



An Economic Platform-based Harvest Assist Device

Paul Heinemann, Professor and Head
Department of Agricultural and Biological Engineering
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The Development Team

|| Zhao Zhang, Ph.D. student (primary developer)

|| Jude Liu, Ag & Biol. Engineering

|| Jim Schupp, FREC, Plant Science

|| Tara Baugher, Adams County Extension

|| Andy Freivalds, Industrial Engineering

The Commercialization Team

Demetri Patitsas, College of Business

Alyssa Looney, College of Business

Judd Michael, ABE, ESM

Jacob Charles, undergraduate student

Manny Leon, undergraduate student

Objective of Project

Design, fabricate, and test a low-cost harvest-assist device

Take advantage of existing platforms

Investigate fruit handling (minimize bruising)

Determine efficiency compared to ladder picking

Compare ergonomics with ladder picking

Started with a commercially-available platform

ORSI eco-pick -- self-propelled, battery-driven

lasts more than a full day
on a charge



The device

Targets:

low cost (<\$10,000 for device)
platform-independent
reduced fatigue and injury
increased throughput

The device

Four components



Receiver

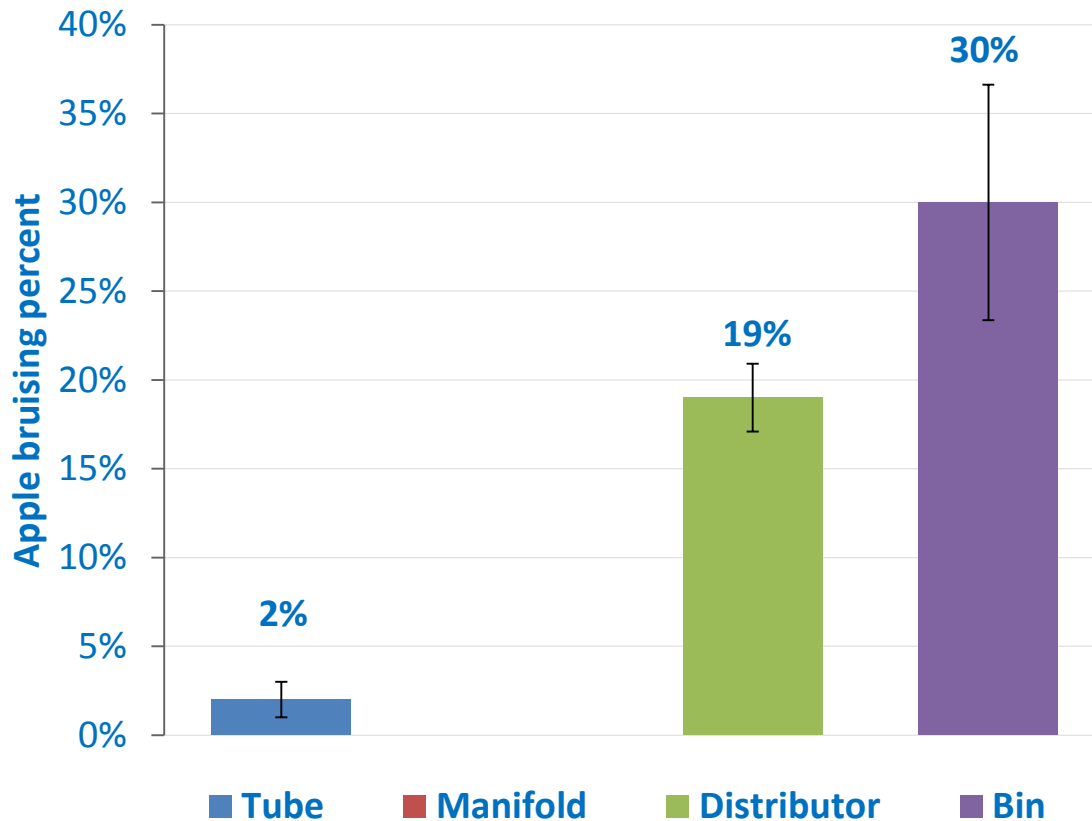
Tube

Manifold

Distributor

Bruising results - 2013 field test

high bruising, attributed to one component

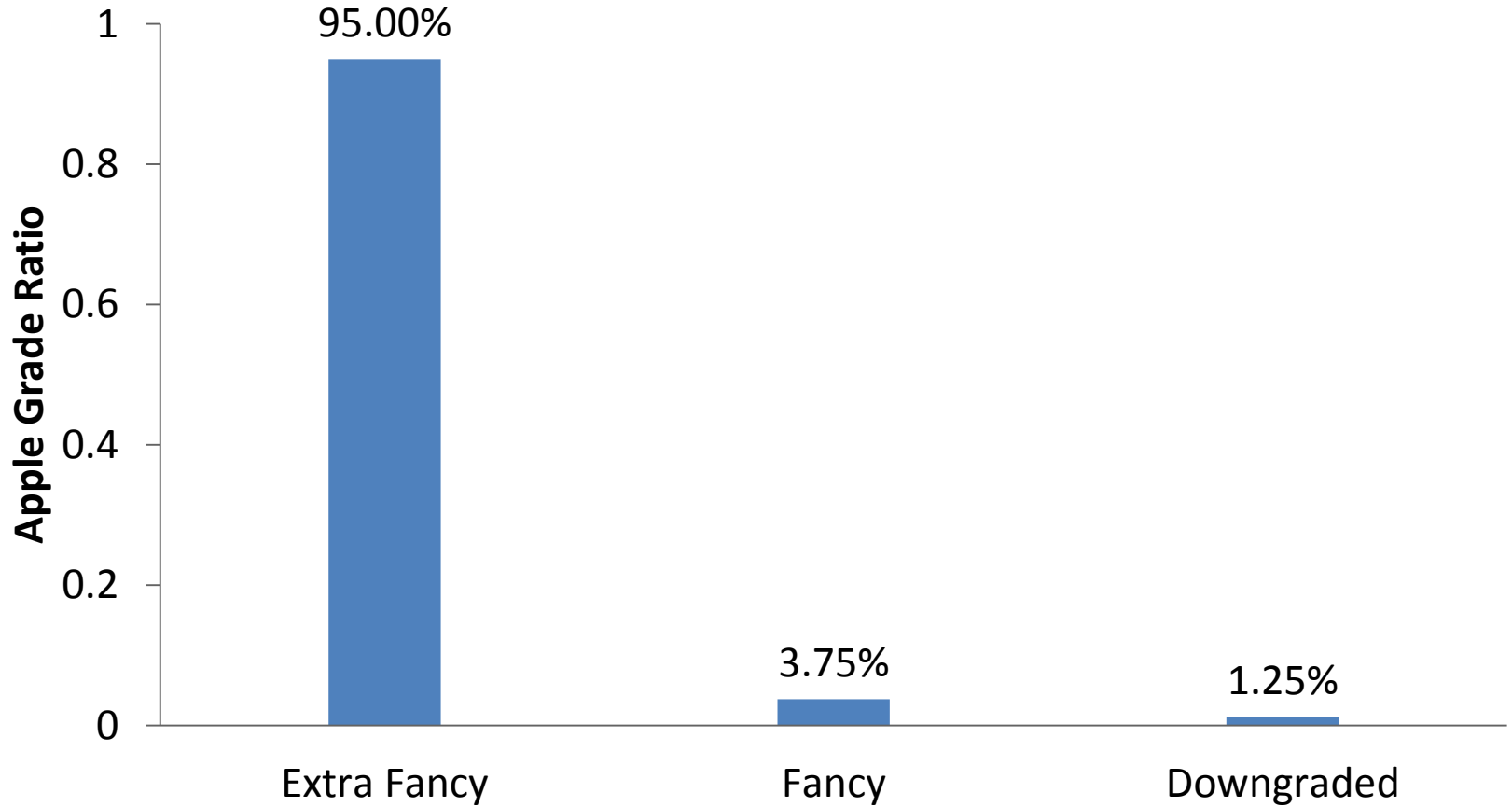


Bruising results

2014 – focused on redesign of distributor to improve performance and reduce bruising



Bruising results – 2014 field tests



Efficiency results

How does this unit improve efficiency?



Fraction of harvest time devoted to ladder picking

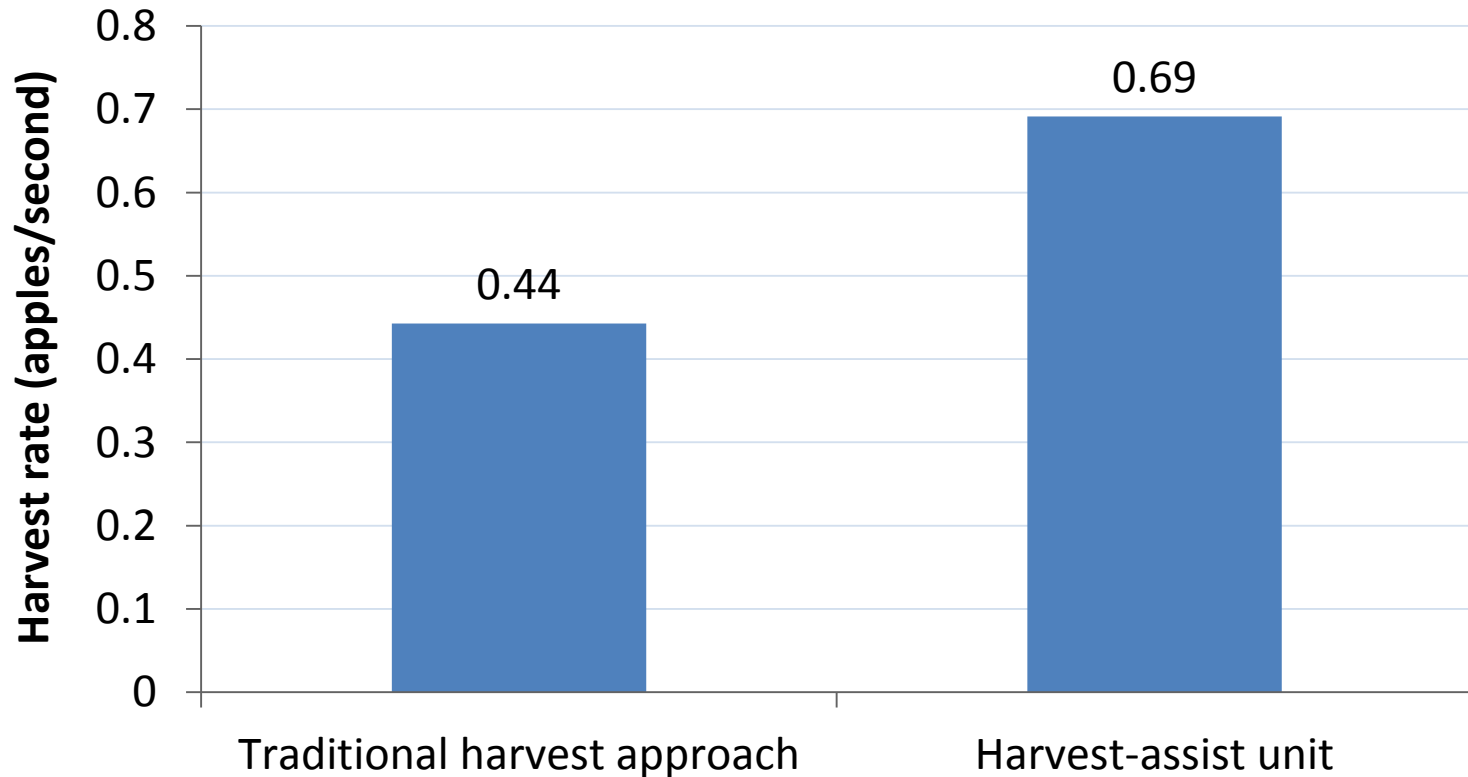
| Activities | Time Percentage |
|--------------------|-----------------|
| Walk to bin | 0.01 |
| Climb up ladder | 0.06 |
| Walk away from bin | 0.03 |
| Climb down ladder | 0.06 |
| Dump apples | 0.05 |
| Walk to ladder | 0.03 |
| Move ladder | 0.06 |

Sum = 0.3 = 30%

For our harvest-assist unit, we eliminate this 30%.

Efficiency

High apple picking – ladder vs. harvest-assist device (includes time to move equipment, dump apples, etc.)



Efficiency increased: 56.8%

Ergonomic results

Evaluated by video – observing postures and stress positions

There are different ways to evaluate – ergonomic “scores”

RULA – Rapid Upper Limb Assessment

“A RULA assessment gives a quick and systematic assessment of the postural risks to a worker.” – CUErgo, Cornell University

Ergonomic results

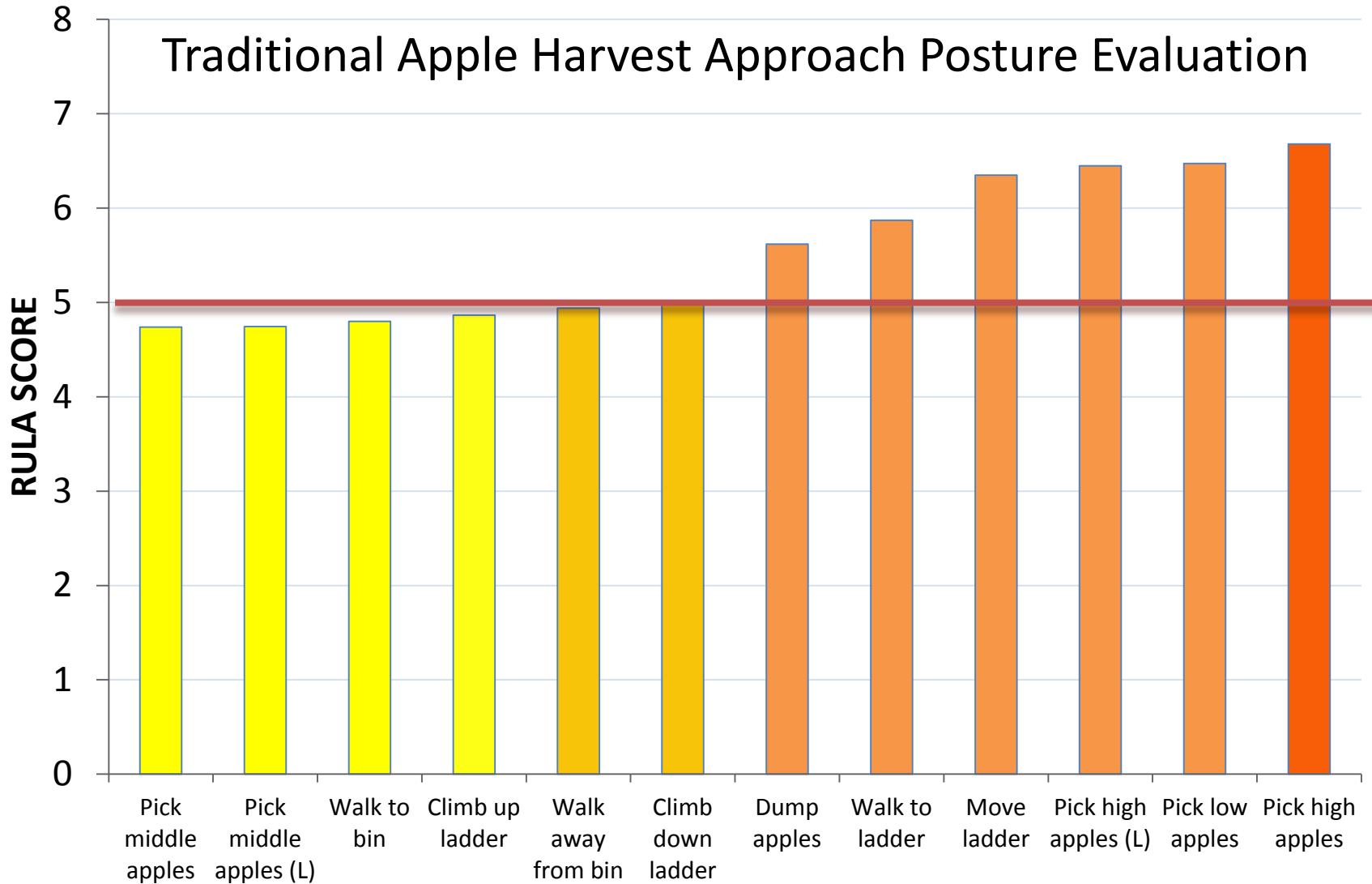
| Action level | RULA score | Interpretation |
|--------------|------------|---|
| 1 | 1-2 | Working in the best posture with no risk of injury from their work posture . |
| 2 | 3-4 | Working in a posture that could present some risk of injury from their work posture, and should be investigated and corrected. |
| 3 | 5-6 | Working in a poor posture with a risk of injury from their work posture, need to be investigated and changed in the near future to prevent an injury |
| 4 | 7+ | Working in the worst posture with an immediate risk of injury from their work posture, need to be investigated and changed immediately to prevent an injury |

from CUergo, Cornell University Ergonomics website

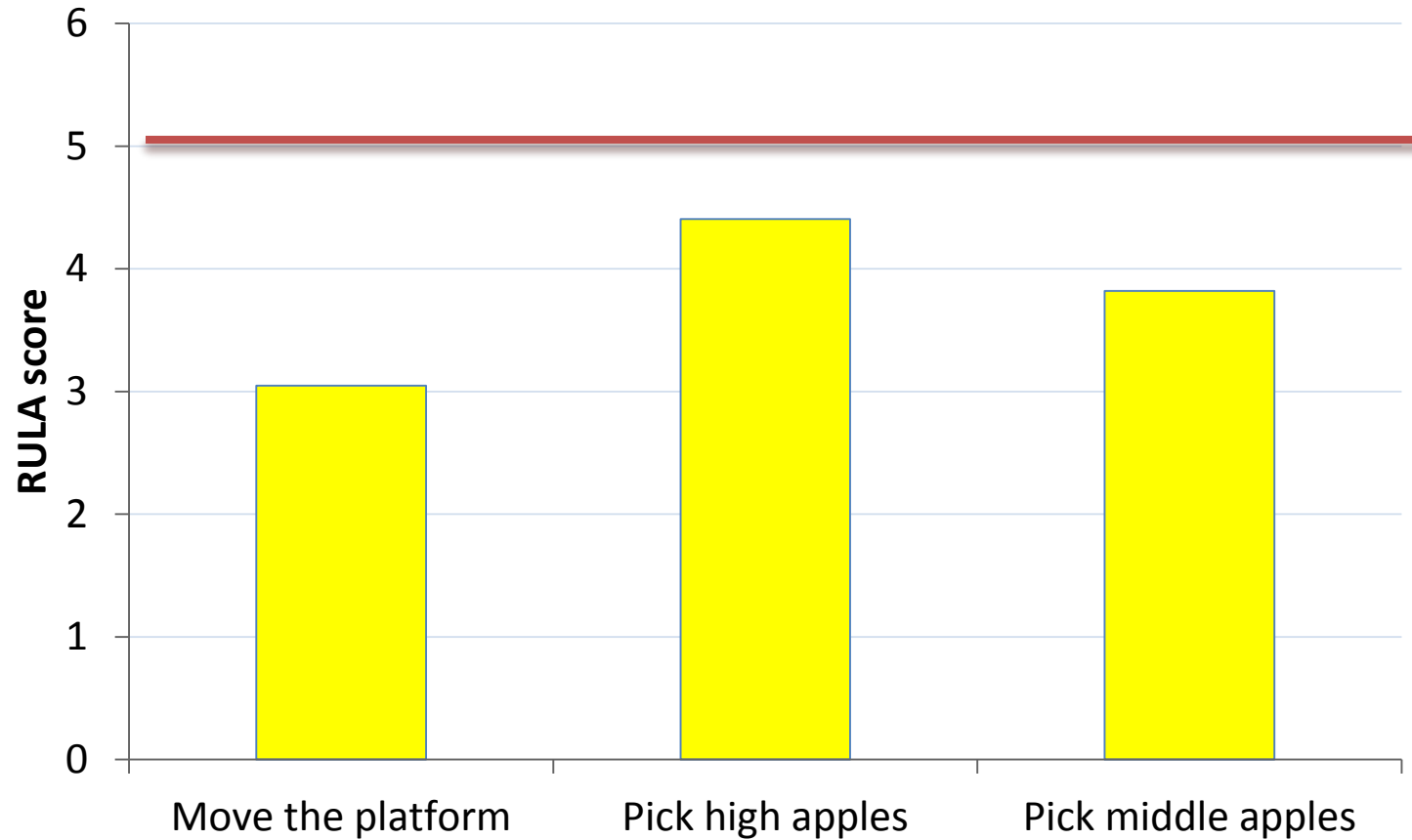
Breakdown of picking tasks



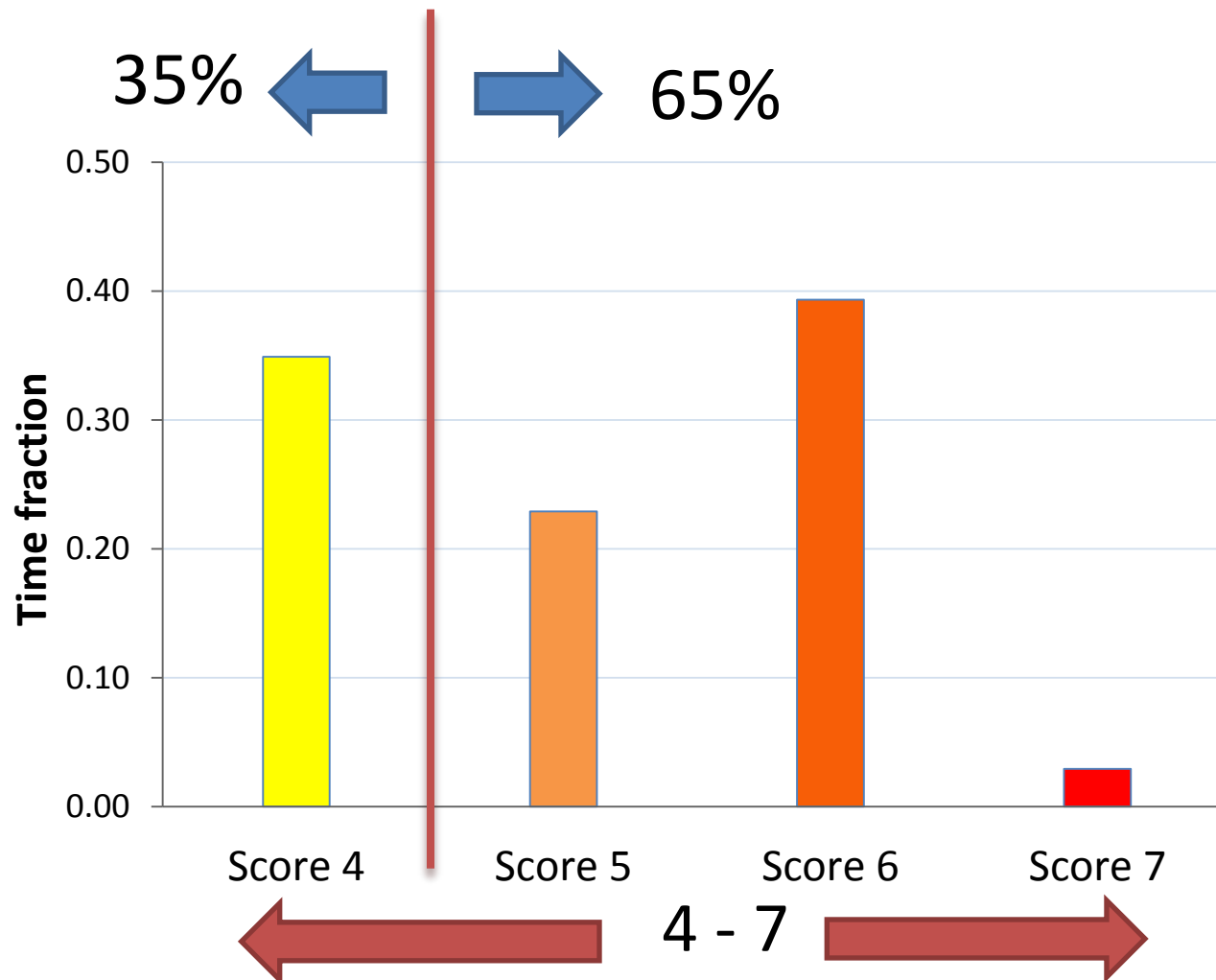
Traditional Apple Harvest Approach Posture Evaluation



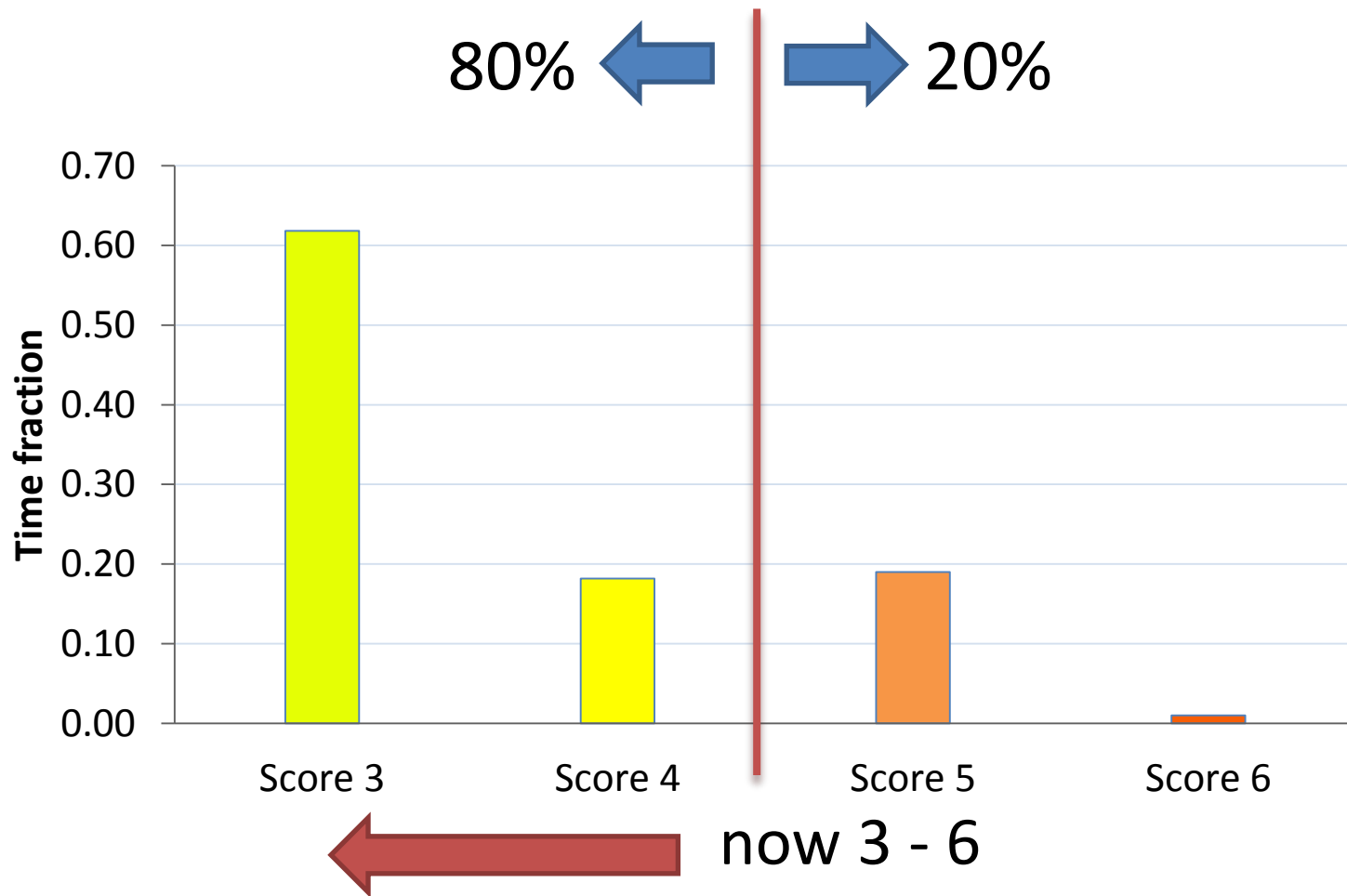
Harvest-assist Approach Posture Analysis



Traditional Harvest – Fraction of time under different RULA scores



Harvest-assist – fraction of time under different RULA scores



Scores below 5:

35% → 80%

Eliminates most
hazardous postures

The **Research Applications Innovation (RAIN) grant program**

Sponsored by PSU College of Agricultural Sciences

The **goal** of RAIN is to create and advance opportunities to commercialize research from the College of Agricultural Sciences.

The **purpose** of RAIN is to provide financial support that will enable researchers to realize the commercial potential of ongoing research projects.

The **impact** of RAIN is to stimulate economic development through the transfer of technologies to the marketplace.

This project received funding from the RAIN program for 2014-15.

Apple grower marketing survey:

Please help us with a short survey (available on paper here, and online)

Summary

- We have developed a low-cost platform-mounted device
- Bruising levels are in or close to acceptable range
- Efficiency is improved
- Ergonomics are improved – lower risk of injury
- Investigating commercialization with potential partners

Other Sources of Support:

The Pennsylvania Department of Agriculture provided support for the initial development and testing (2012-14)

The State Horticultural Association of Pennsylvania (2012-13)

Thank you.



Questions?