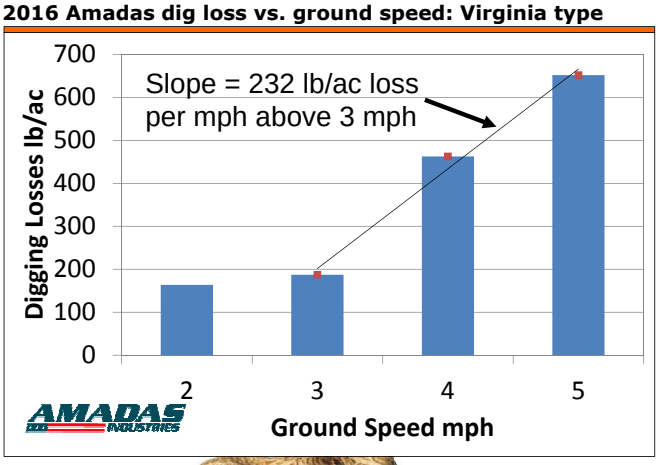
Ground speed: Literature

- Amadas: “Starting speed” 2.5 – 3 mph
- KMC: 3 – 3.5 mph
  - Too fast causes bunching
  - Too slow pulls vines apart, pulling off peanuts
- Bader, UGA: 3.5 – 5 mph
- Roberson, NCSU
  - Heavy pod losses at ground speeds in excess of 4 mph

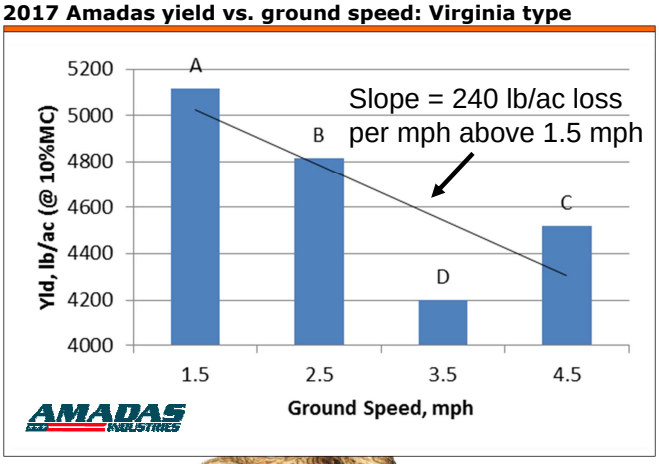
Ground Speed Tests: Conveyor Speed = Ground Speed



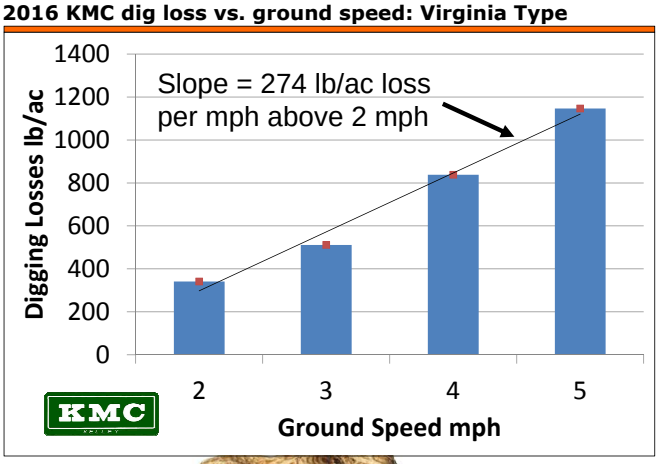
2016 Amadas dig loss vs. ground speed: Virginia type



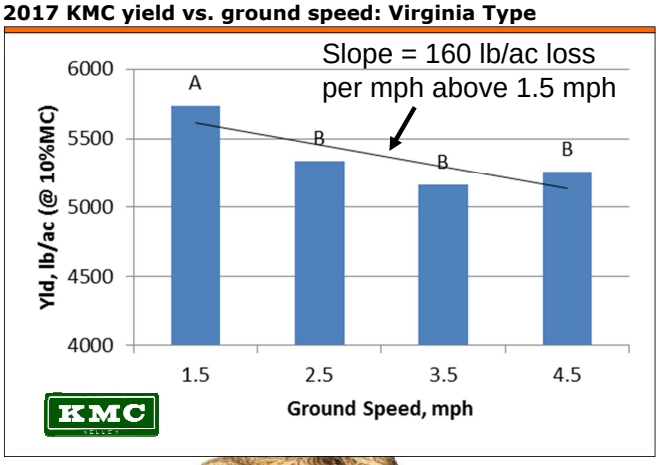
2017 Amadas yield vs. ground speed: Virginia type



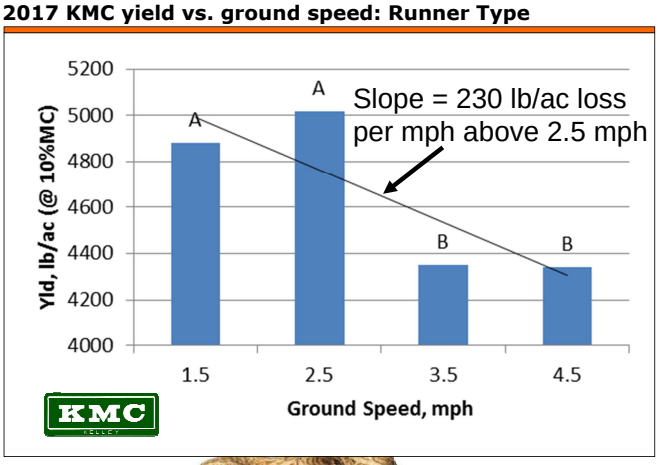
2016 KMC dig loss vs. ground speed: Virginia Type



2017 KMC yield vs. ground speed: Virginia Type



2017 KMC yield vs. ground speed: Runner Type



Field Capacity for Various Digging Speeds

4-Row Diggers

Speed (mph)	Capacity (ac/hr)	Time (hr/10 ac)
2	2.6	3.8
2.5	3.3	3.1
3	3.9	2.6
3.5	4.6	2.2
4	5.2	1.9
4.5	5.9	1.7
5	6.5	1.5

6-Row Diggers

Speed (mph)	Capacity (ac/hr)	Time (hr/10 ac)
2	3.9	2.6
2.5	4.9	2.0
3	5.9	1.7
3.5	6.9	1.5
4	7.8	1.3
4.5	8.8	1.1
5	9.8	1.0

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Reducing soil delivered to buy point

- Digger
  - Dig at shallowest depth possible without cutting off pods (maximum fracture of soil structure)
  - Set conveyor speed to match ground speed
    If rank vines: Ensure upper rods sufficiently open
  - Dirt knockers: Adjust or add additional
  - Lift vines as a standard practice?

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Vine lifter options

KMC Conditioner

Dirt knocker optional

Amadas Crop Lifter

Standard digger
- Less blades, shanks, rotors, rods
- Shorten gauge wheels
- Extend center link

Test
- Behind digger
- 1 day
- 2 days
- 3 days

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Reducing soil delivered to buy point

- Combine
  - Check for dirt buildup on concaves at start of each day
  - Operate at upper end of rated pto speeds
  - Properly adjust retention board (watch discharge)
  - Consider engaging concave teeth / lower strippers (watch for LSKs…not for dry conditions)
  - Consider harvesting more aggressively but at higher moisture content (Drying cost vs. FM cost)
  - Consider value of dump type combines with dirt traps vs. offload conveyors
  - Increase cleaning air, adjust tail board accordingly
- Dump cart
  - Multiple dumps? 1/4 dumps to intermediate cart?
  - Invest in dump carts with dirt screens and dirt traps

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Dump carts with dirt screens and dirt traps

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Multiple dumps

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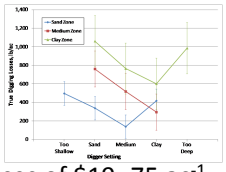
Digging depth to reduce losses

- Digging angle should be adjusted for texture
  - There is an optimum digging angle for each soil texture zone
  - Greater OR lesser angle increases digging losses
  - Similar losses for too shallow and too deep
- Digging losses
  - 3-11% in sand texture
  - 6-16% in medium texture
  - 12-24% in clay texture
  - Non-adjustment = Excessive losses of \$19 -75 ac^{-1}



Conveyor speed to reduce losses

- Best to lag conveyor speed in heavier vines
- Match conveyor speed to ground speed in lighter vines
- Match conveyor speed to ground speed for improved dirt removal, adjust rods to accommodate rank vines

Ground speed

- Optimum speed will vary with conditions
  - Decrease with increasing pod size
  - Decrease with disease pressure
  - Increase with increasing sand content
  - Increase with increasing organic matter
  - Increase with increasing soil moisture (to a point)
- Yield losses increase with ground speed: 150-250 lb/ac per mph above optimum speed
- Optimum speed = 1.5 to 3 mph
  Across diggers, years, peanut types

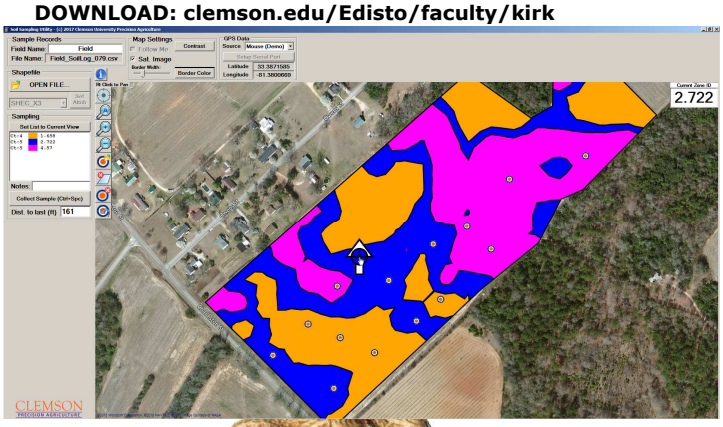
Acknowledgments

National Peanut Board™

- Clemson Ag Mech & Business Undergraduate Program
- Justin Hiers, Kayla Carroll, Cash Coker, Mitch Haynes, Wei-zhen Liang, Misbah Munir

Clemson Soil Sampling Utility

DOWNLOAD: clemson.edu/Edisto/faculty/kirk



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