Effects of Ground Speed and Conveyor Speed on Peanut Digging Losses

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INTRODUCTION

Objectives (Virginia type peanuts)

- Effects of conveyor speed on digging losses
  - 80%
  - 90% Lagging
  - 100% Equal to ground speed
  - 110% Leading
  - 120%

- Effects of ground speed on digging losses
  - 2 mph
  - 3 mph
  - 4 mph
  - 5 mph

Diggers used in study

General site description

- Sand to loamy sand
- Soil Moisture: 4 ± 1% VMC

Amadas (Champs)
KMC (Wynne)

CONVEYOR SPEED TESTS
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

Calculating conveyor speed

- Determine length of conveyor: (Rod Spacing) x (# of rods) ...convert to feet
- Determine ground speed in ft/min:
  \[
  \text{ft/min} = \text{(mph)} \times 88
  \]
- Determine conveyor speed required:
  \[
  \text{Conveyor Speed [rev/min]} = \frac{\text{Ground Speed [ft/min]}}{\text{Conveyor Length [ft/rev]}}
  \]
  \[
  \text{Conveyor Cycle Time [sec/rev]} = \frac{60 \times [\text{sec/min}]}{\text{Conveyor Speed [rev/min]}}
  \]

Conveyor Speed Tests: Ground Speed was 3 mph

- **Conveyor Speeds**
  - 0.8 x
  - 0.9 x
  - 1.0 x
  - 1.1 x
  - 1.2 x

Amadas Conveyor Speeds at 3mph

- 80%
- 90%
- 100%
- 110%
- 120%

Amadas Conveyor Speed Tests: Champs

- **Mechanical Digging Losses lb/ac**
  - 80pct: 191
  - 90pct: 201
  - 100pct: 187
  - 110pct: 212
  - 120pct: 327
KMC Conveyor Speeds at 3mph

80% 90% 100% 110% 120%

KMC Conveyor Speed Tests: Wynn

<table>
<thead>
<tr>
<th>Losses (lb/ac)</th>
<th>80pct</th>
<th>90pct</th>
<th>100pct</th>
<th>110pct</th>
<th>120pct</th>
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<td>B</td>
<td>427</td>
<td>362</td>
<td>511</td>
<td>444</td>
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</table>

Ground Speed Tests: Conveyor Speed = Ground Speed

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

Amadas Ground Speeds at 100% Conveyor Speed

- 2 mph
- 3 mph
- 4 mph
- 5 mph
**Amadas Ground Speed Tests: Champs**

- **Mechanical Digging Losses, lb/ac**
  - 2 mph: 164
  - 3 mph: 187
  - 4 mph: 463
  - 5 mph: 652

**Amadas Digging Losses as Function of Ground Speed**

- **Slope = 232 lb/ac loss per mph above 3 mph**

**Amadas Economic Analysis**

- **6-row Digger Costs ($/ac)**
  - Revenue: $30/ac
  - Digging Costs: $400/ton

**KMC Ground Speeds at 100% Conveyor Speed**

- **KMC Digging Losses as Function of Ground Speed**
  - **Slope = 274 lb/ac loss per mph above 2 mph**
KMC Economic Analysis

Field Capacity for Various Digging Speeds

4-Row Diggers

<table>
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<th>Speed (mph)</th>
<th>Capacity (ac/hr)</th>
<th>Time (hr/10 ac)</th>
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<tbody>
<tr>
<td>2</td>
<td>2.6</td>
<td>3.8</td>
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<td>2.5</td>
<td>3.3</td>
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6-Row Diggers

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Conclusions

- Best to lag (>80%) or match conveyor speed to ground speed
- Digging losses increase with ground speed: 230-270 lb/ac per mph increase (this test)
- Digging machinery costs decrease with ground speed
- Optimum ground speed for profitability minimizes sum of digging loss costs and digging machinery costs
  - Amadas Belt Conveyor / Champs = 3 mph
  - KMC Chain Conveyor / Wynn = 2 mph

Acknowledgments

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