Reduction of Peanut Digging Losses

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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

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

Determining Digging Losses

Digging Loss Visual Indicators

Too Shallow

Too Deep
**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**

- **Sandy Soil**
- **Heavy Soil**
Hypothetical Digging Loss Outcomes

<table>
<thead>
<tr>
<th>Digger Setting</th>
<th>Digging Losses lb ac(^{-1})</th>
<th>Revenue Losses $ ac(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimum</td>
<td>344</td>
<td></td>
</tr>
<tr>
<td>Sand</td>
<td>720</td>
<td>75</td>
</tr>
<tr>
<td>Medium</td>
<td>474</td>
<td>26</td>
</tr>
<tr>
<td>Clay</td>
<td>437</td>
<td>19</td>
</tr>
</tbody>
</table>

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

Automated Blade Depth Control

Depth gauge operation
Digger Performance - KMC 2-Row Tests

Digging Losses – KMC 2-Row Tests – Virginia Type

Yield – KMC 2-Row Tests – Virginia Type

Diggers used in both studies

2017 site description
2017 site description

KMC
8.5 ac
Soil MC = 8.5% ± 3%
% Sand = 95% ± 6%

Amadas
6.3 ac
Soil MC = 5.7% ± 2%
% Sand = 91% ± 6%

2017 planting map

Runner
Virginia

Conveyor Speed Tests

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Virginia</td>
<td>Runner + Virginia</td>
</tr>
<tr>
<td>Conveyor speeds</td>
<td>80%</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>90%</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>110%</td>
<td>115%</td>
</tr>
<tr>
<td></td>
<td>120%</td>
<td>130%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Month</th>
<th>KMC</th>
<th>Amadas</th>
</tr>
</thead>
<tbody>
<tr>
<td>80°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100°F</td>
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<td></td>
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<tr>
<td>110°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120°F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Digging losses (lbs/ac)
2017 Amadas conveyor speed tests

Runner

Virginia

2017 KMC conveyor speed tests

Runner

Virginia

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

Ground Speed Tests

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Virginia</td>
<td>Runner + Virginia</td>
</tr>
<tr>
<td>Ground speeds</td>
<td>2 mph</td>
<td>1.5 mph</td>
</tr>
<tr>
<td></td>
<td>3 mph</td>
<td>2.5 mph</td>
</tr>
<tr>
<td></td>
<td>4 mph</td>
<td>3.5 mph</td>
</tr>
<tr>
<td></td>
<td>5 mph</td>
<td>4.5 mph</td>
</tr>
</tbody>
</table>

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

Ground Speeds
- 4.5 mph
- 3.5 mph
- 2.5 mph
- 1.5 mph

2016 Amadas dig loss vs. ground speed: Virginia type
Slope = 232 lb/ac loss per mph above 3 mph

2017 Amadas yield vs. ground speed: Virginia type
Slope = 240 lb/ac loss per mph above 1.5 mph

2016 KMC dig loss vs. ground speed: Virginia Type
Slope = 274 lb/ac loss per mph above 2 mph

2017 KMC yield vs. ground speed: Virginia Type
Slope = 160 lb/ac loss per mph above 1.5 mph

2017 KMC yield vs. ground speed: Runner Type
Slope = 230 lb/ac loss per mph above 2.5 mph
Field Capacity for Various Digging Speeds

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>4-Row Diggers</th>
<th>6-Row Diggers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capacity (ac/hr)</td>
<td>Time (hr/10 ac)</td>
</tr>
<tr>
<td>2</td>
<td>2.6</td>
<td>3.8</td>
</tr>
<tr>
<td>2.5</td>
<td>3.3</td>
<td>3.1</td>
</tr>
<tr>
<td>3</td>
<td>3.9</td>
<td>2.6</td>
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<tr>
<td>3.5</td>
<td>4.6</td>
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<tr>
<td>4</td>
<td>5.2</td>
<td>1.9</td>
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<tr>
<td>4.5</td>
<td>5.9</td>
<td>1.7</td>
</tr>
<tr>
<td>5</td>
<td>6.5</td>
<td>1.5</td>
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</tbody>
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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

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?

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

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

Dump carts with dirt screens and dirt traps
Multiple dumps

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

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