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% } Lagging
  - 90% }
  - 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)

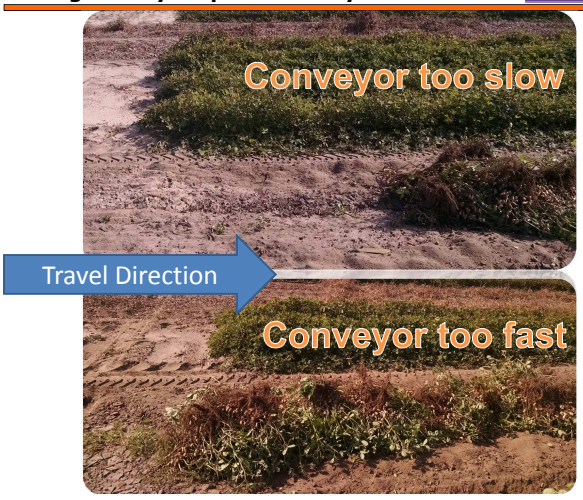
KMC (Wynne)

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

Setting conveyor speed visually



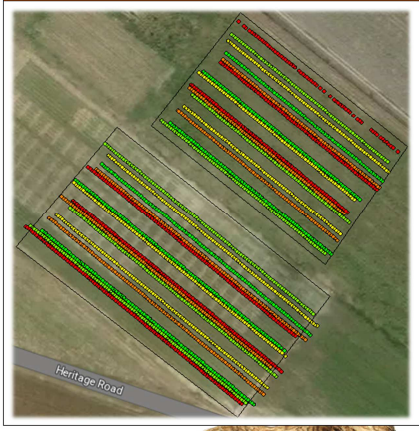
Calculating conveyor speed

- Determine length of conveyor:
  (Rod Spacing) x (# of rods) …convert to feet
- Determine ground speed in ft/min:
  ft/min = (mph) x (88)
- Determine conveyor speed required:

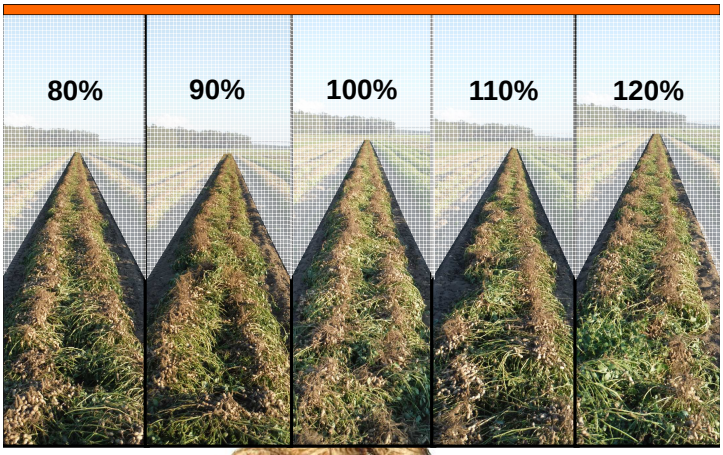
$$\text{Conveyor Speed [rev/min]} = \frac{\text{Ground Speed [ft/min]}}{\text{Conveyor Length [ft/rev]}}$$

$$\text{Conveyor Cycle Time [sec/rev]} = \frac{60\,\text{[sec/min]}}{\text{Conveyor Speed [rev/min]}}$$

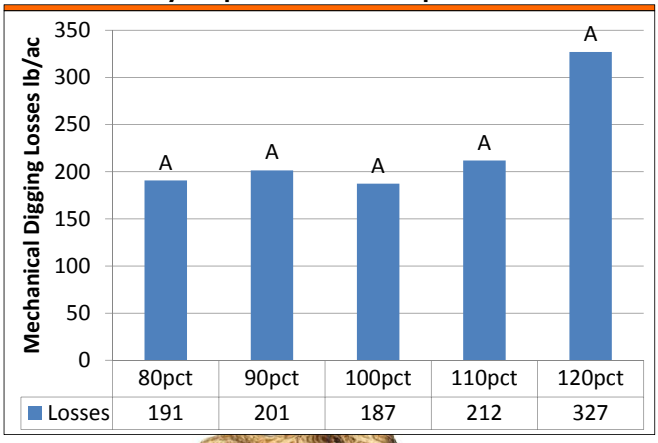
Conveyor Speed Tests: Ground Speed was 3 mph



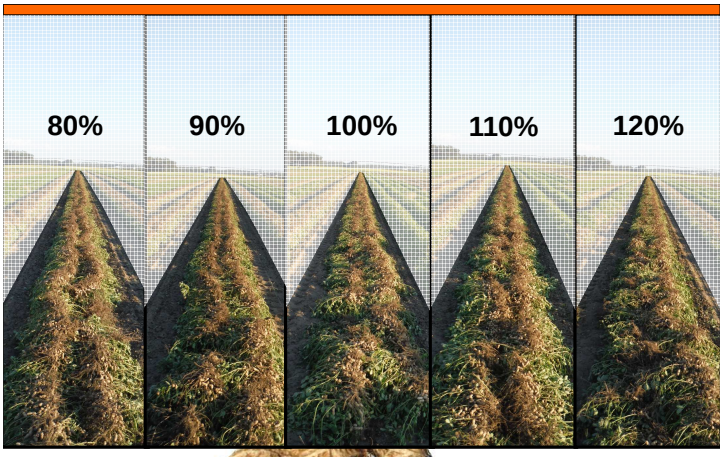
Amadas Conveyor Speeds at 3mph



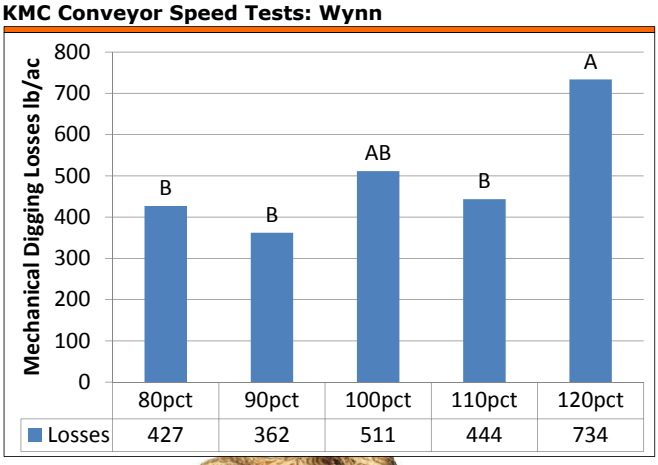
Amadas Conveyor Speed Tests: Champs



KMC Conveyor Speeds at 3mph



KMC Conveyor Speed Tests: Wynn



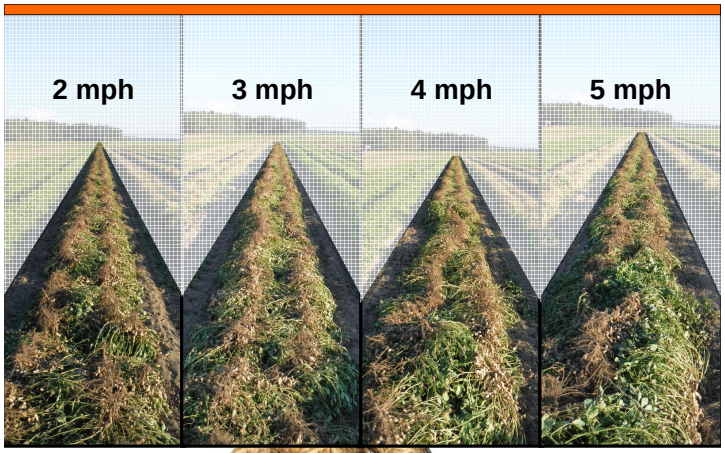
GROUND SPEED TESTS

Ground speed: Literature

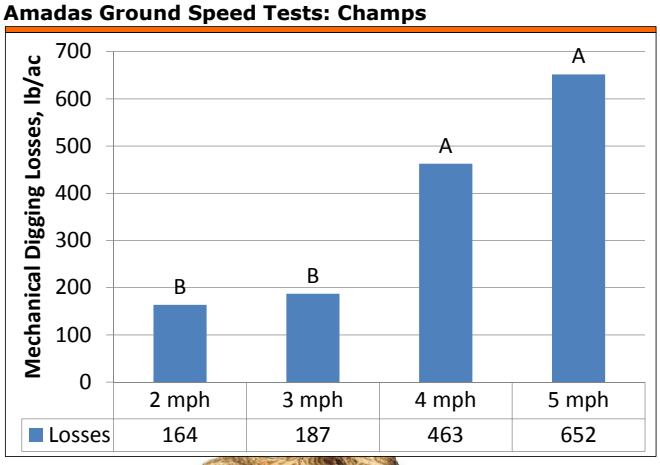
- Amadas: "Starting speed" 2.5 – 3 mph
- KMC: 3 – 3.5 mph
  - Too fast causes bunching
  - Too slow pulls vines apart, pulling off peanuts
- Bader, UGA: 3.5 – 5 mph
- Roberson, NCSU
  - Heavy pod losses at ground speeds in excess of 4 mph

Ground Speed Tests: Conveyor Speed = Ground Speed

Amadas Ground Speeds at 100% Conveyor Speed



Amadas Ground Speed Tests: Champs



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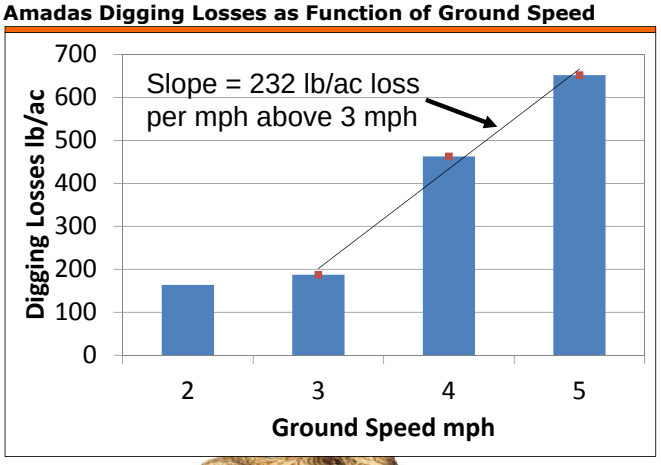
Amadas Digging Losses as Function of Ground Speed



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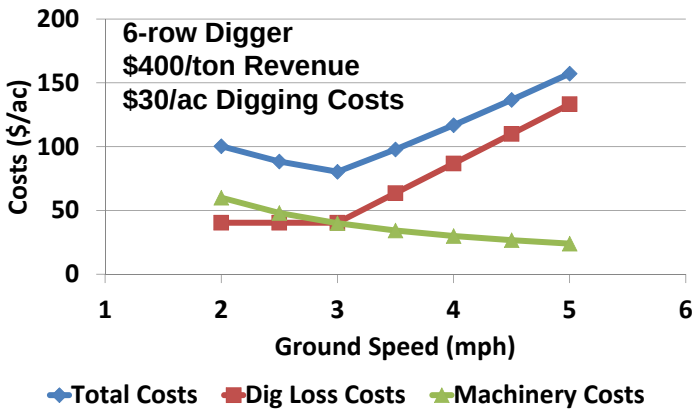
Amadas Economic Analysis



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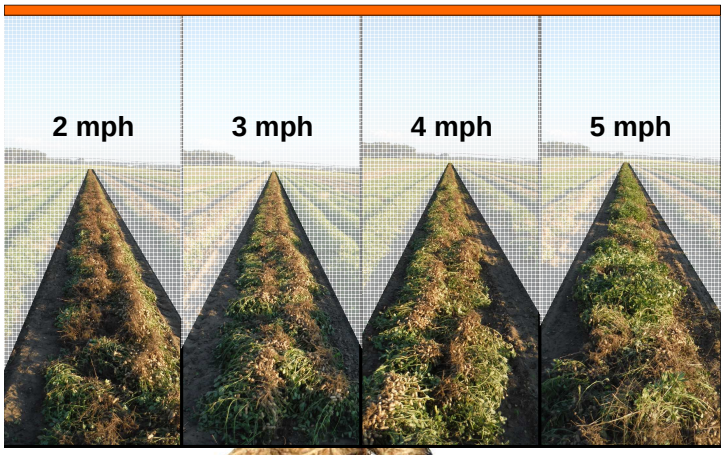
KMC Ground Speeds at 100% Conveyor Speed



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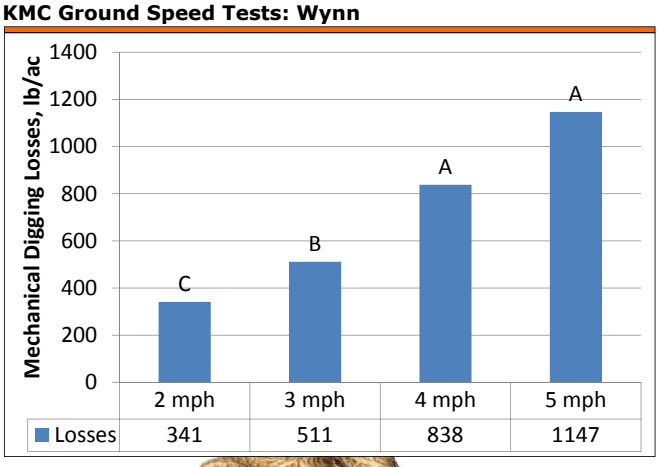
KMC Ground Speed Tests: Wynn



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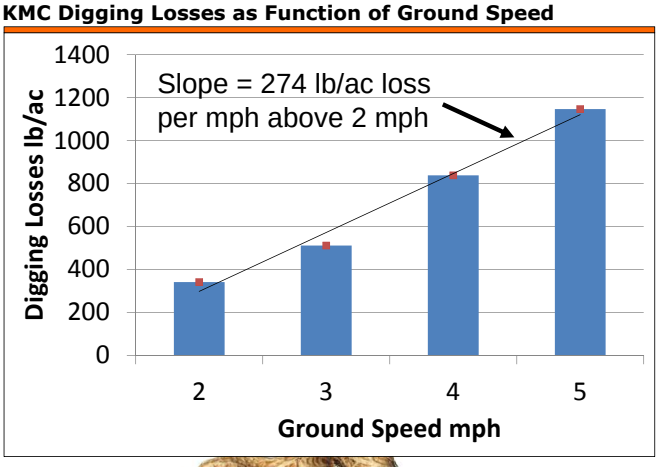
KMC Digging Losses as Function of Ground Speed



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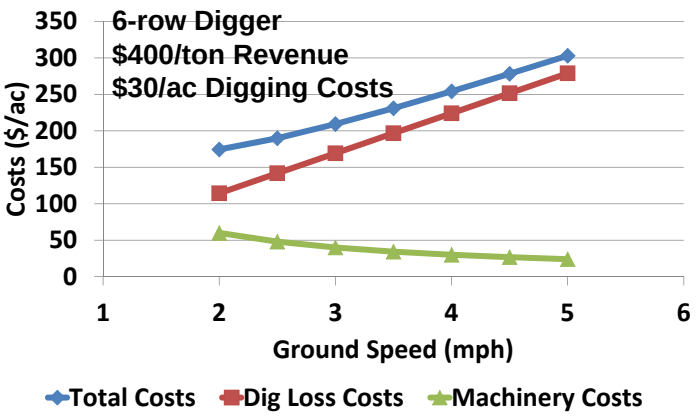
KMC Economic Analysis



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

CONCLUSIONS

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

- Clemson Ag Mech & Business Undergraduate Program
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