

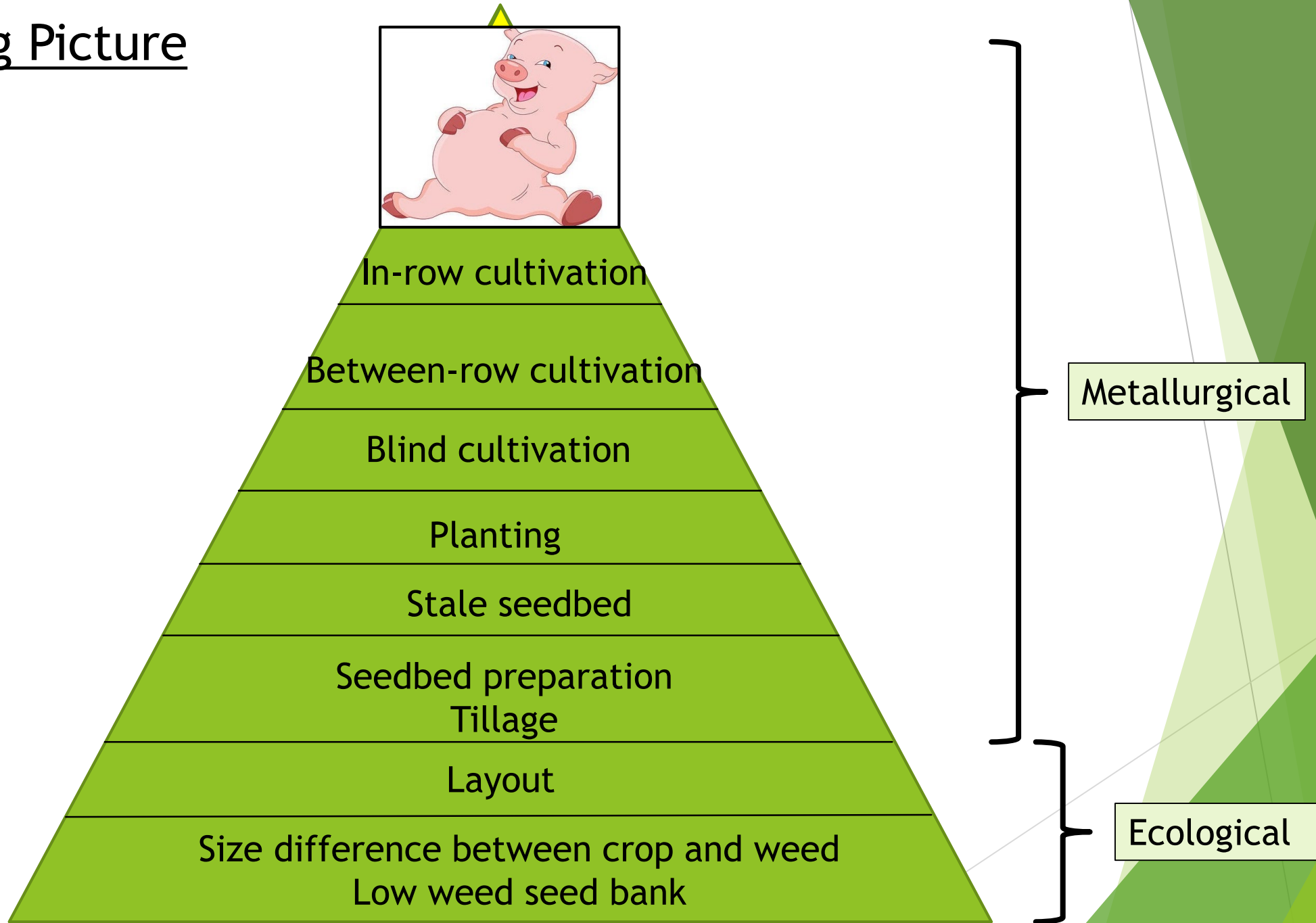
Cultivation tools and techniques



Sam Hitchcock Tilton
Lakeshore Technical College

Practical Farmers of Iowa Conference
January 16, 2020

The Big Picture



Ecological weed management - Reduce your weed seedbank

What is 20% of 10?

vs

What is 20% of 1000?

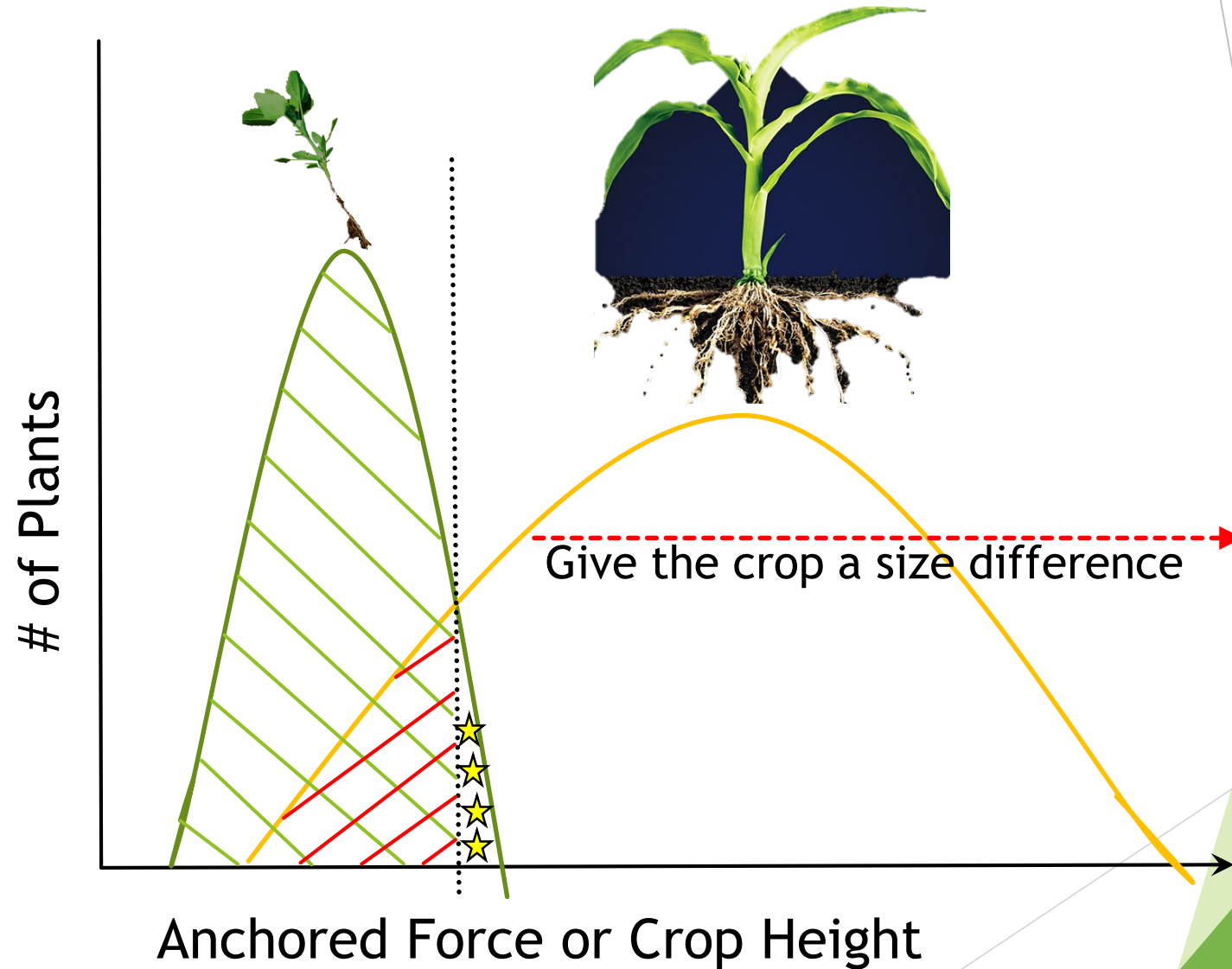


Eric Gallandt, UMaine

A model to understand crop, weed, and cultivator

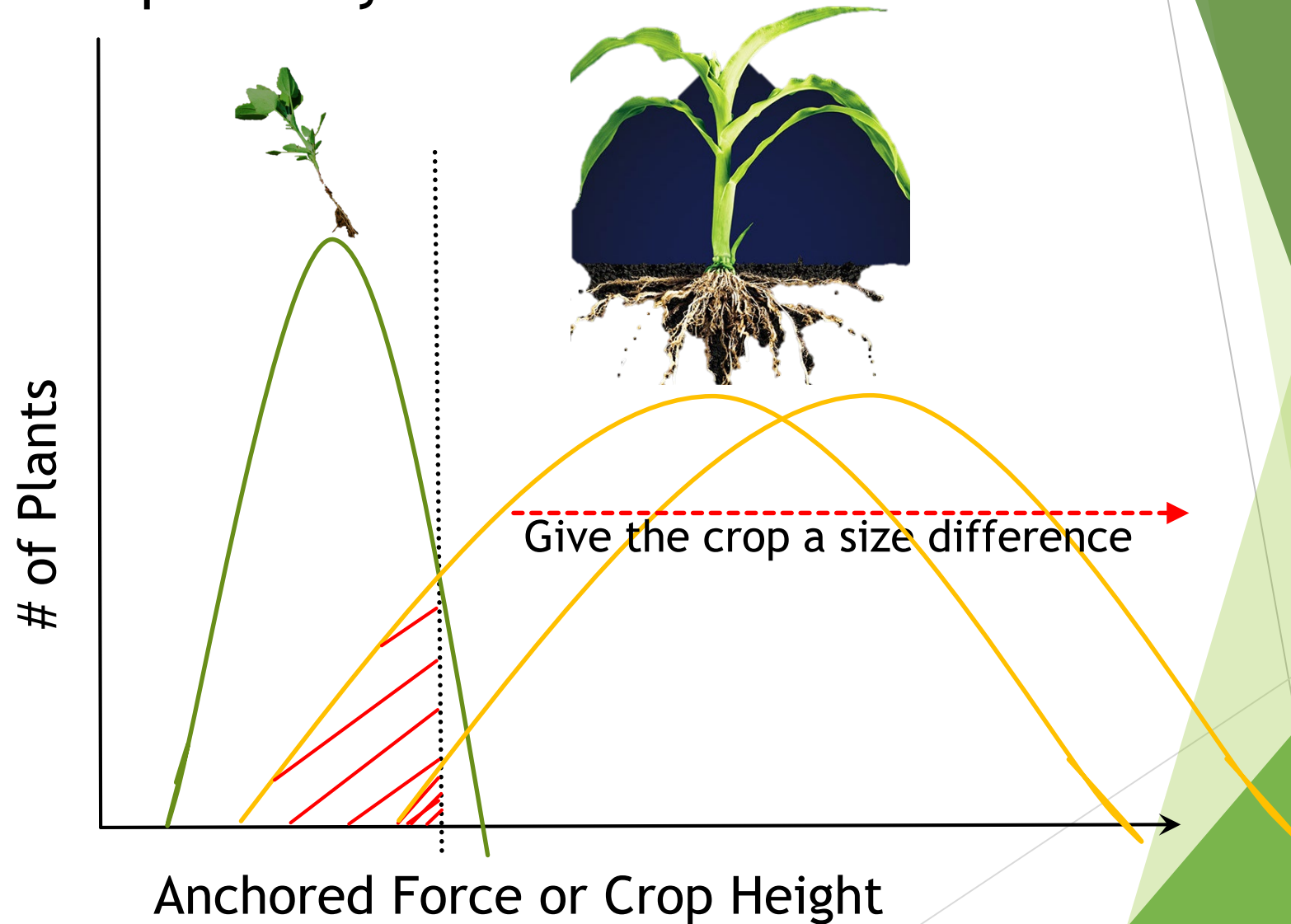
Our mechanical tools will apply an even force - that's the best they can do

But neither crop nor weed are uniform sizes



Adapted from Kurstjens, 2004

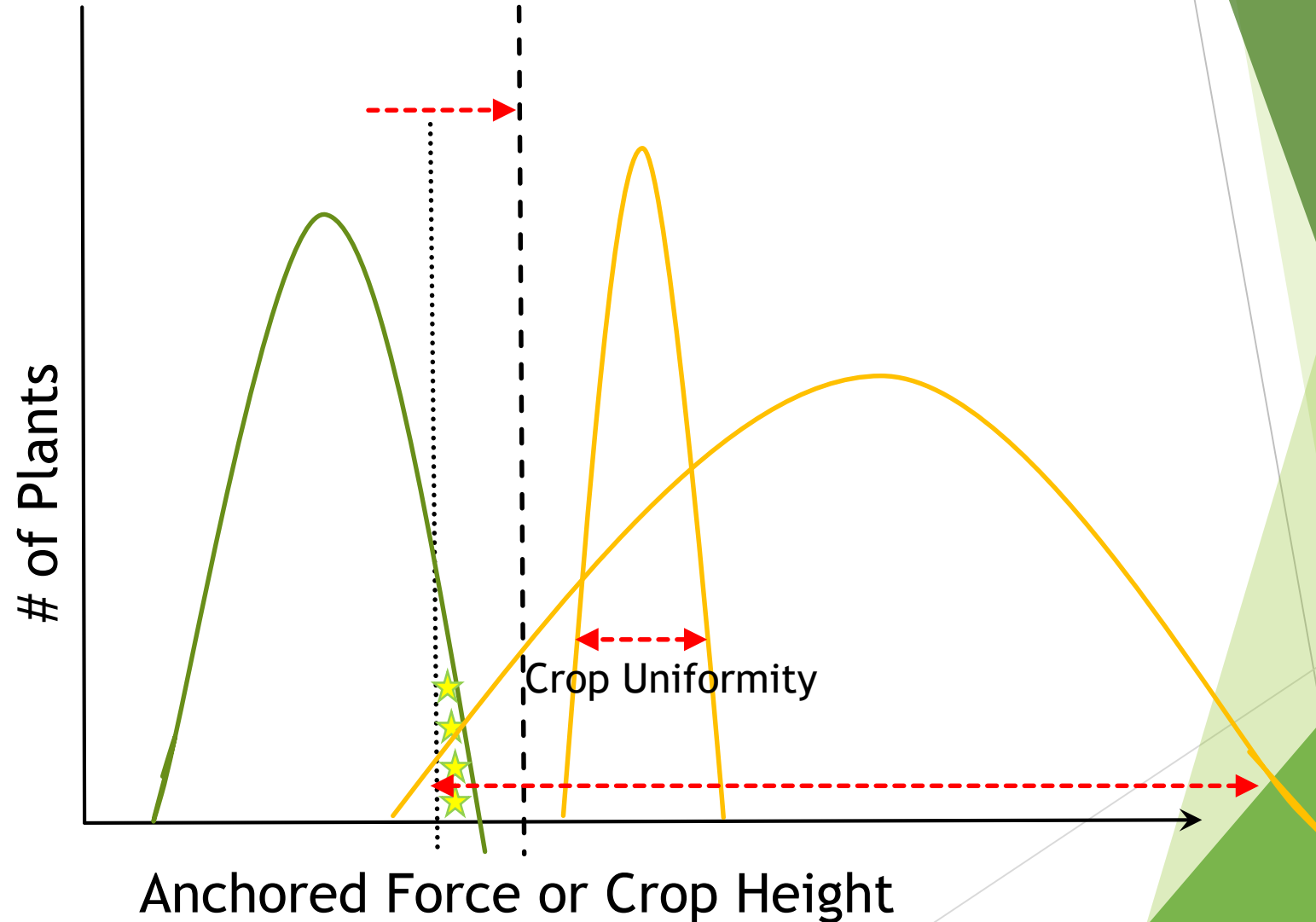
A crop with a Size Difference allows us to tune-in the cultivator more precisely



Adapted from Kurstjens, 2004

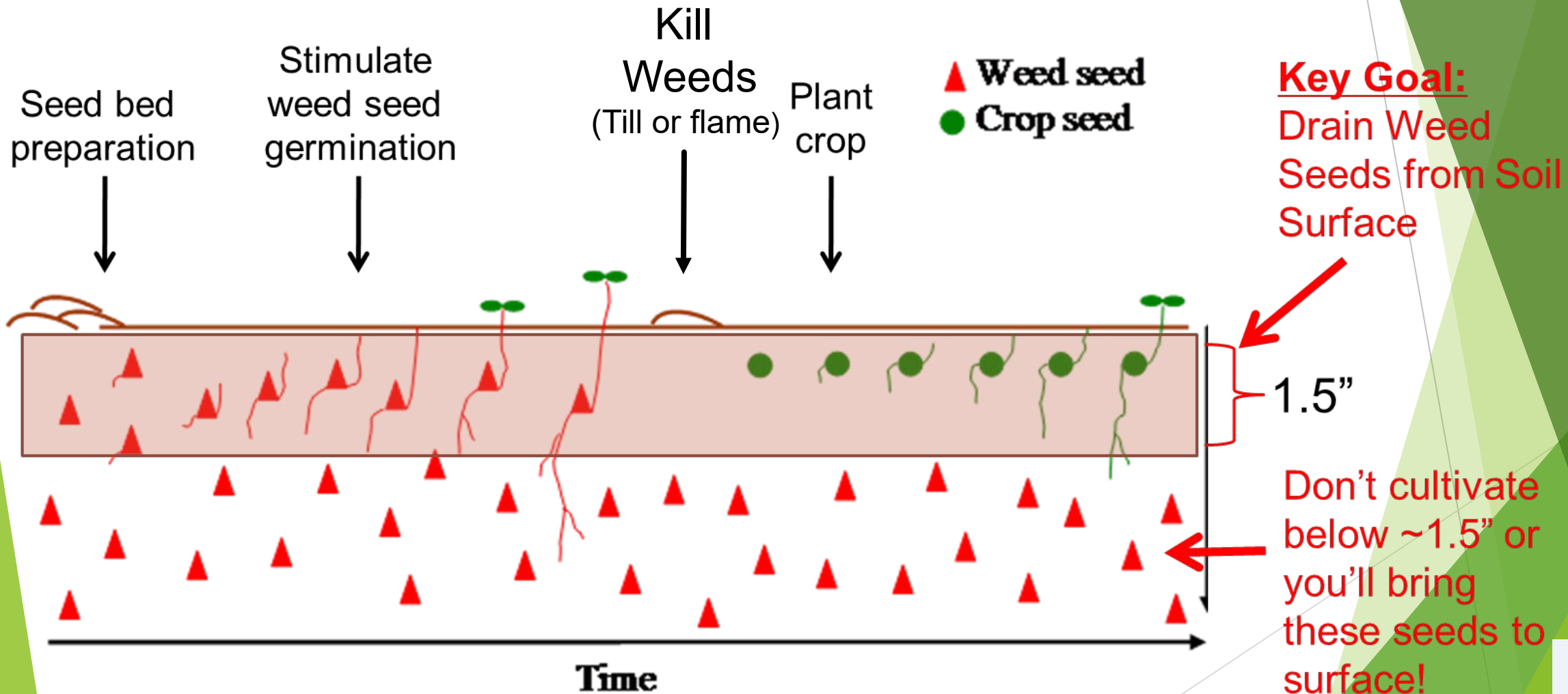
A crop with Uniformity allows us to tune-in the cultivator more precisely

- Crop population to be as even as possible - similar root length and top height
- So that that tool force can be dialed in right at the sweet spot
- Being as aggressive as possible while preserving our crop



Adapted from Kurstjens, 2004

False Seedbed - a **Size Difference** for your crop



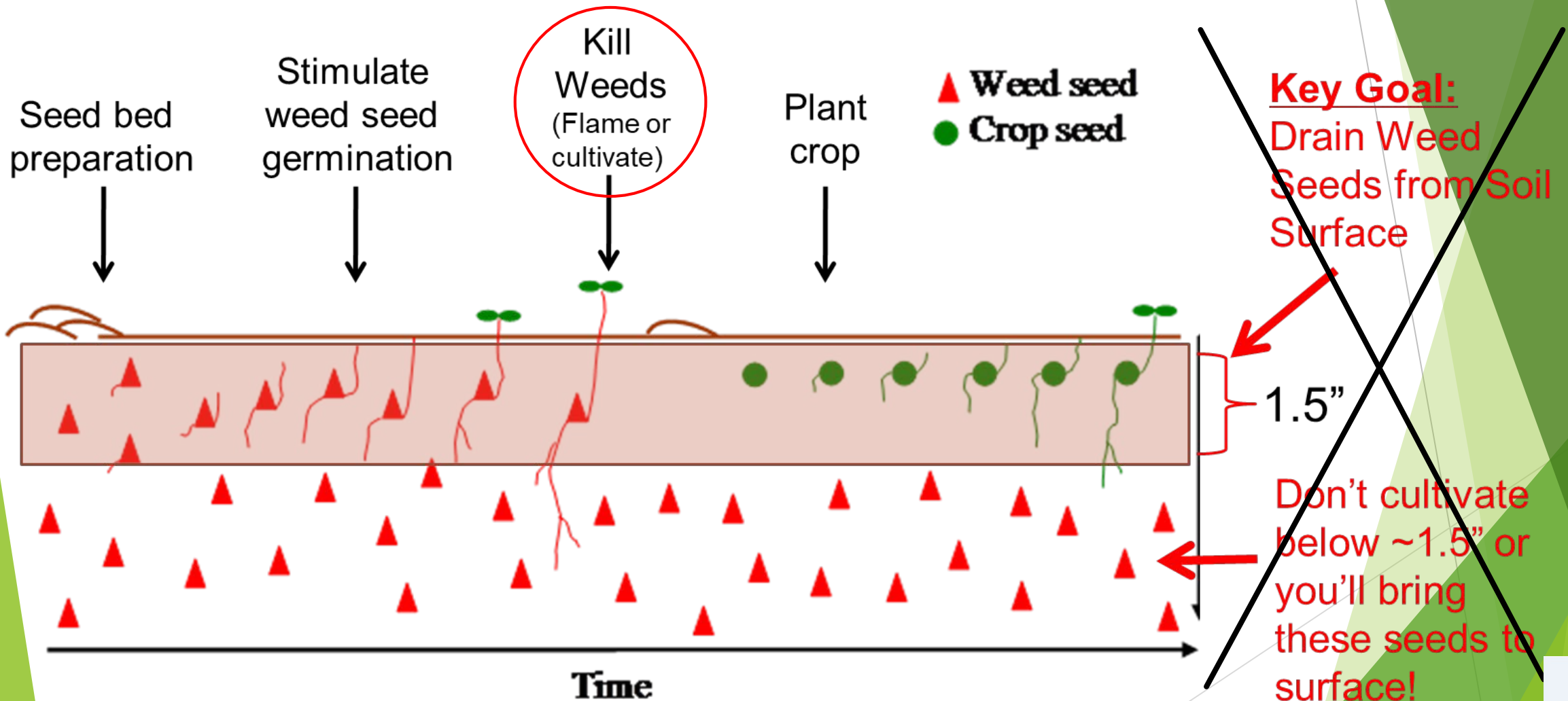
Merfield, C. N. (2013). The BHU Future Farming Centre

False Seedbed - Results

Even in performing a False seedbed, uniformity is important - soil moisture



Flame weeder - for a Stale seedbed



Merfield, C. N. (2013). The BHU Future Farming Centre

Seedbed - Uniformity for your crop

An uniform seedbed is the first step in a uniform crop

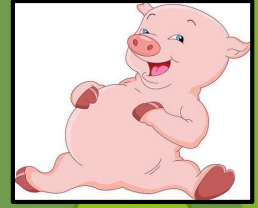
You don't want half of your crop twice as big as the other half - now you have two different crops to manage

You know that seeds want oxygen and moisture to germinate - the better tilth your soil has, the more even conditions you will have

Prepare your field so that your planter can place seeds precisely and uniformly, leaving every seed in the field in as similar conditions as possible.

- Supply even soil moisture for all plants
- Clods will let weeds survive in their 'shadow'

Planting - Uniformity for your crop through population



Plant your seeds at the same depth, so that they emerge at the same time and are rooted with the same force

Who is recommending your population?

For mechanical cultivation, especially blind harrowing - increase seeding rates by 5-10% from conventional

Question conventional row spacing - in Organic we want canopy closure as quickly as possible





Seeder - Set-up



Don't just measure at the toolbar - measure at the business end

1/2 inch !

Planting - Match seeder to cultivator

| Planter rows | Cultivator rows | Ok? |
|--------------|-----------------|---|
| 6 | 6 |  |
| 8 | 6 | ! |
| 12 | 6 |  ! |
| 6 | 12 | ! |



John Deere Co.

Planting - Guidance (Now or later)



Orthman Co.

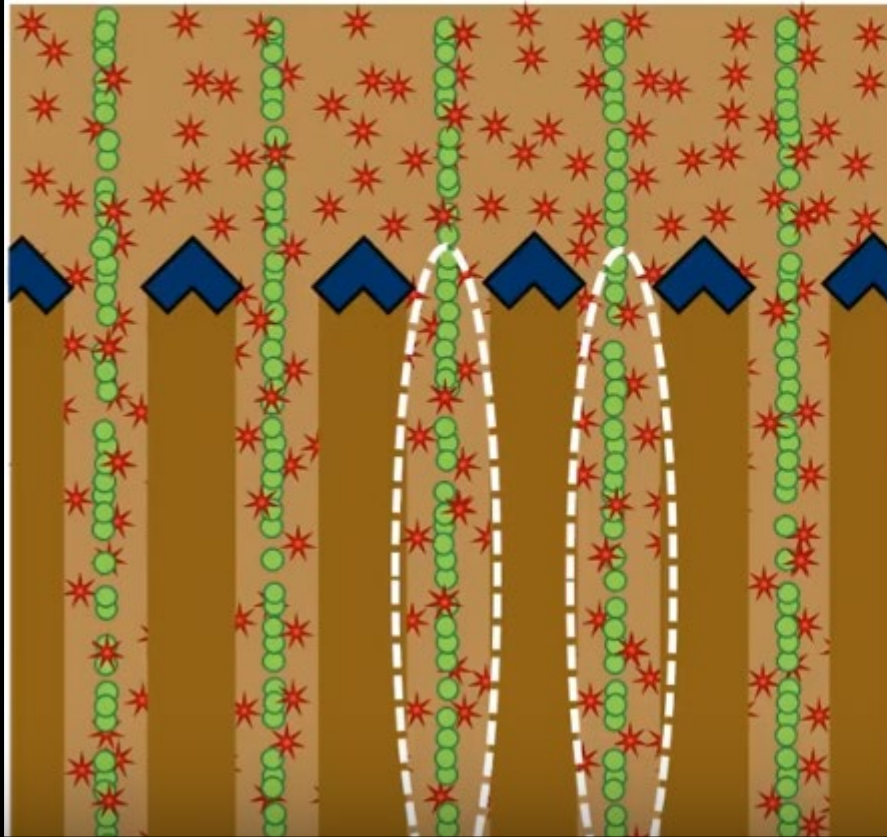
Location of Tractor axle
vs.
Location of implement

Planting - Special considerations for small grains



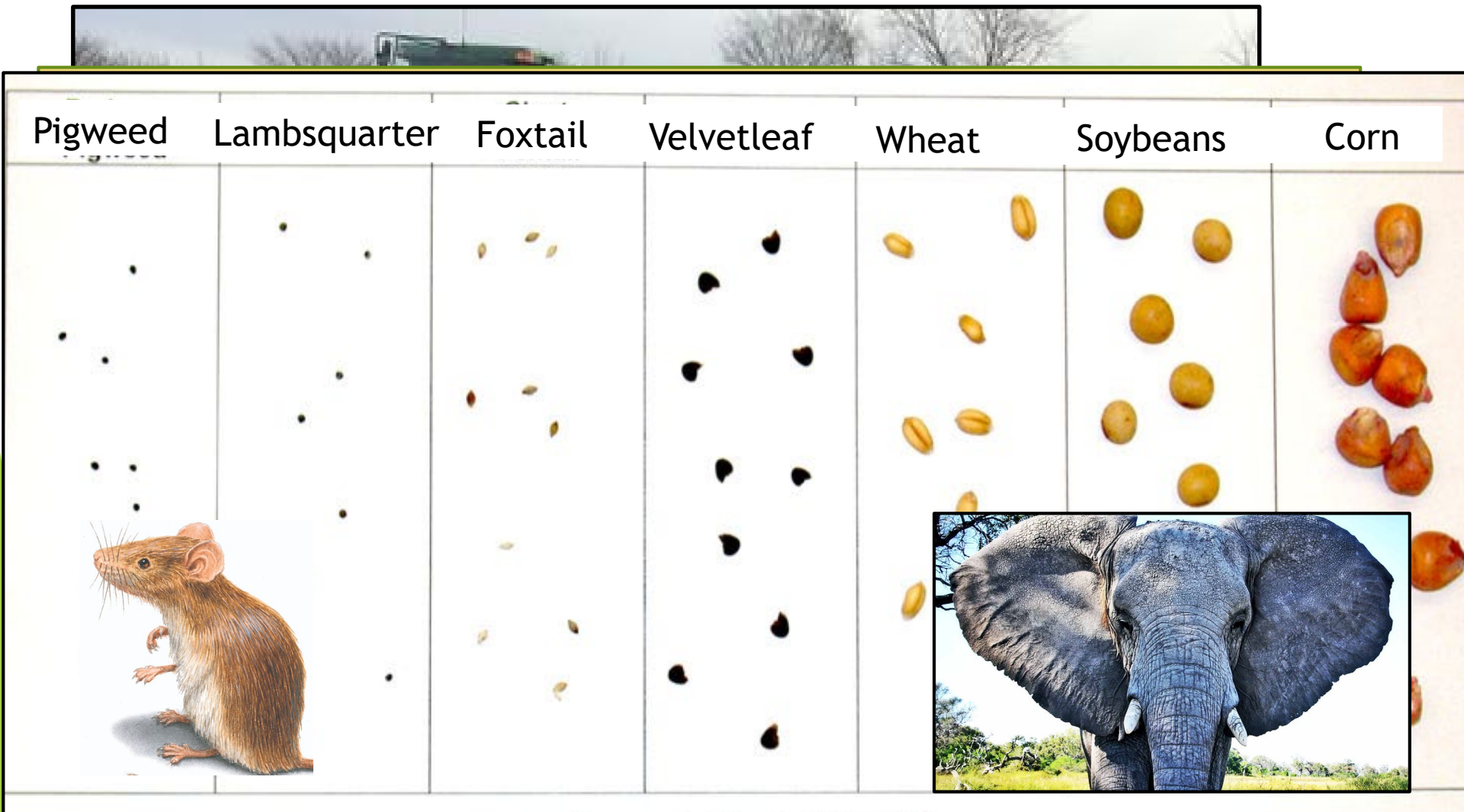
Planting - Special considerations for small grains

Band Sowing



Source: Kolb, Mallory, and Gallandt

Pre-emergence Harrowing - Get that Size Difference



To maximize blind harrowing, **plant as deeply as possible** to maximize time between crop and weed emergence and to give you more play with tool working depth

First Steel in the Field !

Rotary Hoe



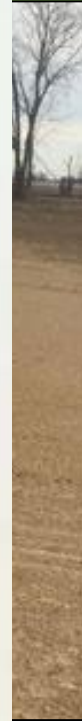
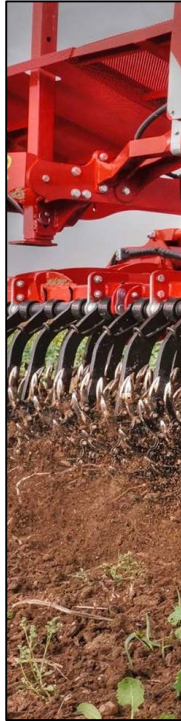
- Needs a soil crust - poor in sand or tight clay
- 1-2 day effective window
- Poor with residue (options)
- Only tool to cultivate corn at 1-2 leaf stage
- Must be used at high speeds - 6-12 mph
- Wear out faster than flex-tine

Flex-tine harrow



- More aggressive than Rotary Hoe
- Better in light soil without crust
- Holds value

First Steel in the Field !



Vulnerable stages of weeds

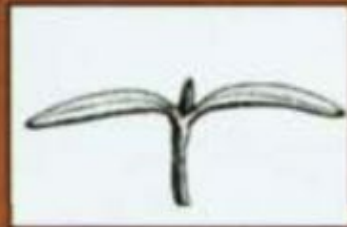
ROTARY HOE



ANNUAL
GRASS



LAMB'S QUARTERS



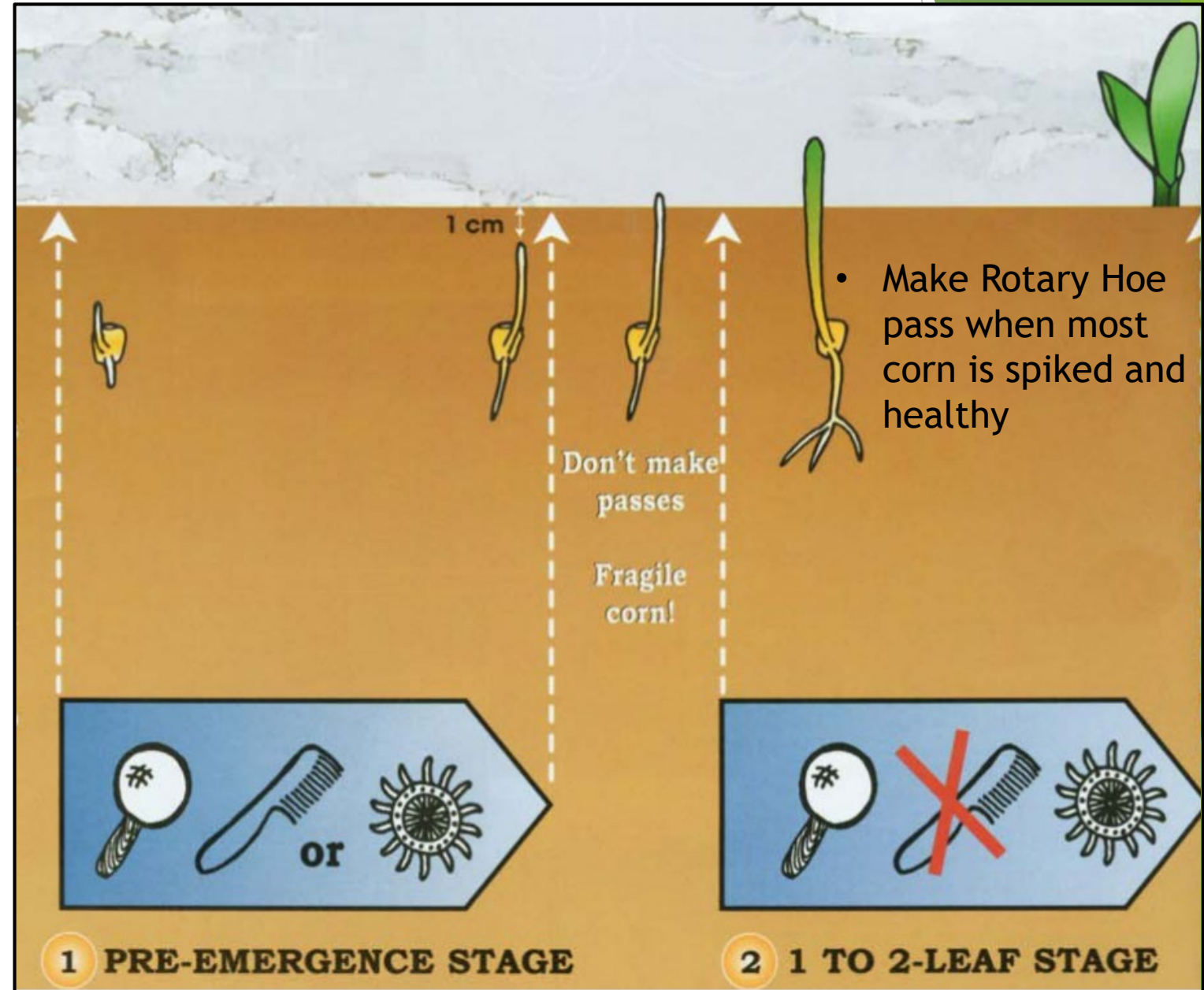
WILD BUCKWHEAT

FLEX-TINE HARROW



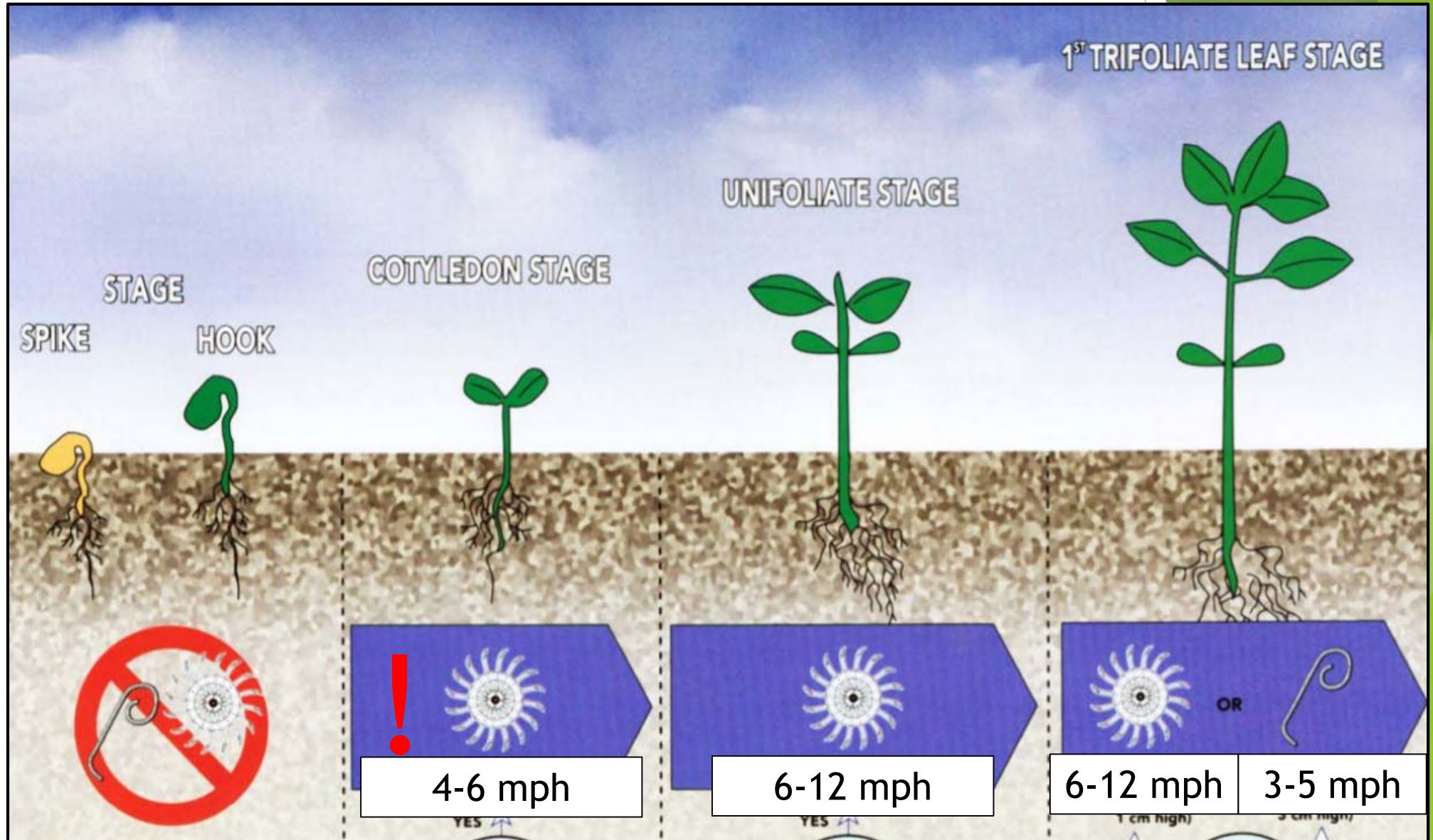
Pre-emergence harrowing - Timing for Corn

- Start scouting after just 3 days
- Best window for pre-emergence pass is when the corn has sprouted but is still 3/8" from the surface
- Flex-tine is best here 6-9 mph



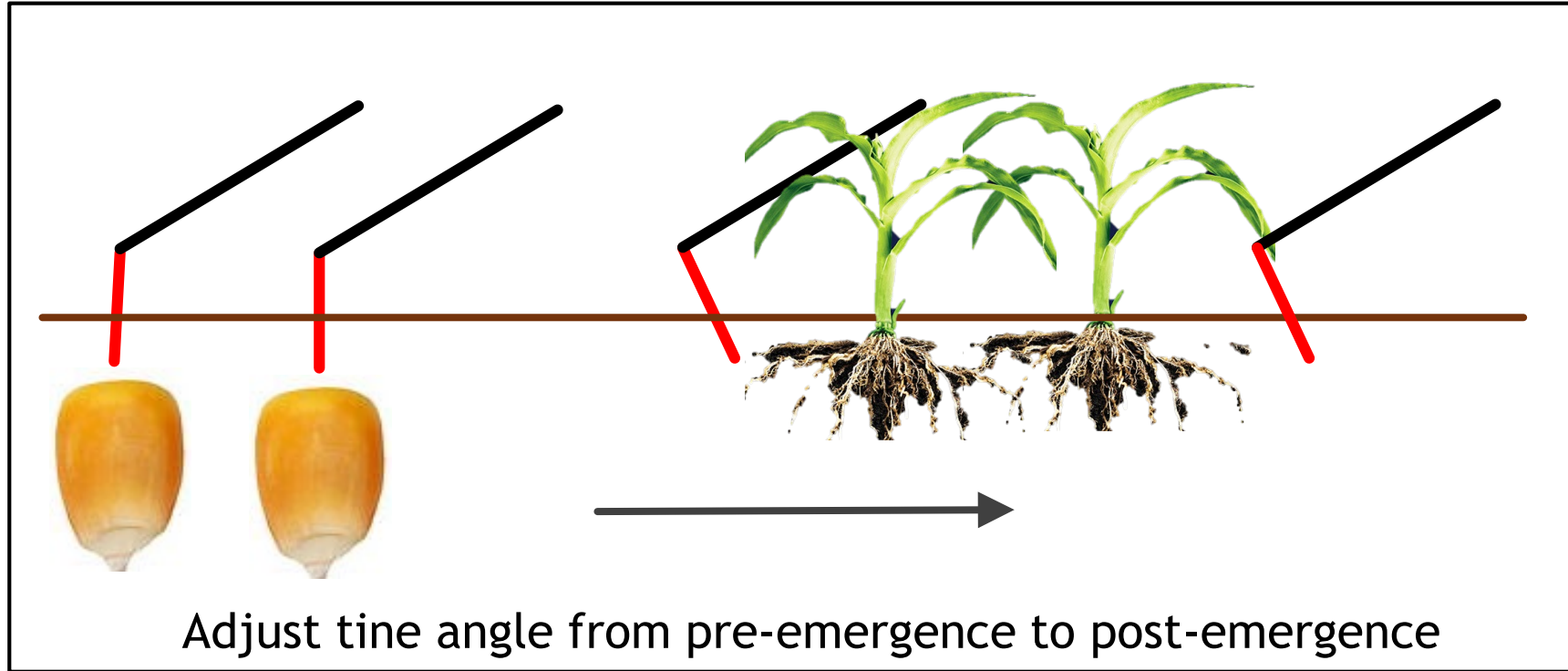
Source: Mechanical Weeding of Corn, Douville and Coulombe

Harrowing - Timing for Beans



Source: Mechanical Weeding of Soybeans, Douville

Blind Harrowing (post-emergence)



Goal for
harrowing or
Rotary Hoe -
**4% crop death
or less**

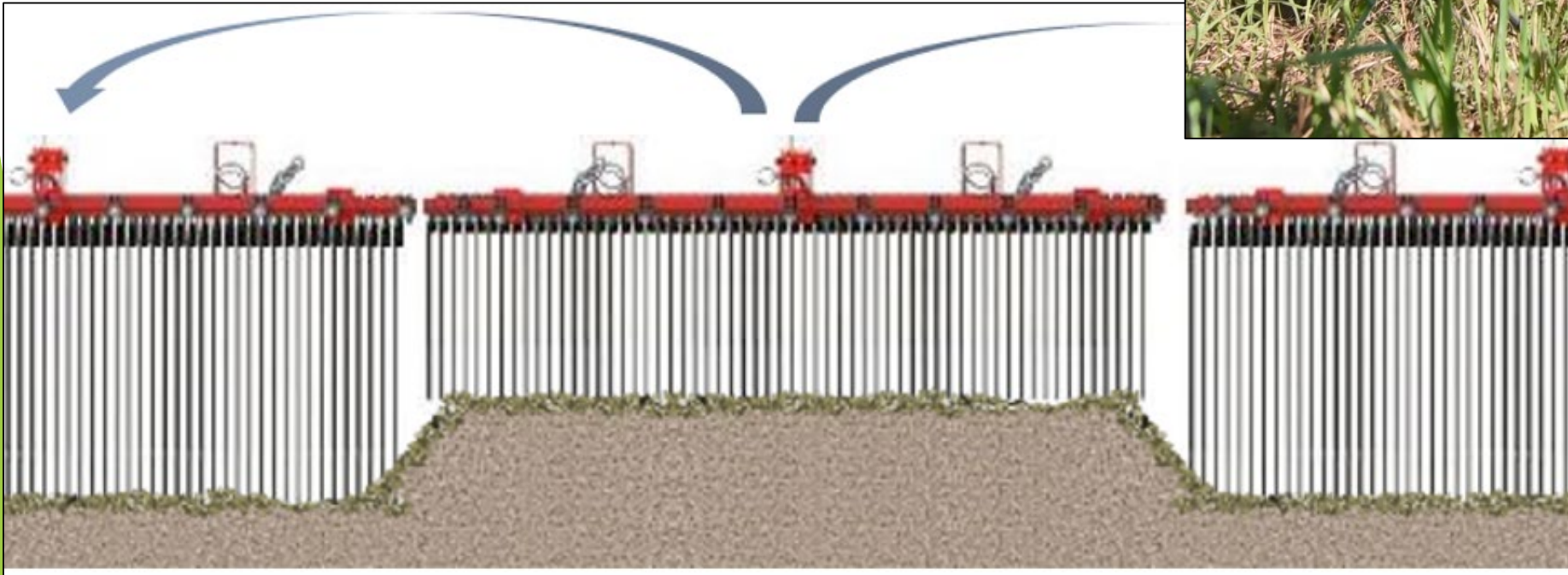
If you're too aggressive
with the flex-tine, try
raising the tines right over
the row (then steering
becomes important)

Flex-tine 2.0 - Dealing with uneven ground

Hydraulic cylinders - Einbock



Springs - Treffler



Mounting - Anatomy of a 3-point linkage

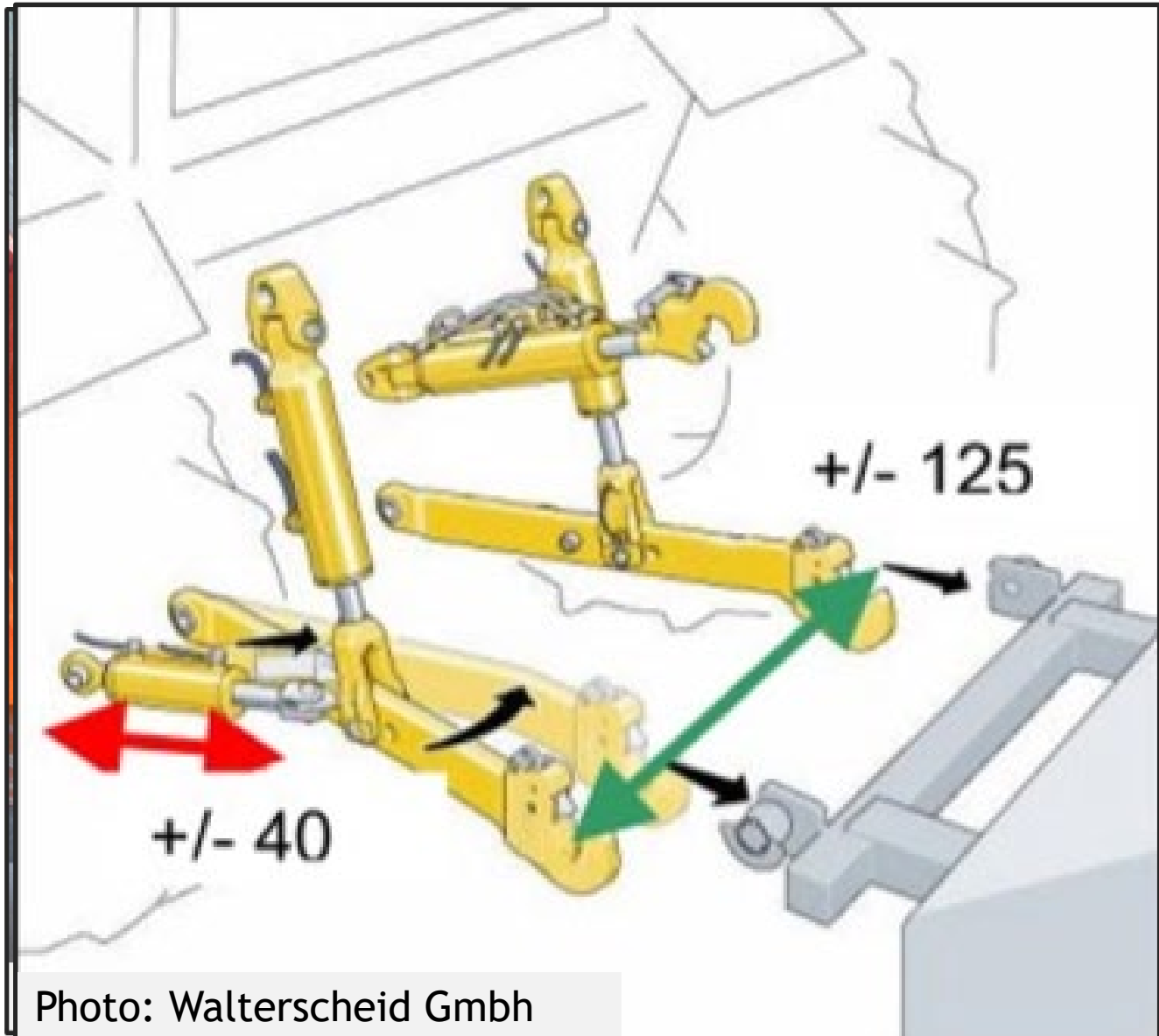


Photo: Walterscheid GmbH

Cultivator - The spectrum of improvements - Level 1



Machinery Pete

Steering: Guide Coulters



Photo: Gary McDonald

How tight, thine sway bars?

Available coulter steering kits

Mounting Sweeps - Vibro Shanks

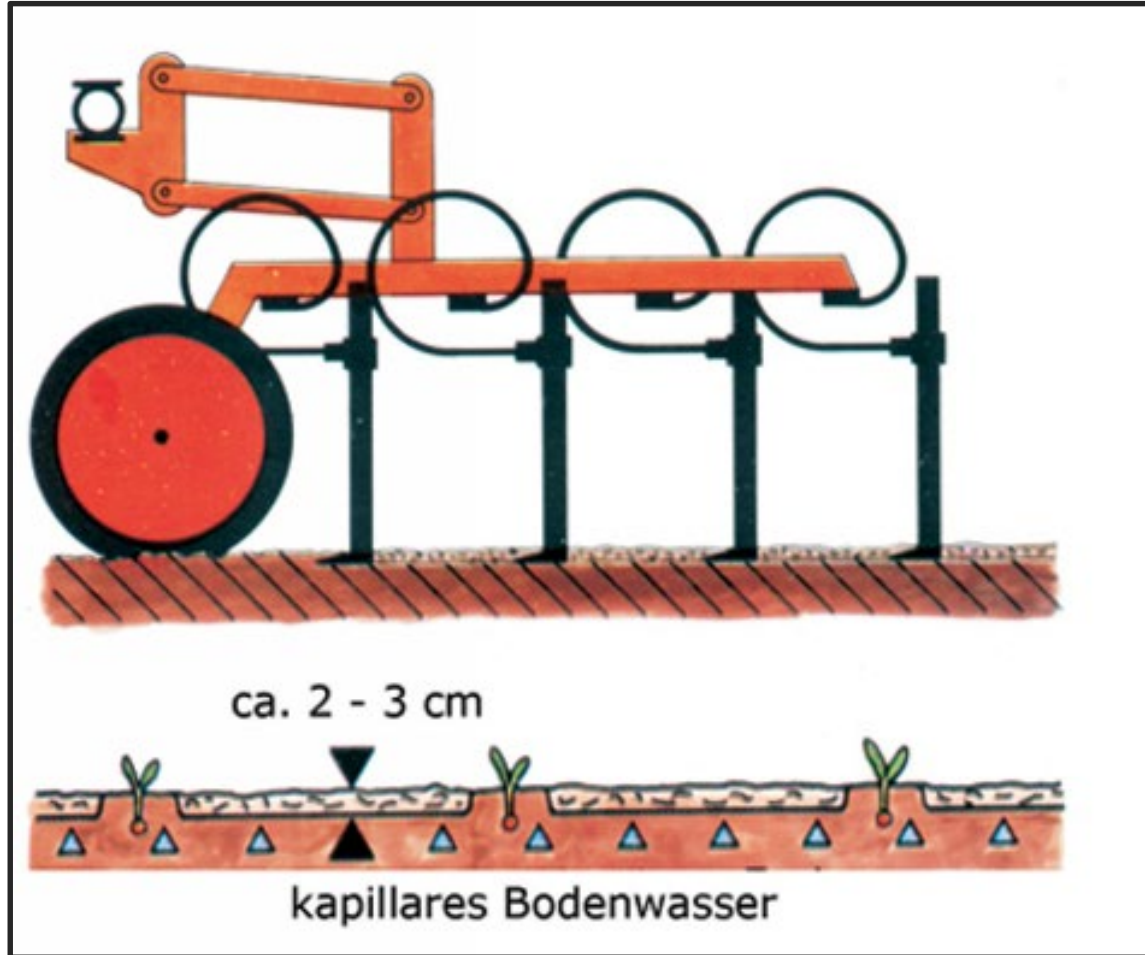
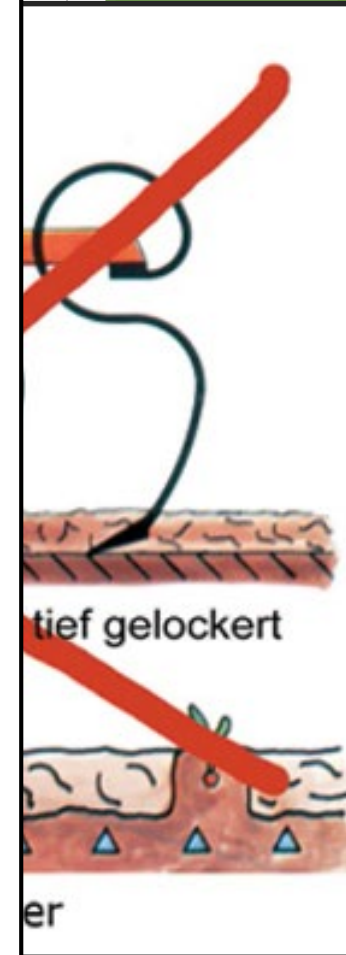
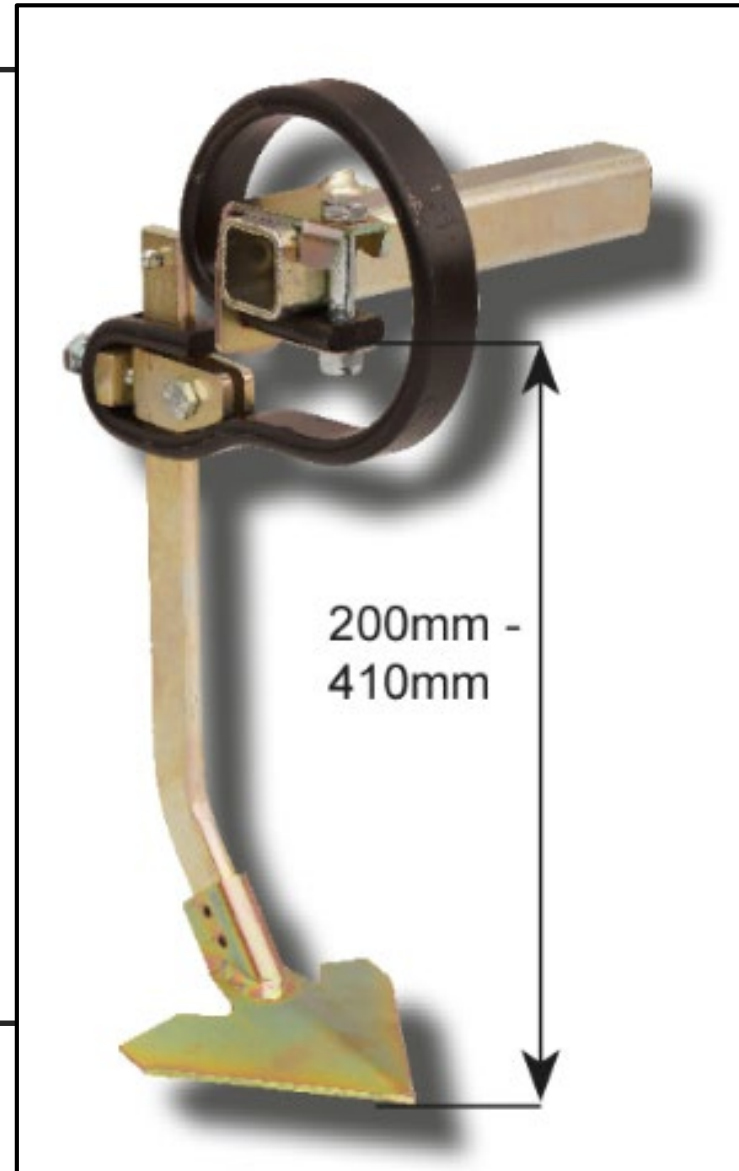


Photo: Schmotzer



Knives - Move less soil

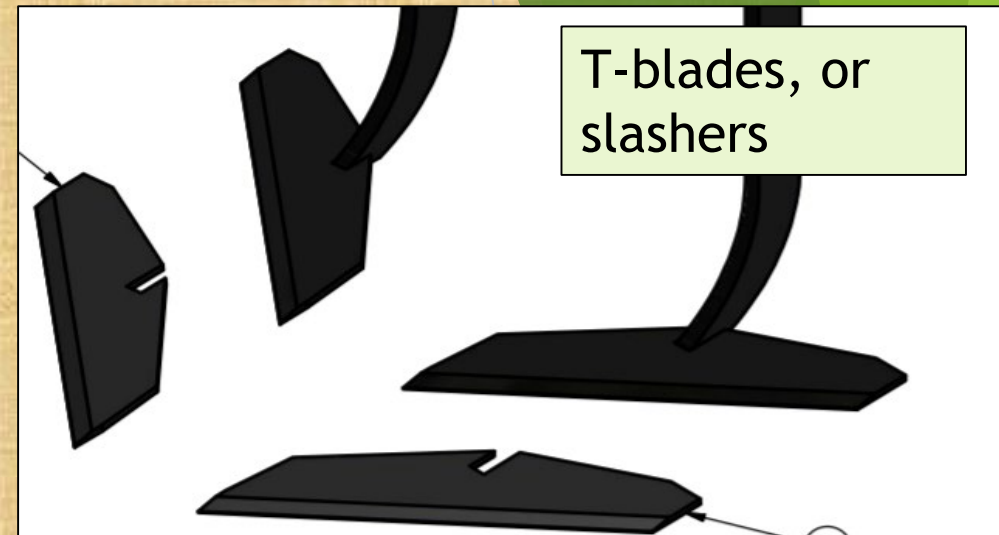


Photo: Frato Co.



Side-knives,
with 'cranked'
shanks

Photo: KULT



T-blades, or
slashers



Low rake angle

Cultivation philosophy - European vs. American



Killing weeds through soil
movement

versus

Killing weeds through
cutting and uprooting



In-row tools: The Final Frontier



Photo: KULT-Kress

Kill current weeds by uprooting and prevent future weeds by breaking capillary

Forward hip angle moves soil out of the row.

Backward hip angle moves soil into the row

Finger weeders - crumble the soil in a narrow band



Cultivator - The spectrum of improvements - Level 2



KULT-Kress

New tools solve problems

AND may create others

Cultivator - The spectrum of improvements - Level 3

**Retro-fit a 6-row
cultivator**

6 finger weeder assemblies
12 vibro-springs
12 sweeps and shanks

~\$7,000

But how will you steer it?

KULT-Kress, Brainard Lab, MSU



Cultivator - Guidance, RTK

What does RTK steer?

Limitations of RTK

Get the accuracy that
you're paying for

How tight, thine
swaybars?

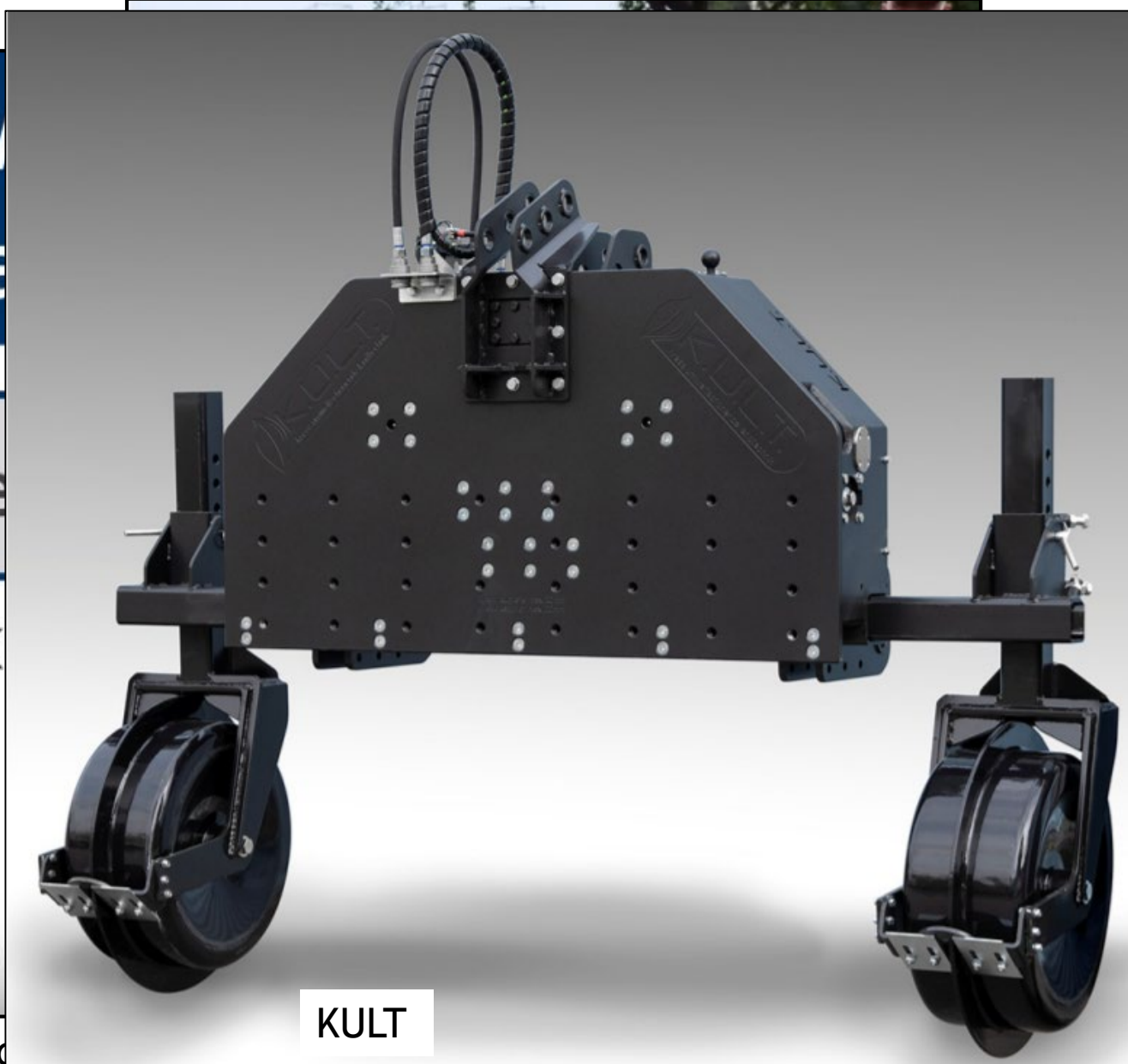
Direct-seeded
onions



Steketee

Cultivator - Guidance nuts and bolts

- W
ca
- I. Came
 - II. Look
 - III. Row
 - IV. Crop



KULT

Source: Gallandt, and

Einböck



Cultivator - Guidance, Camera on cultivator

Number of rows
relates to number
of cameras needed

Limitations -
tractor shadow,
lighting, wind,
weed size, stand

2.5mph first pass
Later 5-7mph

Side-shift hitch
with one camera
\$30-40k



Photo: KULT-Kress

Camera Guidance - Will not erase previous sins

Must have a minimum height difference of ~4" between crop and weed

Manual override



Photo: KULT-Kress



Cultivator - Guidance, other options

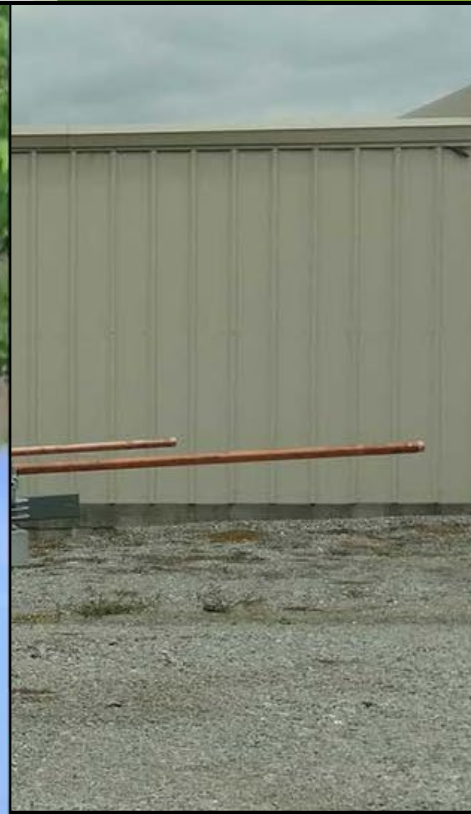
- Mirrors
- Go-pro camera to cell-phone
- Older wand steering system
- Mid-mount cultivator
- A stick - really



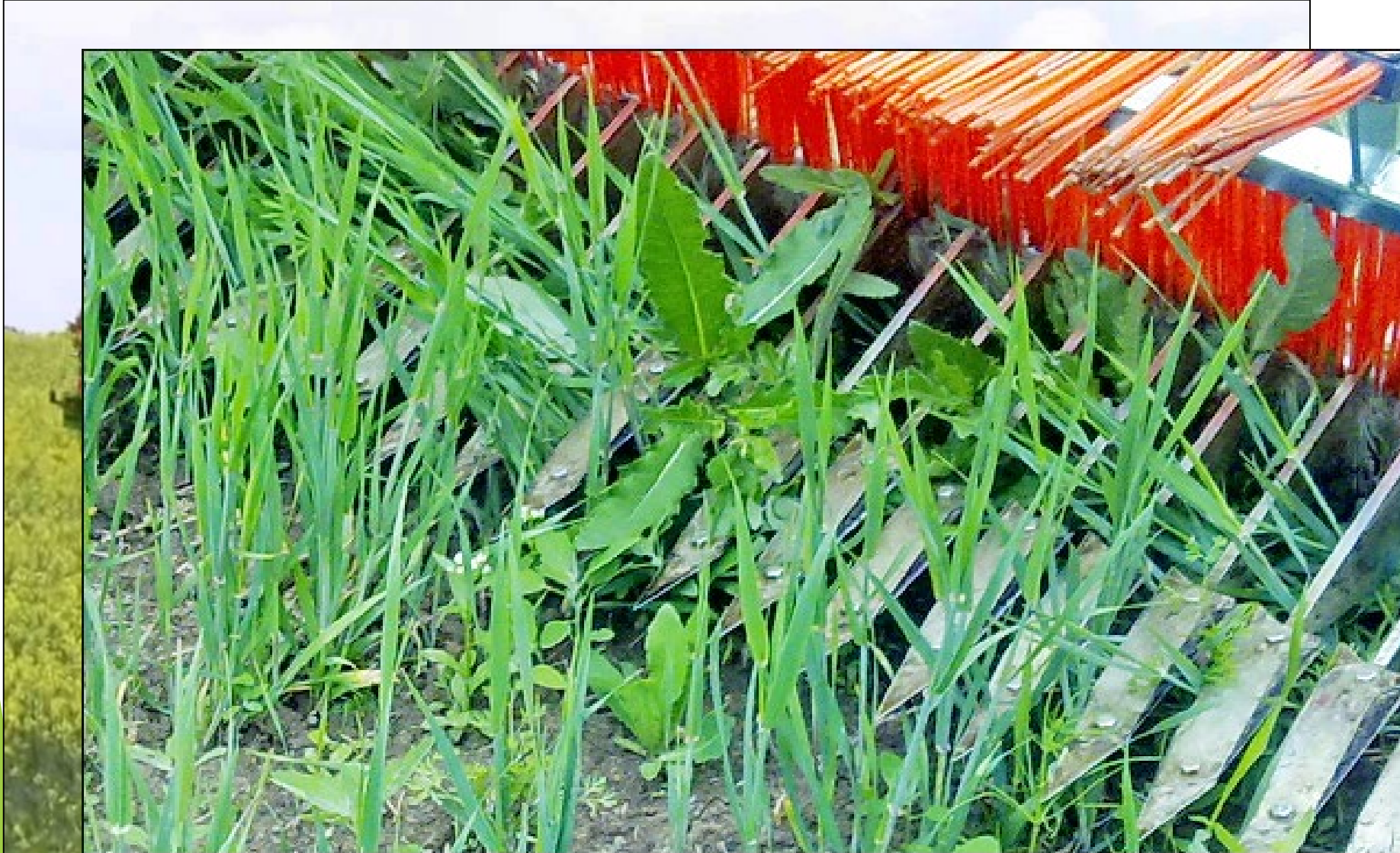
Beyond Steel - Erasing previous sins



Weed Zapper

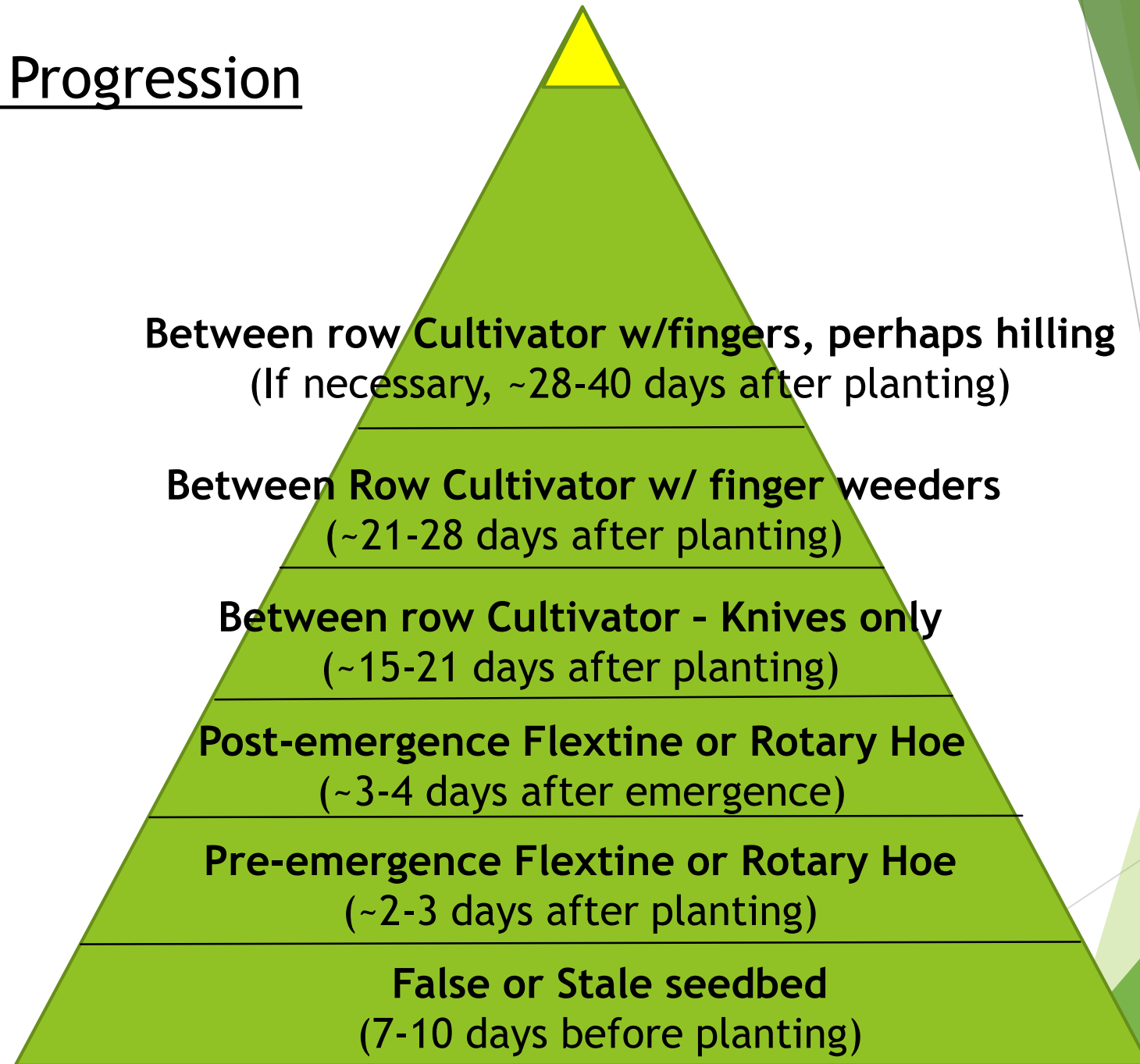


Beyond Steel - Erasing previous sins



Combcut

The Cultivation Progression





National Geographic

Sam.hitchcocktilton@gotoltc.edu



Come see all these tools in action!

Wednesday, September 16th 2020
Pheasant Ridge Farm
Cedar Rapids, IA

Acknowledgments - Dan Brainard & Bernie Zandstra (MSU), Christian Kirchoff & Michael Smith & Kim Haug (KULT-Kress), Leonard Mol (Steketee), Hans and Dave Bishop (PrariErth Farm), Theo Remij (Frato), Clyde Morter (Guy Machinery), Charles Merfield, Peter Seely