Mechanical Weed Control and Weed Ecology in Vegetable Production

LAKESHORE TECHNICAL COLLEGE Sam Hitchcock Tilton Lakeshore Technical College

Practical Farmers of Iowa Conference

January 17, 2020



A model to understand crop, weed, and cultivator

Plants

of

#

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 <u>Size Difference</u> allows us to tune-in the cultivator more precisely





A crop with <u>Uniformity</u> 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



These Tools are not magic!

TWO KEY PRINCIPLES:

- 1) Reduce weed densities before you plant
- 2) Maintain size difference between crop and weed









Know your weeds and your tillage

<u>Weed type</u> - what time of year does it set seed? when does it germinate? How long from germination to seed set? What is the weak point in its life cycle?

Target specific weeds with -

Depth of tillage Time of tillage Type of tillage Mowing



From Clements et. al. 1998

Ecological weed management - Reduce your weed seedbank

What is 20% of 10? vs What is 20% of 1000?

"All these tools are great, but I am realizing that I am only as good as my planning. John Peterson [of Angelic Organics] said that the tools are secondary and their timing is primary. But I am starting to see that even before the timing of using a tool is the much bigger-picture planning: I need to use my rotations, cover-crops, summer-fallows, and stale-seedbeds to target specific weeds and fields and tailor-make the place where I plant each crop. So that when it comes to fall carrots, I don't want to be deciding where they will go in April, but right now I want to be thinking where the 2021 carrots will go."

Eric Gallandt, UMaine



Flame weeder - for a Stale seedbed



Stale Seedbed Examples





Make the most of your passes





It is much easier to cultivate a level field

- Easier to maintain constant depth
- Promotes more uniform crop growth

Critical for small-seeded crops like carrots

For transplants and largeseeded crop helpful but less critical



Combine with passes, to promote germination of crop and weeds

Tools for precision tillage - The decision for precision



Roller on the back of field cultivator is controlled with a hydraulic cylinder for depth adjustment

Mounting - Anatomy of a 3-point linkage







Improving transplant accuracy







WHITE THREAD STAGE—MOST SUSCEPTIBLE



NC State extension

Match Planting Rows to Cultivator







Tools

2.

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





Tool carriers - Wheel hoes



All the elements for precision weed control are here

Tool carriers -Wheel hoes



Are all the elements for precision weed control are here?



We are looking good - the decision for precision





Precision between-row Cultivators



Blind Harrowing (post-emergence)



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



<u>Cultivation philosophy - European vs. American</u>



Killing weeds through soil movement

versus

Killing weeds through cutting and uprooting



Knives - Move less soil



Mounting Sweeps - Vibro Shanks



Basket weeder





Precision between-row Cultivators - Multi-bed



Precision between-row Cultivators - Camera Guidance

\$12-20k for camera hitch

Plus tools -\$9k



Precision between-row Cultivators



In-row weeding





Finger Weeder



In-row tools: The Final Frontier



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



HT's Ten Commandments of Cultivation

- Choose a row configuration that gives your tools enough room to work
- Choose a row configuration and stick to it
- Have tools that are able to operate shallowly
- Stale Seedbed when possible
- Have enough seeders to seed all rows at once to create parallel rows
- Your tools should be set up EXACTLY on your row spacing
- Your tools should respond to the ground conditions row by row
- You should cultivate before you see weeds
- Goal is to have several weeding tools, so that they rarely need to be adjusted

The Cultivation Progression

Between row Cultivator w/fingers, perhaps hilling (If necessary, ~28-40 days after planting)

Between Row Cultivator w/ finger weeders (~21-28 days after planting)

Between row Cultivator - Knives only (~15-21 days after planting)

Post-emergence Flextine or Rotary Hoe (~3-4 days after emergence)

Pre-emergence Flextine or Rotary Hoe (~2-3 days after planting)

> False or Stale seedbed (7-10 days before planting)





Sam.hitchcocktilton@gotoltc.edu



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

National Geographic

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

