

Precision Farming & Organic Crops

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Roger Knutson
12-January 2013

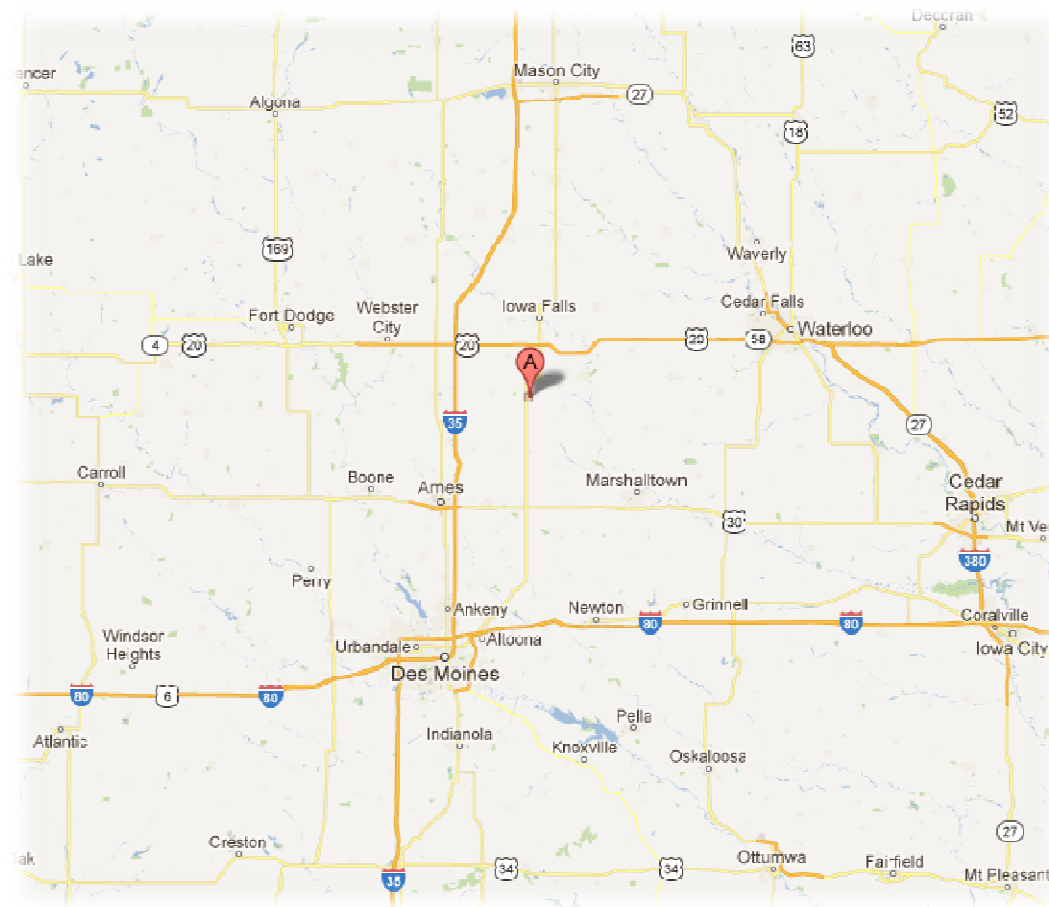


Acknowledgements

- Lindsay Bolson
- Roger & Mary Knutson
- Sarah Carlson & PFI



Location



Organic crop strategy

- 1999 organic introduction

- Primary crops

- Corn (36" rows; 32,500)
- Soybeans (36" rows; 160,000)
- Oats (8" rows)

- Secondary crops

- Buckwheat
- Wheat
- Alfalfa & clover
- Rye



Enterprise crop strategy

- Organic
 - Corn
 - Soybeans
 - Oats
- Sustainable
 - Conventional (non-GMO) soybeans
 - Conventional (non-GMO) corn
 - Conventional oats



Crop management tools

Current/traditional

- Pre-plant tillage
 - Plow
 - Disc
 - Field cultivator
 - Drag
- Post-plant/pre-emerge tillage
 - Tine harrow
 - Rotary hoe
- Post-emerge cultivation
 - Rolling cultivator
 - Traditional shovel/sweep cultivator



Crop management tools

Current/traditional



Crop management tools

Current/traditional



Crop management tools

Current/traditional



Crop management tools

Current/traditional



Crop management tools

Current/traditional



Crop management tools

Additional/legacy opportunities



Crop management tools

Additional/legacy opportunities



John Koschmeder, Riceville, IA



Crop management tools

Additional/legacy opportunities



Crop management tools

Additional/legacy opportunities

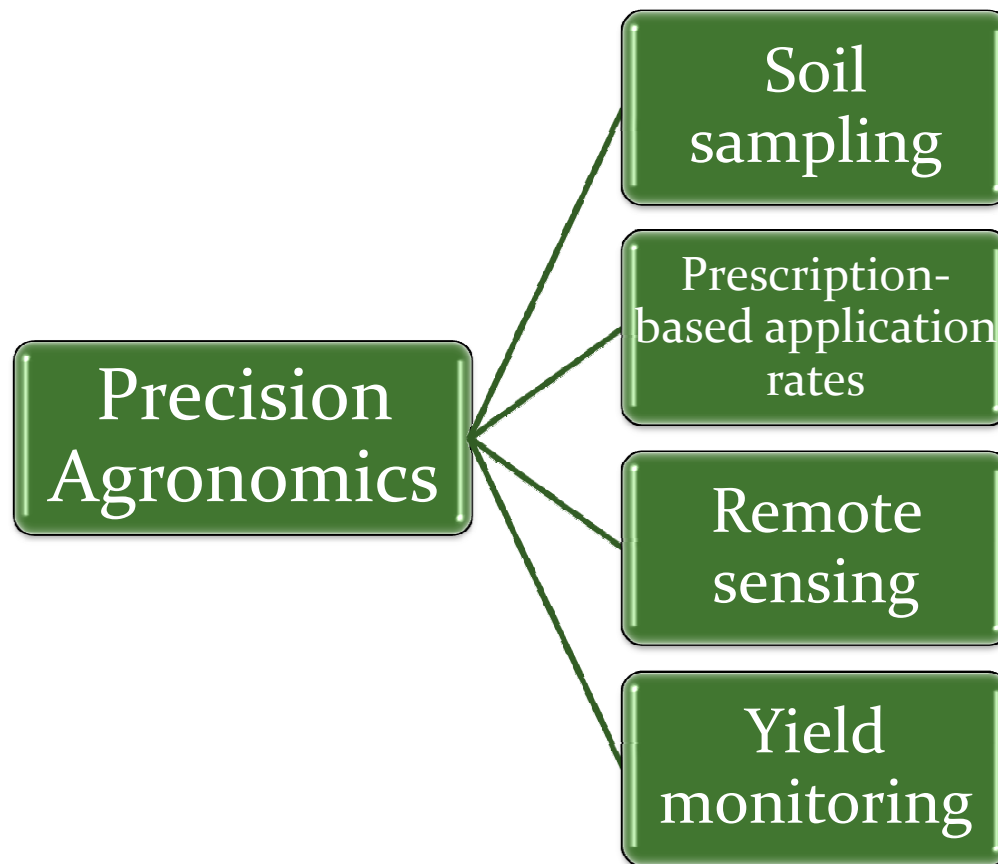


www.organicweedpuller.com



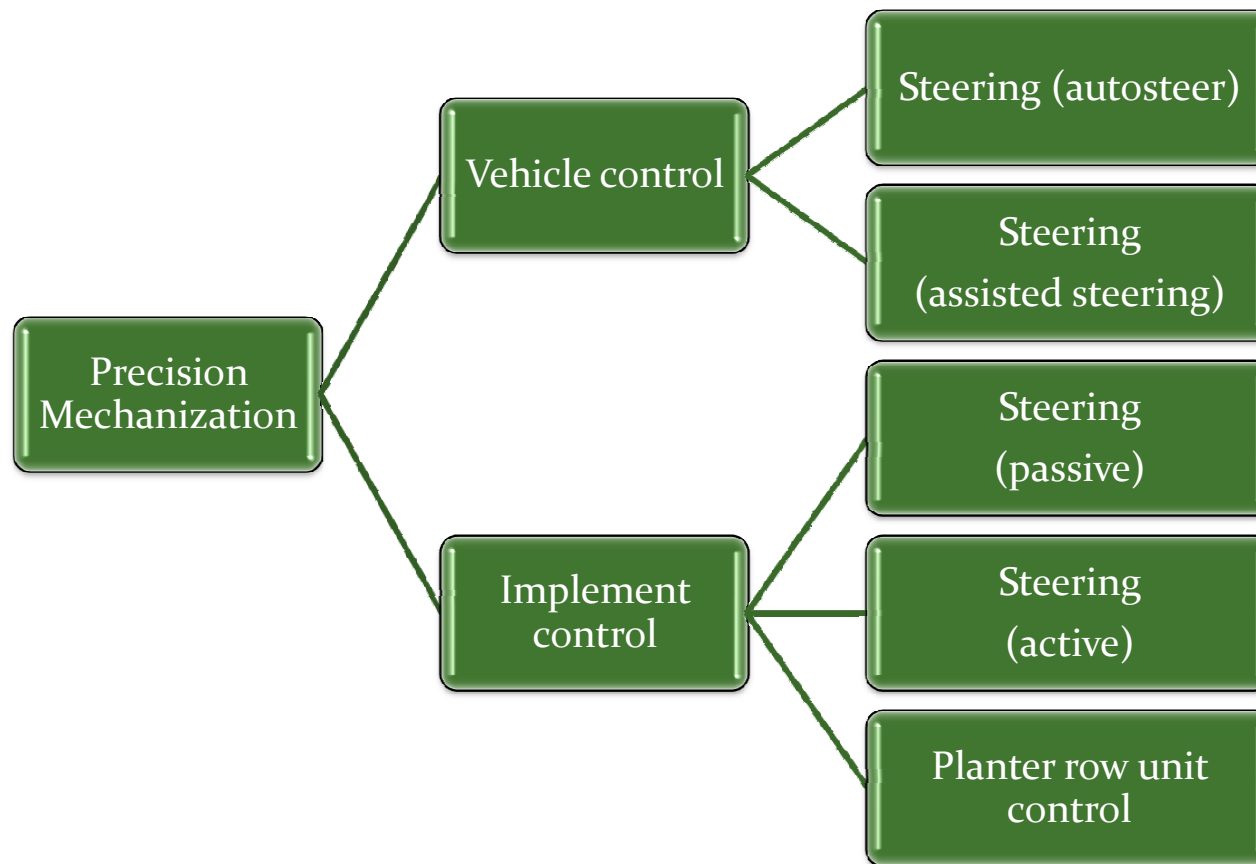
Precision farming

What is it?



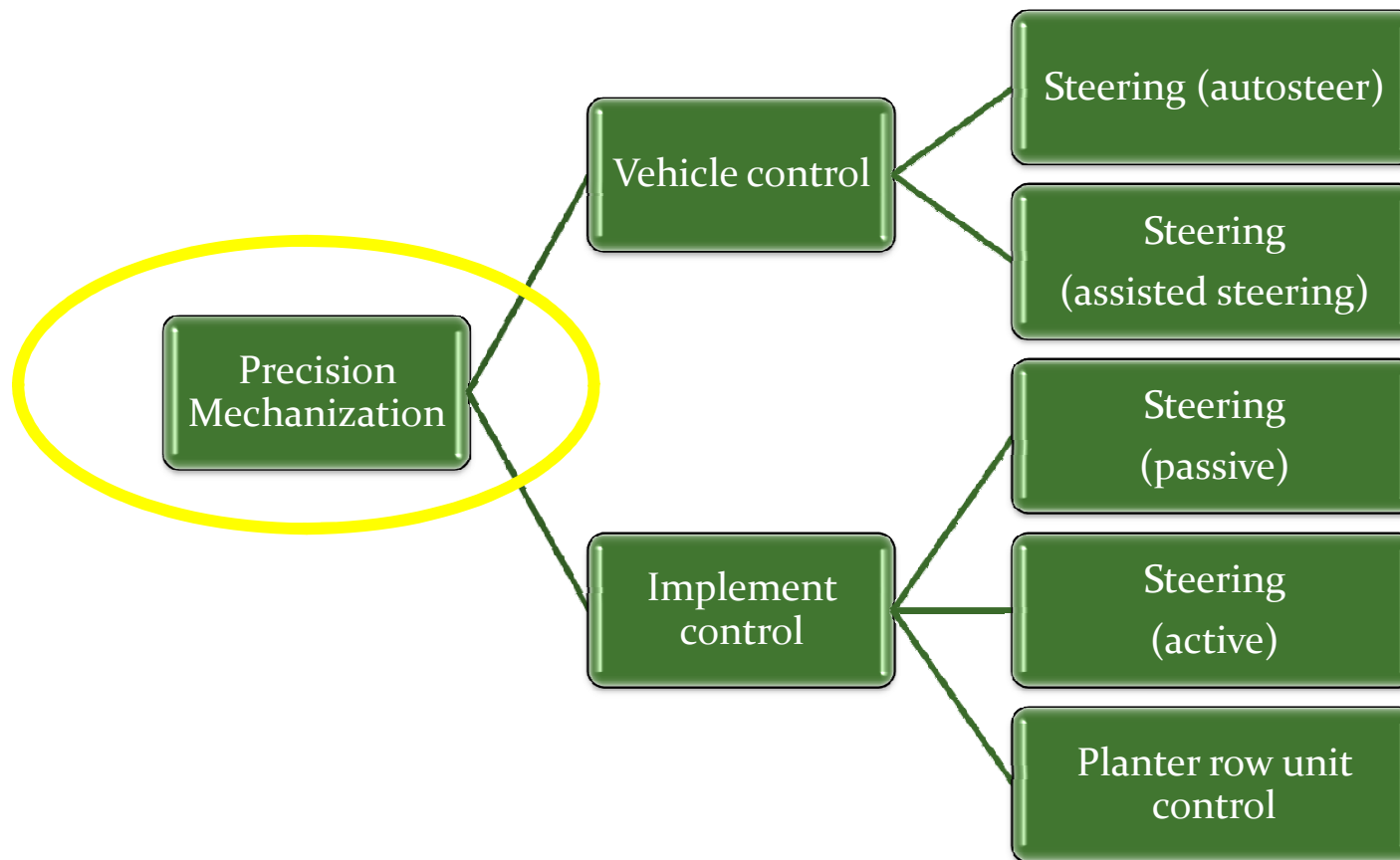
Precision farming

What is it?



Precision farming

What is it?



Precision farming integration

2007: Autoguidance



Precision farming integration

2012: Assisted steering, RTK



Precision farming integration

2013: Assisted steering, ultrasonic sensors



Precision farming

So what does precision mechanization mean to an organic farmer?

Precision farming Yesterday

Precision organic mechanization is not new!
....except it has been human powered or human assisted.



Precision mechanization Yesterday



Precision mechanization Yesterday



Precision mechanization Yesterday



Precision mechanization Yesterday



www.organicweedpuller.com

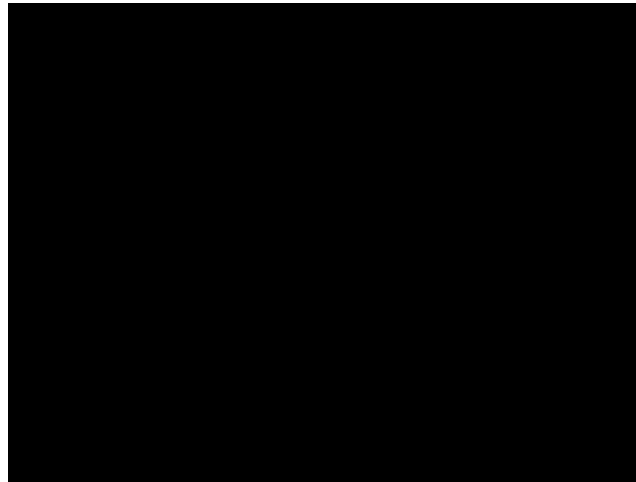


Precision mechanization Yesterday



Precision mechanization

Yesterday



Precision mechanization

Today

What about today? What opportunities have arisen because of precision mechanization?



Precision mechanization (today)

Cultivation



Precision mechanization (today)

Hands-free cultivation



Precision mechanization (today)

Enhanced blind cultivation

BLIND CULTIVATION

"Blind cultivation" is the easiest and best opportunity to destroy the weeds that would be growing within the rows and presenting direct competition to the crop. In blind cultivation, the entire field is tilled shallowly with the implement, paying little attention to where the rows are.

The point of blind cultivation is to stir the top 1 to 2 inches of soil, adding air and causing the millions of tiny germinating weed seeds to dry out and die. The larger crop seeds germinate below the level of the cultivation and are not usually damaged by this operation. Weed seedlings are very vulnerable to drying out and to burying at this stage, and by doing an effective job of blind cultivation, you can achieve the biggest possible crop/weed size differential from the start. Blind cultivation also can break a soil crust, allowing crop seedlings to emerge.

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A VOICE FOR TECH-AGRICULTURE
August 2002 • Vol. 32, No. 8

Organic Weed Control
Cultural & Mechanical Methods



Precision mechanization (today)

Alternative cropping practices



Controlled traffic

www.mitchellfarm.com



Precision mechanization (today)

Alternative cropping practices



Strip intercropping: 2010, 230 bu/ac

Precision mechanization (today)

Alternative cropping practices



Precision mechanization

Tomorrow

So what's the future? What are the emerging opportunities? What are our goals?

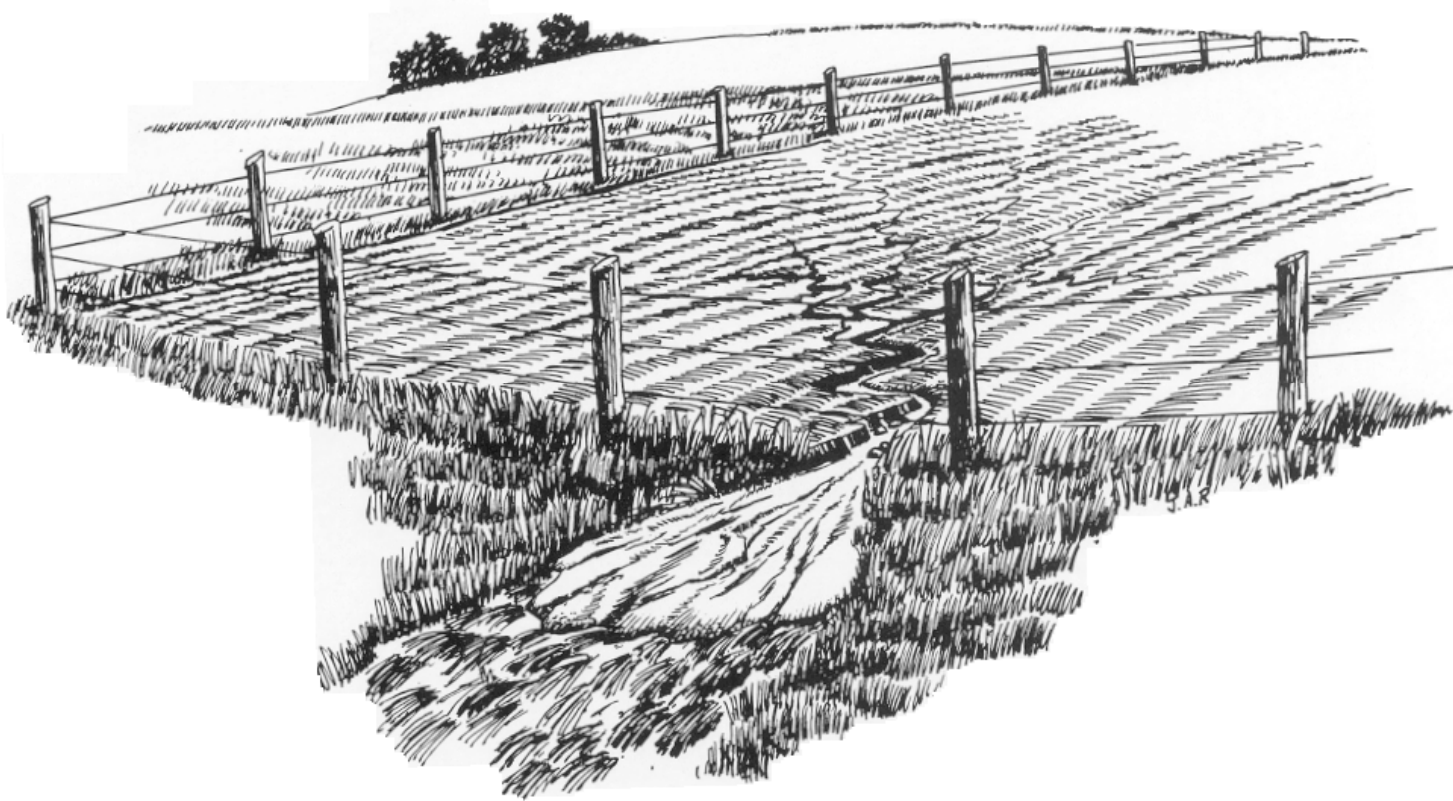


Precision mechanization
Tomorrow

Erosion

Precision mechanization

Tomorrow



http://www.maswcd.org/Youth_Education/StudyGuides/Soils_study_guide.htm

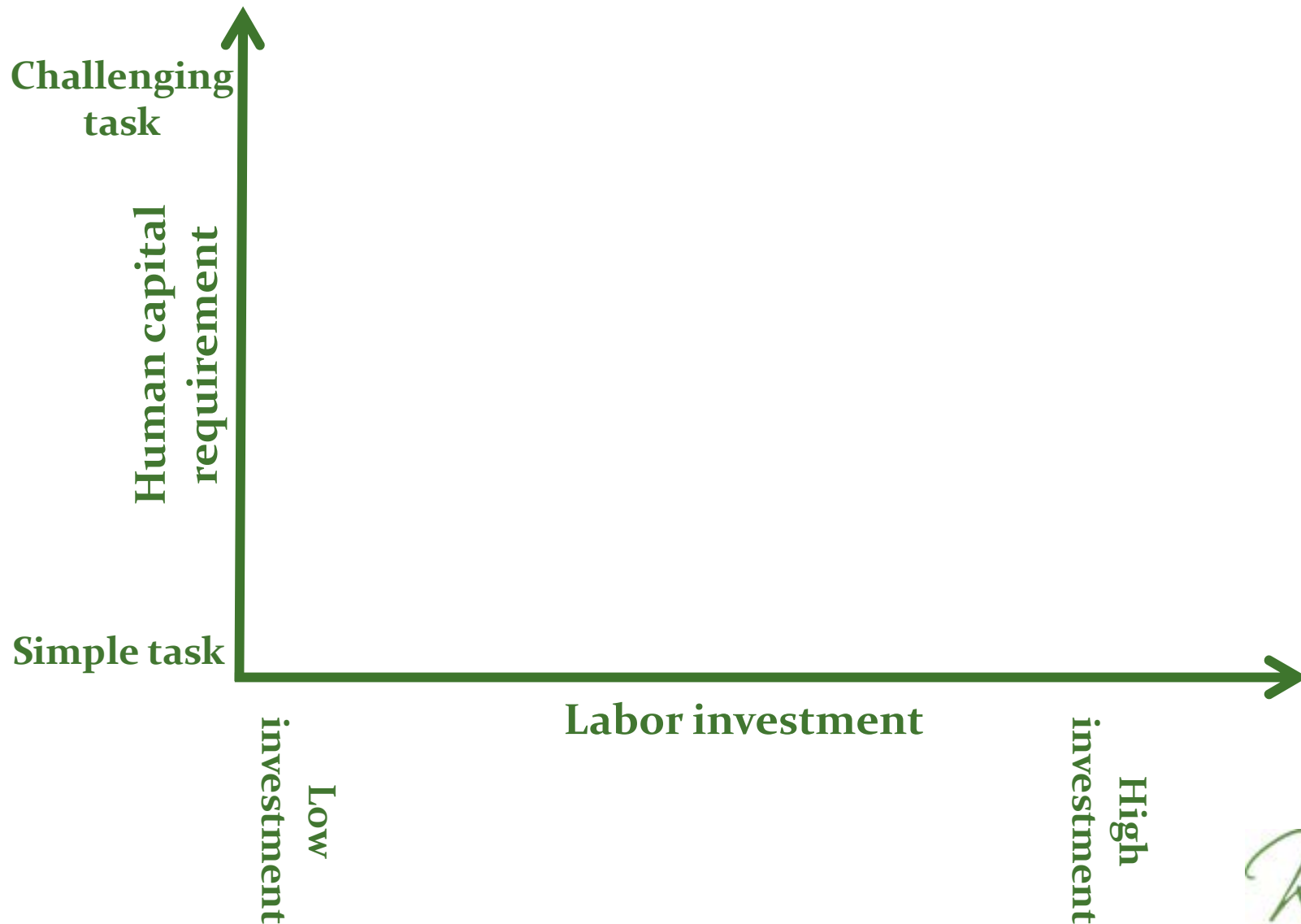


Precision mechanization
Tomorrow

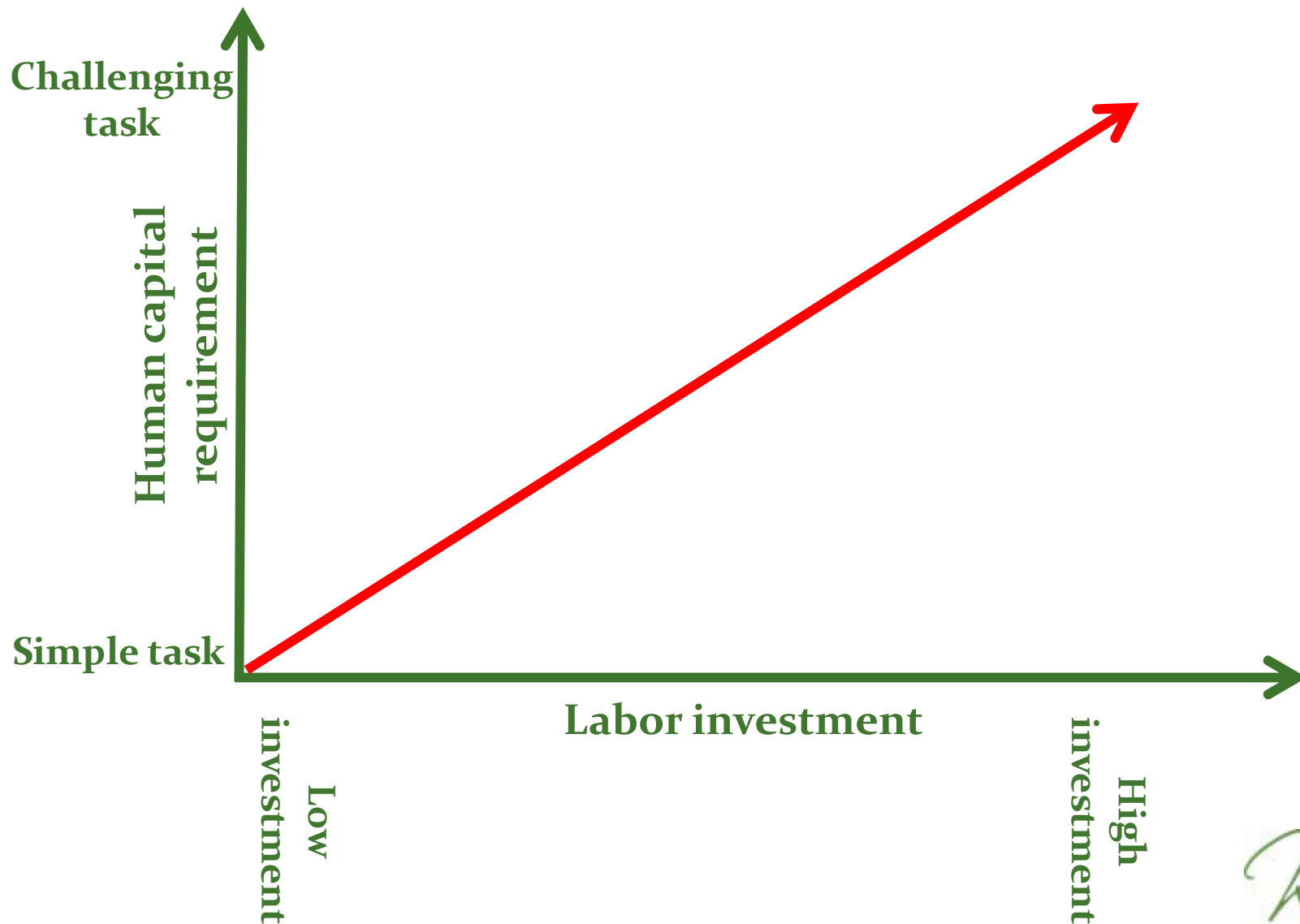
Labor



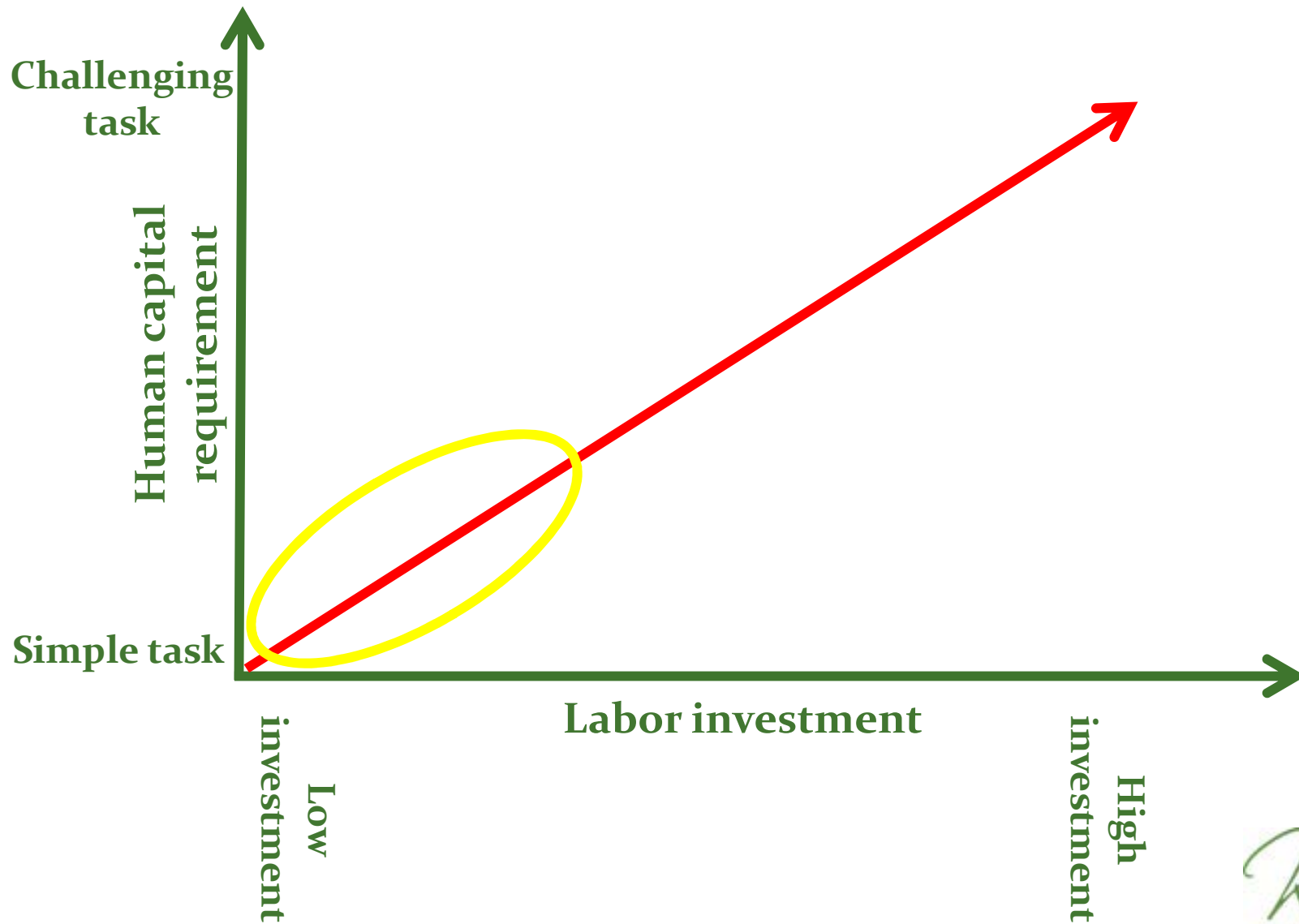
Precision mechanization Tomorrow



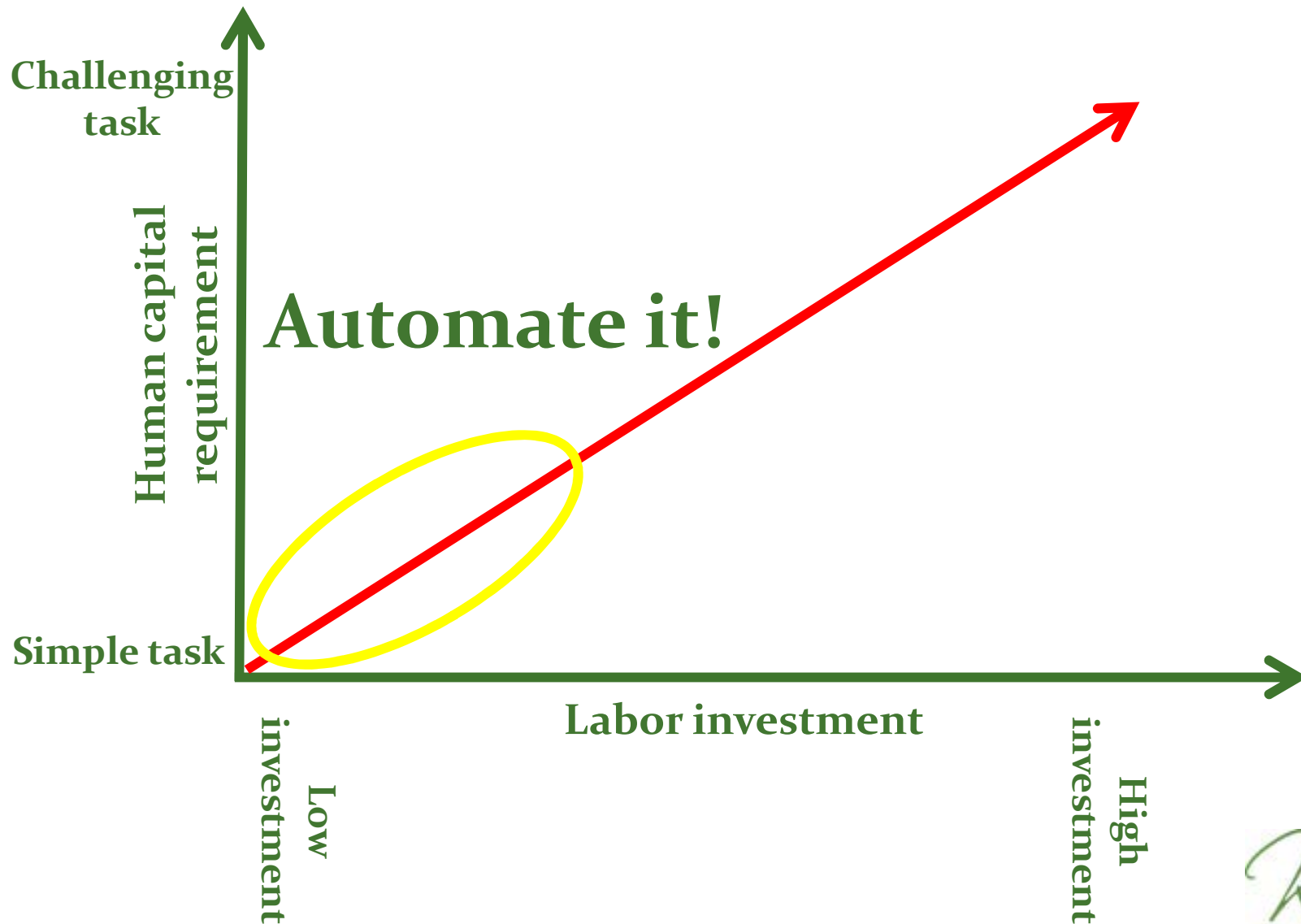
Precision mechanization Tomorrow



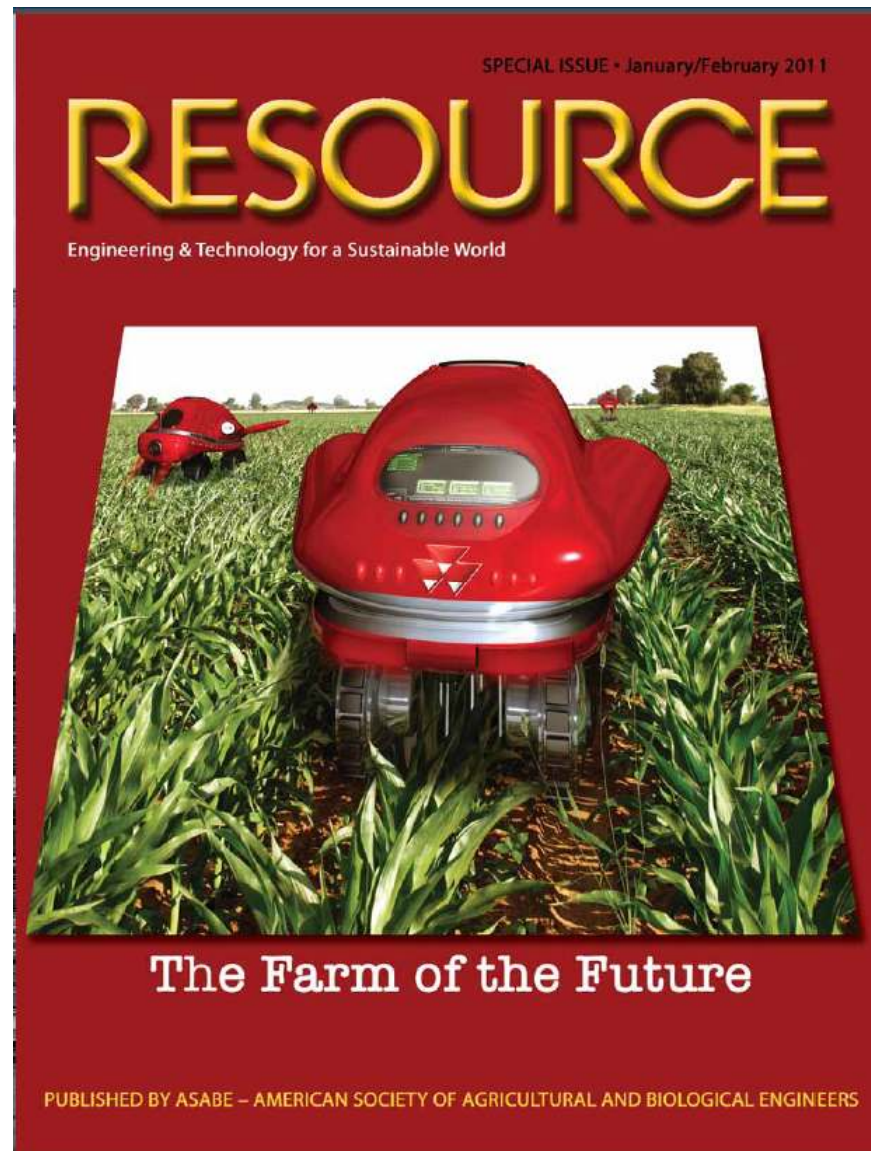
Precision mechanization Tomorrow



Precision mechanization Tomorrow



Precision mechanization Tomorrow



Precision mechanization (tomorrow)

ASABE Farm of the Future

“What about robotics? The vision of robots working on a farm is not too far into the future.”

Dr. Simon Blackmore, FutureFarm



Precision mechanization (tomorrow)

ASABE Farm of the Future

“Speaking from experience. By combining traditional farming lessons – using nature as a guide – with state-of-the-art technology, and by combining flexible thinking with the proper government policies, we can integrate the best of our past, current, and future practices. Our future dividends will be substantial, but only if we protect our agricultural capital.”

Howard Buffett, Howard G. Buffett Foundation



Precision mechanization (tomorrow)

ASABE Farm of the Future

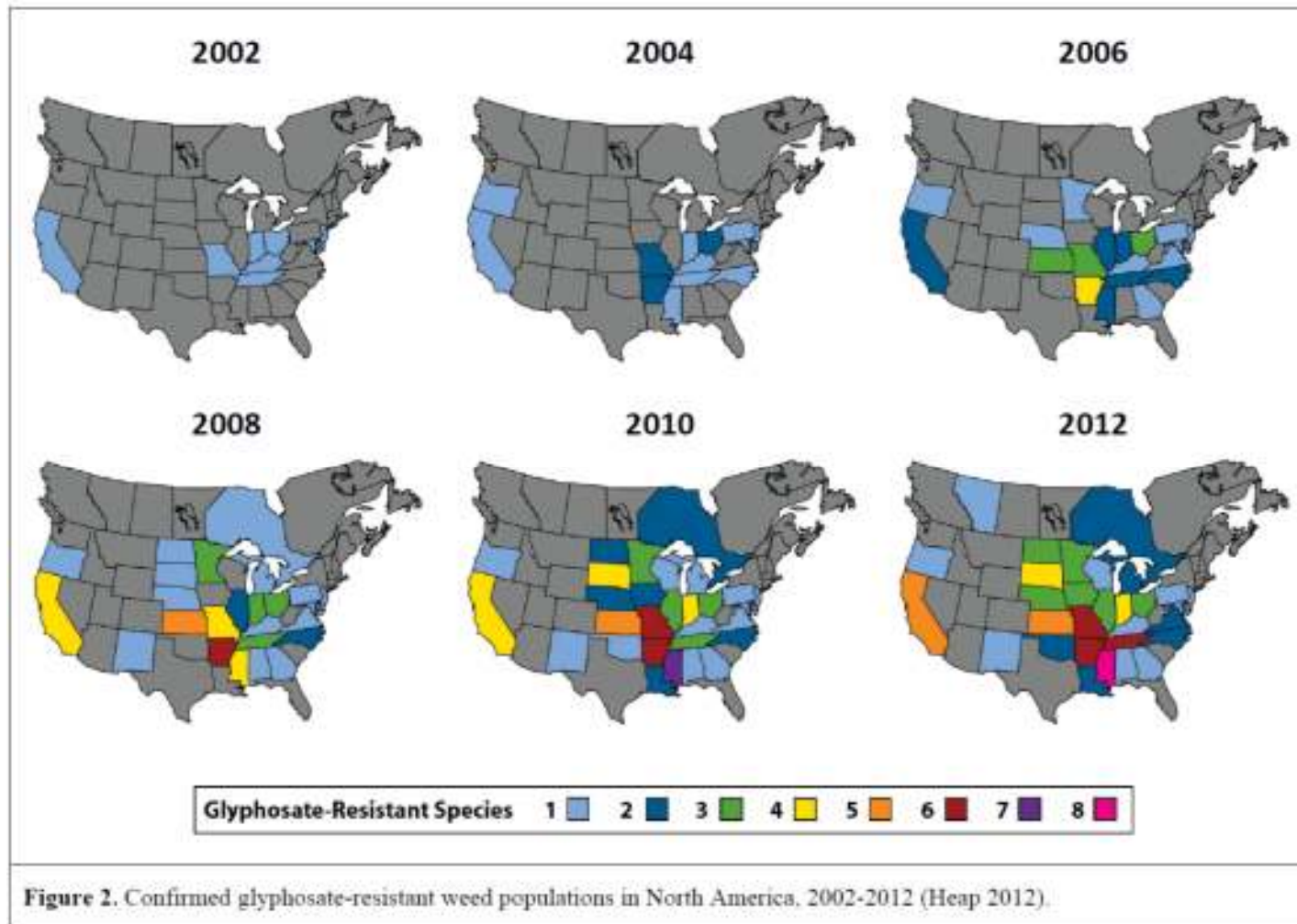
“What does the specialty crop farm of the future look like?
Automation that replaces human labor.... Economic forces will
demand it, and engineers will provide it.”

Francis Pierce, Washington State University



Precision mechanization (tomorrow)

Herbicide resistance



Precision mechanization (tomorrow)

Herbicide resistance

Hoosier Ag Today, 04 March 2012, “The End of the Chemical Era”

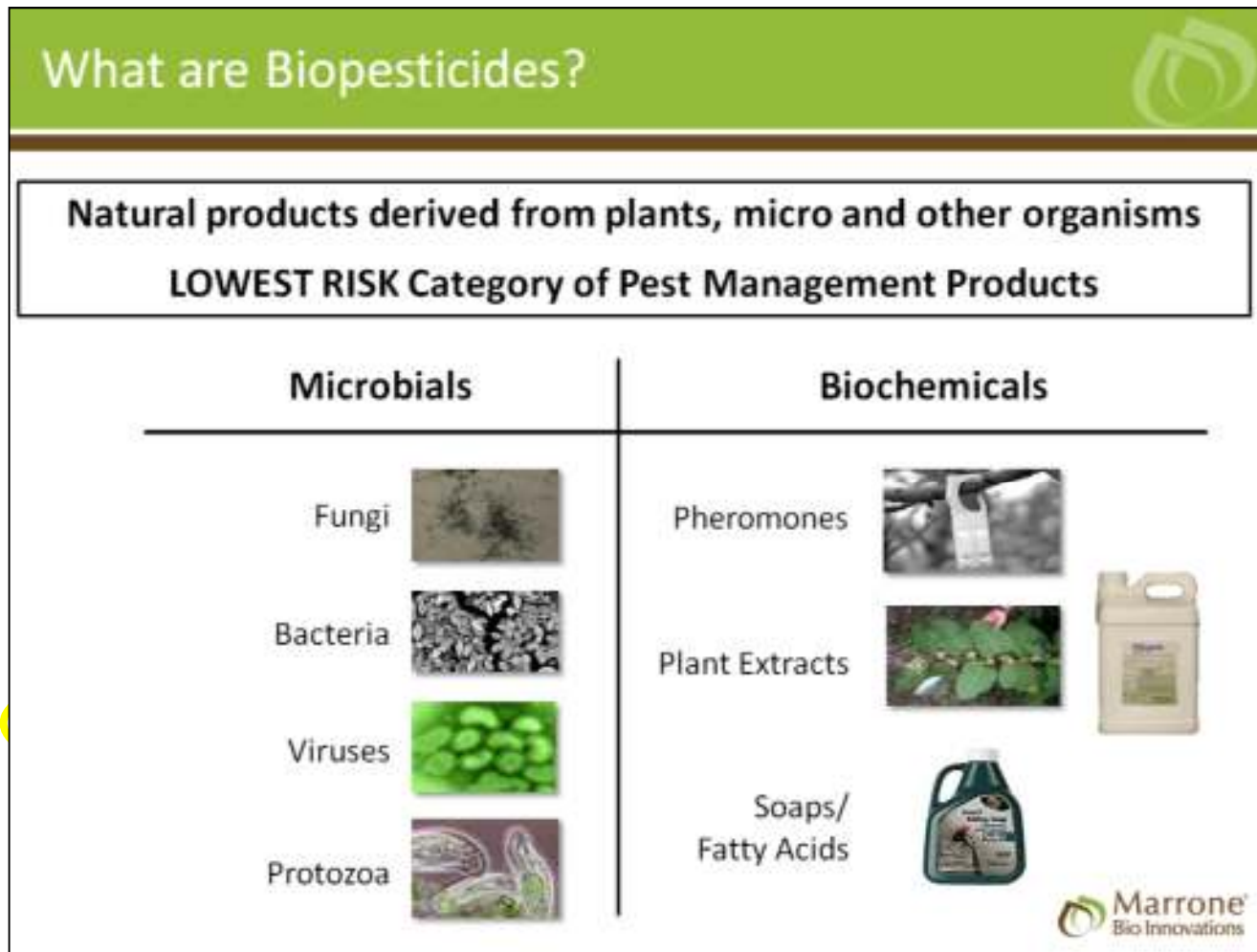
“We may soon run out of chemicals to control weeds.... Stachler sees a future with robotic weed control.”

Dr. Jeff Stachler, North Dakota State University



Precision mechanization (tomorrow)

Biopesticides

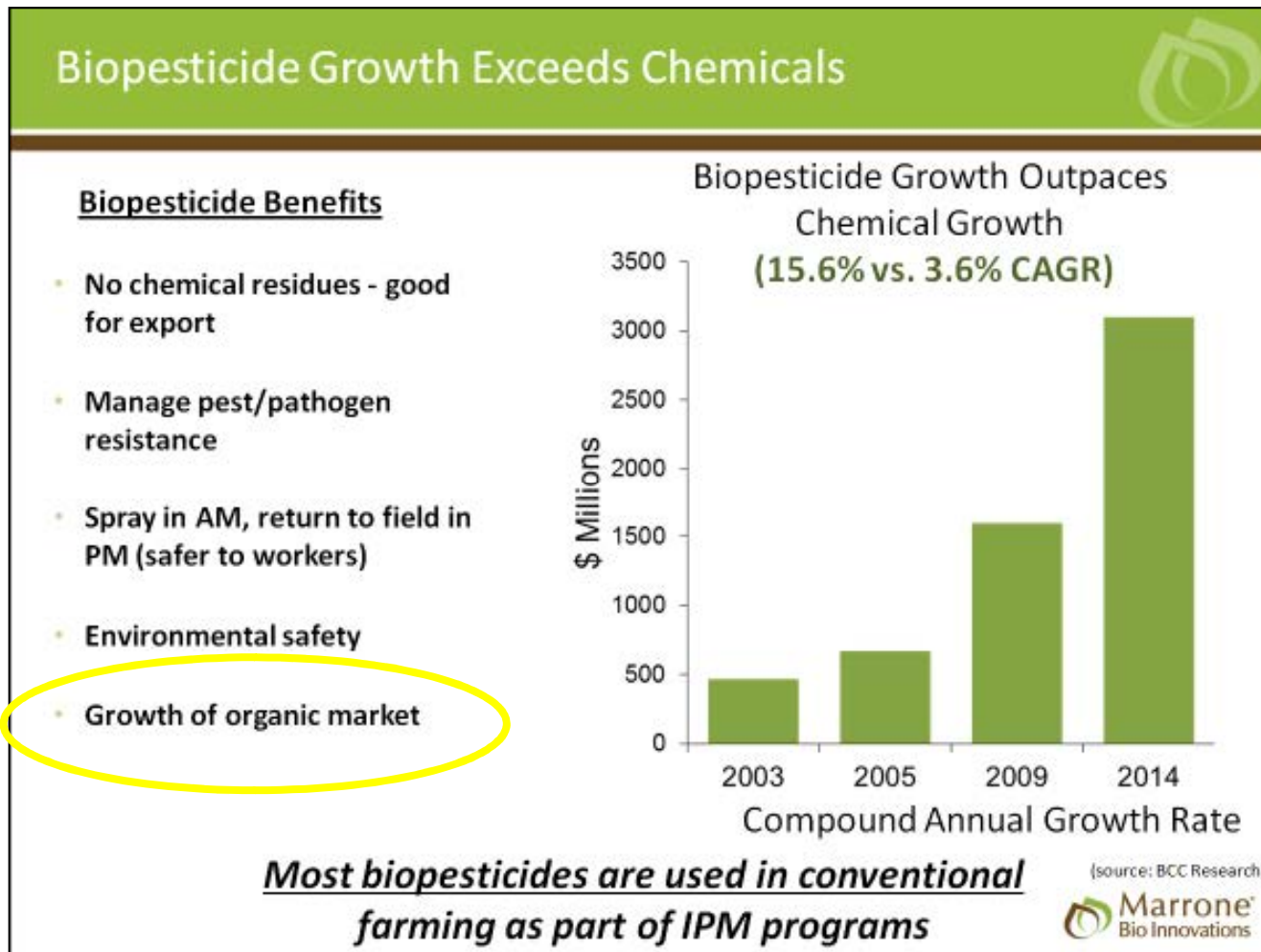


Tim Johnson, Global Product Development Director
Marrone Bio Innovations



Precision mechanization (tomorrow)

Biopesticides



Tim Johnson, Global Product Development Director
Marrone Bio Innovations



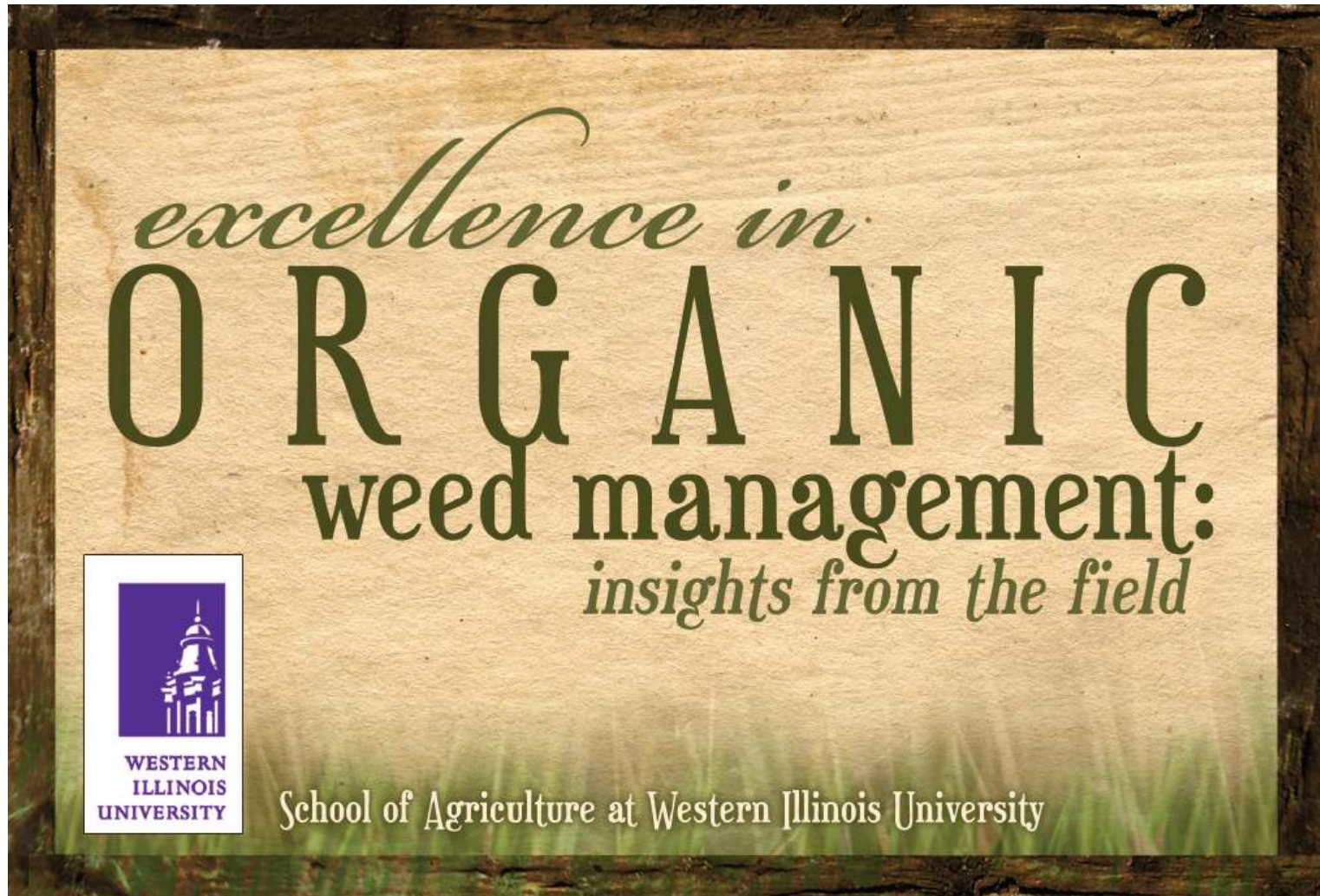
Precision mechanization (tomorrow)

Cover crops



Precision mechanization (tomorrow)

Cover crops



Organic weed management

Corn cobs



“Air-propelled abrasive grit for postemergence in-row weed control in field corn”

Dr. Frank Forcella, USDA Morris, MN research station



Precision mechanization (tomorrow)

Farm automation: Master-slave robotics

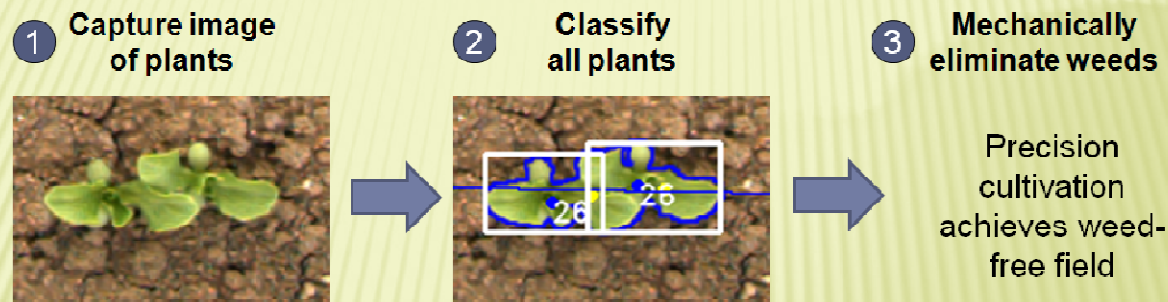


Fendt GuideConnect: Two tractors, one driver
RTK-guided autosteer + V2V wireless communication

Precision mechanization (tomorrow)

Future farm automation

Blue River Technology provides an alternative to chemical weed control



By identifying, classifying and measuring the location of every plant, our system provides a weed-free field without chemicals for:

- Corn
- Soybeans
- Cotton

Product will be available regionally in 2015 and nationally in 2017

Note: Although the photos of plant identification shown here contain lettuce, the system will have capability across multiple crops

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Jorge Heraud, CEO, Blue River Technology



Precision mechanization (tomorrow)

Future farm automation



IOWA STATE UNIVERSITY
College of Engineering
College of Agriculture and Life Sciences


Agricultural and Biosystems Engineering

Dr. Lie Tang, Iowa State University



Precision mechanization (tomorrow)

Future farm automation

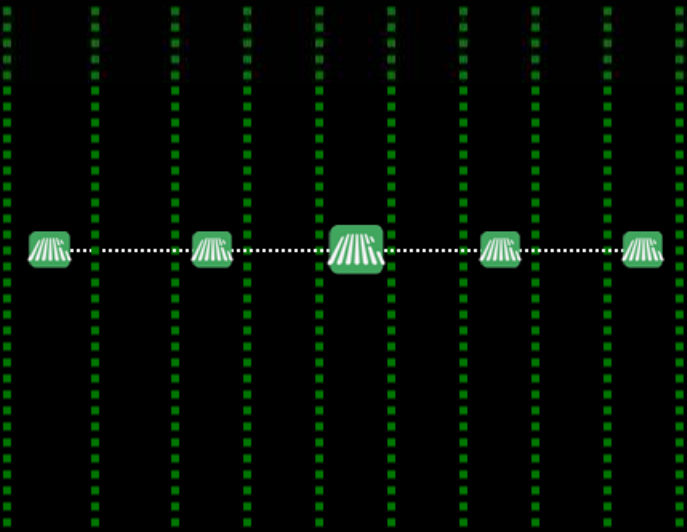


rowbot.com

ROWBOT

An autonomous platform for management tasks in taller corn, such as:

- side dressing N
- seeding cover crops



The diagram shows a top-down view of a cornfield with vertical green dashed lines representing rows. Five green icons of the Rowbot platform are positioned in a horizontal line across the middle of the field, connected by a horizontal dotted line, illustrating its autonomous movement and task execution.

Kent Cavender-Bares, Rowbot, Inc.



Precision mechanization (tomorrow)

Future farm automation



We know that we need to continue to find ways to increase the productivity of land on a per unit basis. Agriculture has started to add computerization and automation to the current machinery with things like GPS based precision farming systems that can autonomously drive tractors, monitor yield, and apply fertilizer. However, these aftermarket add-ons are built around the single most expensive and awkward part of the equipment. The person controlling the tractor.

Future of Farming: Prospero Robot Farmer (YouTube video)



Organic weed management

Conclusions

1. Precision vehicle and implement control is not new
2. RTK GPS-guided autosteer has opened additional opportunities
3. Future advancements will focus on master-slave automation and stand-alone robotics, with scalable technology to fit a wide array of farm sizes



Questions

Thank you!

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Family Farms
Hubbard, Iowa Roger & Mary Knutson