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Mechanical Weed Management

This material is based upon work that is supported by the National Science Foundation under grant number 2013-11315-01. The authors are Kristine Moncada, Carmen Fernholz, Jeff Gunsolus, Constance Carlson, and Craig Sheaffer.

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Mechanical Weed Management

- I. Introduction
- II. Primary Tillage
- III. Seed Bed Preparation
- IV. Cultivation



Mechanical Weed Control

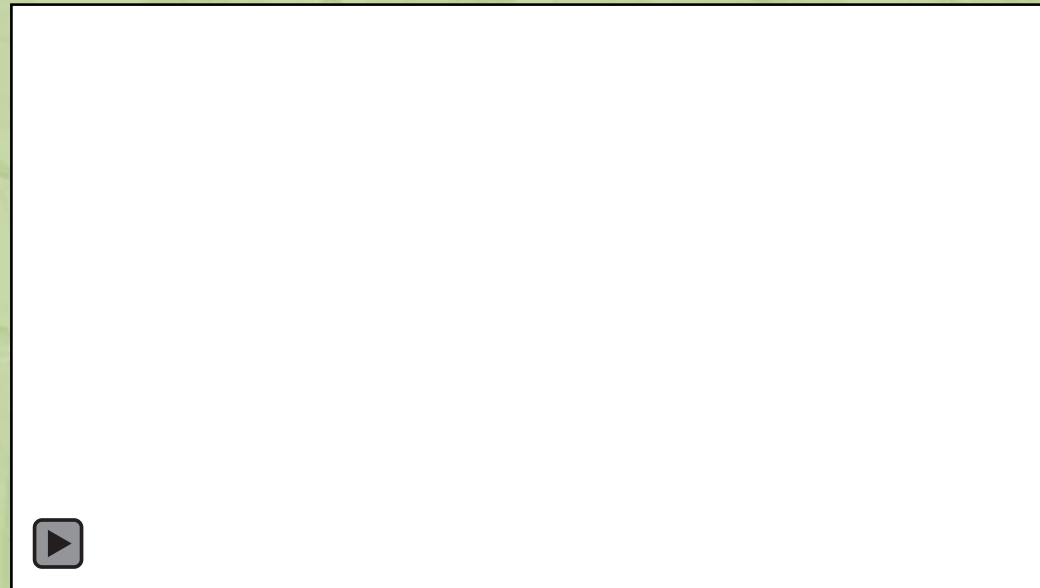
Using tillage to destroy weeds by burying, uprooting, breaking apart or drying out



Mechanical Weed Control

Can be classified
by timing:

- Primary tillage
 - Seed bed preparation
 - Cultivation
- Before planting
- After planting



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Tillage



- Types = primary and secondary
- Prepares the soil for planting

Primary Tillage



- Use of plows to turn over the soil and incorporate crop residue
- Fall or spring
- Kills existing weeds *but also stimulates weed germination*

Primary Tillage



- Moldboard plow
- Chisel plow
- Disk plow

Primary Tillage Equipment: Moldboard Plow



Primary Tillage Equipment: Disk Plow



Primary Tillage Equipment: Chisel Plow



Conservation Tillage

- Leaves 30% of soil covered in residue
- Protects the soil



Important Considerations

Tillage choices can affect weed prevalence

Animate and adjust



Primary
tillage



Perennials
Annual grasses



Cocklebur

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Seed Bed Preparation

- Also called secondary tillage
- Evens out the soil for planting
- Works in amendments like compost and manure
- Controls early emerging weeds



Secondary Tillage Equipment: Field Cultivators, Disks and Harrows





**Secondary tillage goal –
Give the crop an even start**

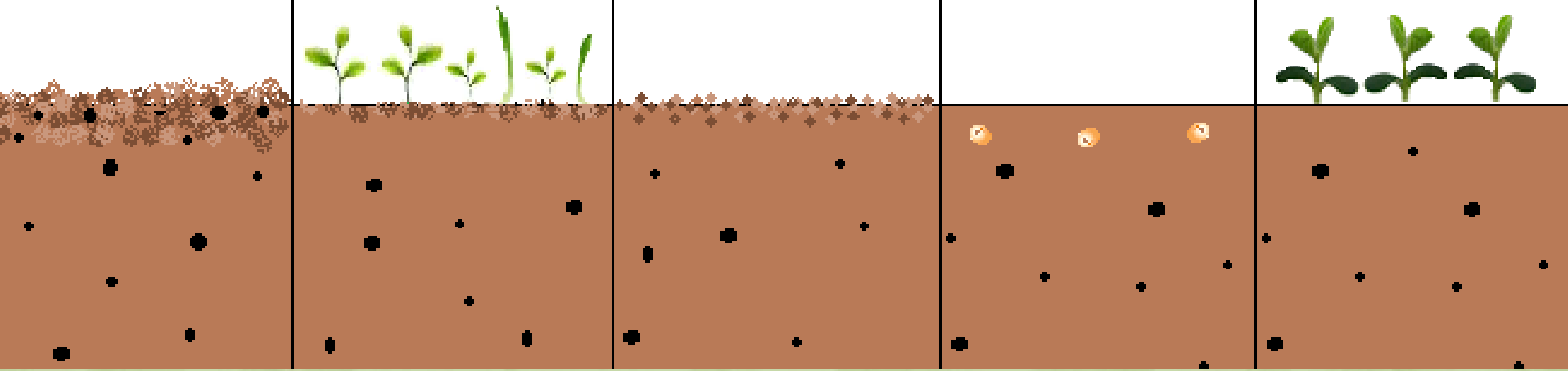


False Seedbed

- “Fools” weeds into germinating
- Operations prior to crop planting
- 1st tillage operation leads to weed flush
- 2nd tillage kills weed flush
- Crop is immediately planted



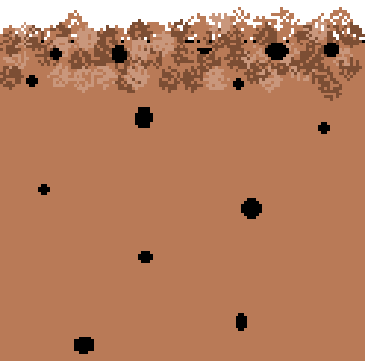
False Seedbed Steps



False Seedbed Steps

Step 1

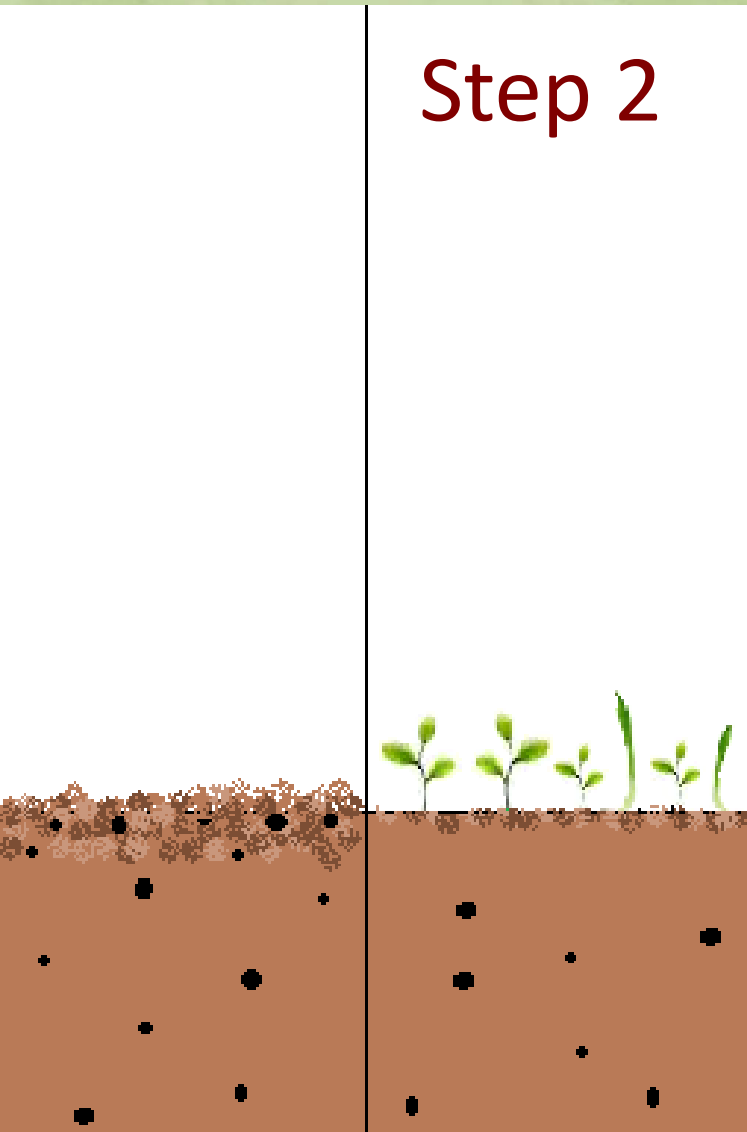
- 1st tillage
- 3-4" deep
- Soil temp = 60-65° (late afternoon)
- Minimize soil compaction



False Seedbed Steps

Step 2

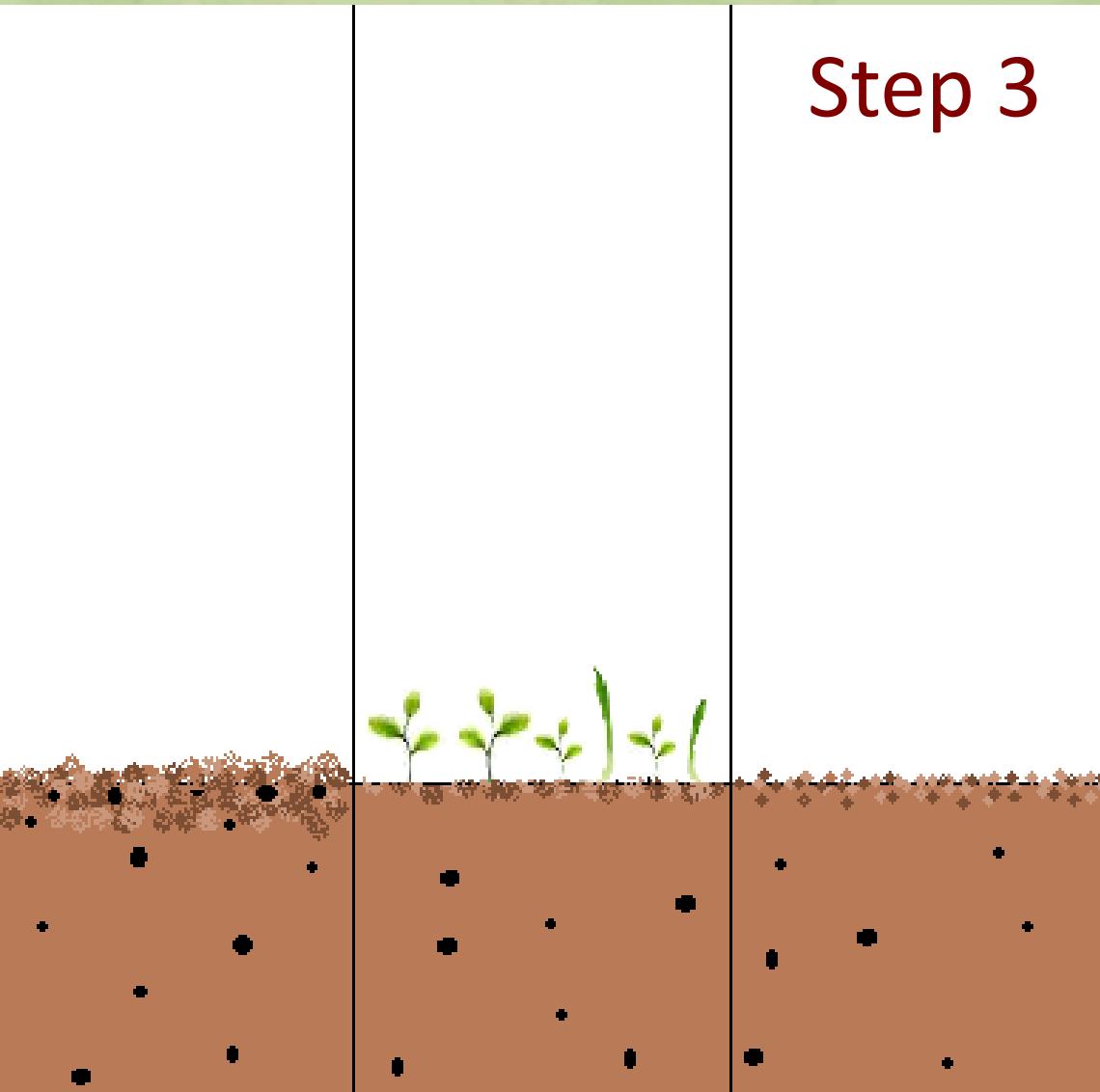
- Wait for weed flush
- About 3 weeks time to grow



False Seedbed Steps

Step 3

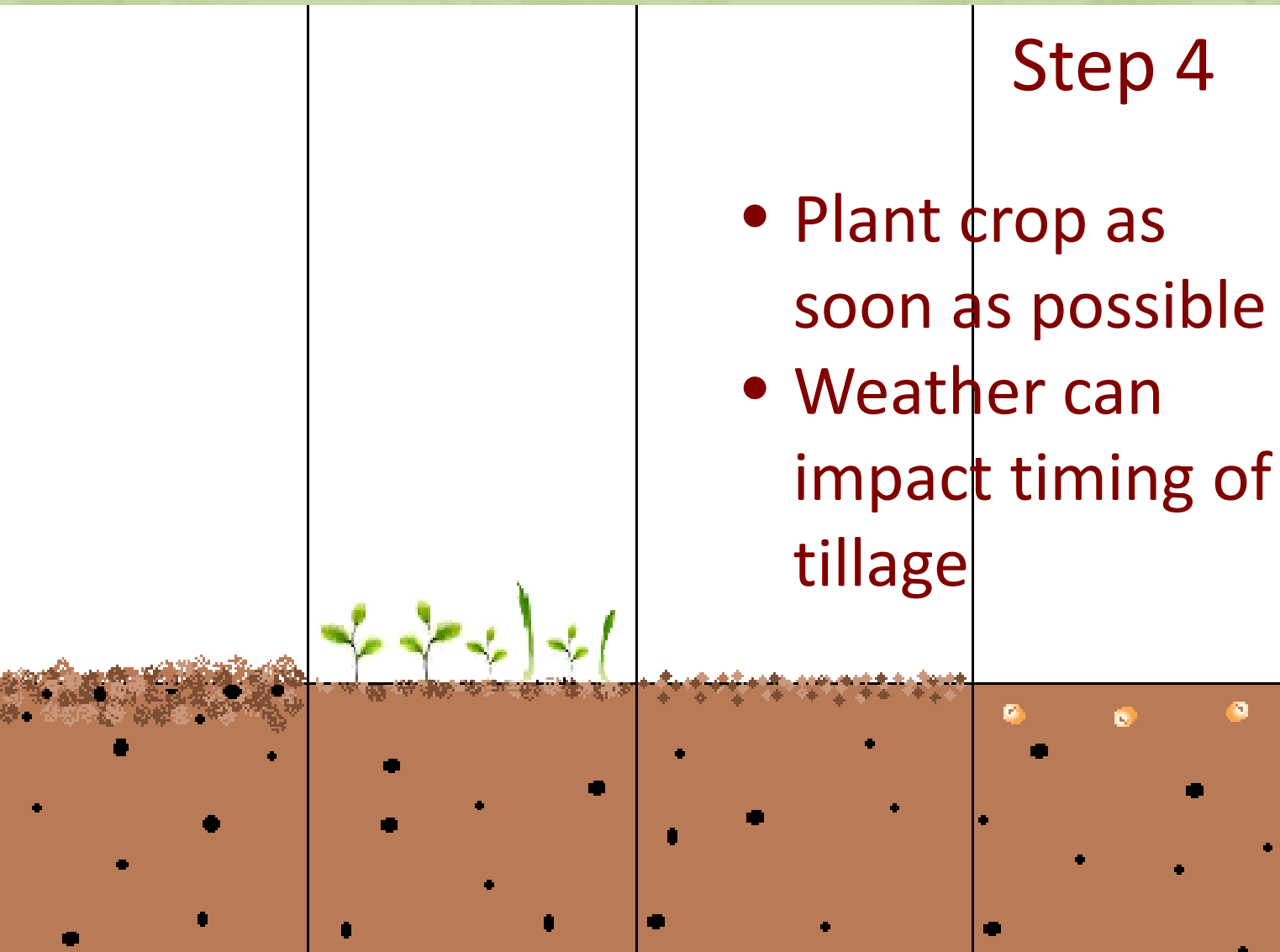
- 2nd tillage
- 2-3" deep - shallower than first tillage
- Weeds killed



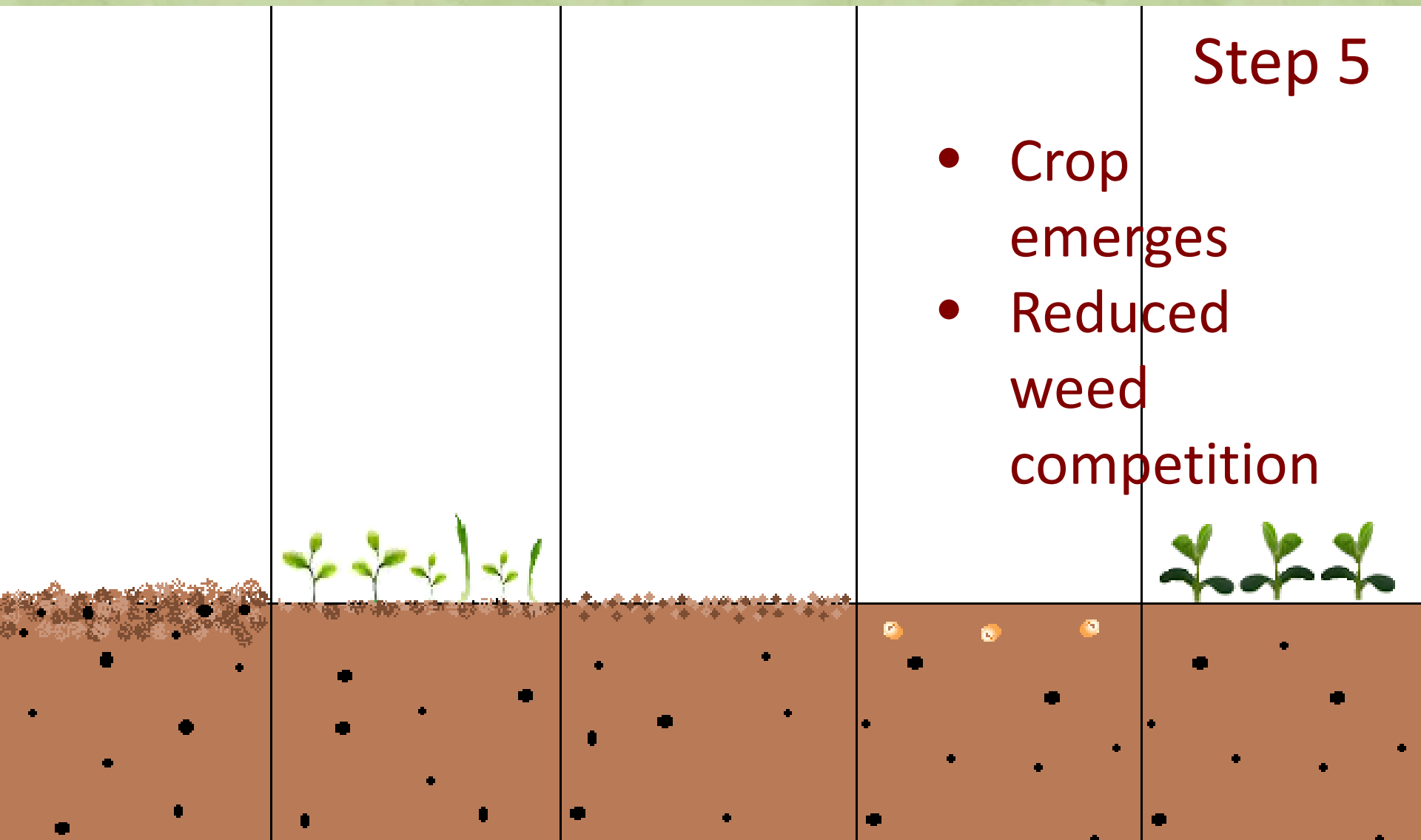
False Seedbed Steps

Step 4

- Plant crop as soon as possible
- Weather can impact timing of tillage



False Seedbed Steps



Step 5

- Crop emerges
- Reduced weed competition

False Seedbed Tips

- Best when soil is warm for germination
- Shallow operations are more effective to not bring new weed seeds to the surface
- Crop will need to be planted immediately after last operation



False Seedbed Warnings

- Don't overly delay crop planting
- Not recommended for early-planted cool season crops
- May not be suitable in drought conditions



After Planting



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A photograph of a field with rows of young corn plants. The soil is dark and appears to be recently tilled, with some clumps of earth visible. The plants are small and green, spaced out in rows. The background shows more of the field extending to the horizon.

(Cultivation) Post Planting

- Tillage after crop is planted
- Equipment varies depending on crop type and crop stage



Cultivation Timing

- Before crop emerges
- Soon after crop emerges
- Between or within rows (when crop is more developed)

Cultivation Before Crop Emerges



- For weeds that emerge before the crop
- “Blind” or “pre-emerge” cultivation
- 3 – 5 days after crop is planted
- Affects top 1” of soil
- Most effective under hot and dry conditions



White-thread stage

Blind Cultivation - Equipment



- Chain harrow
- Flex tine harrow
- Spring tooth harrow
- Spike tooth harrow
- Rotary hoe

Equipment: Tine Weeder



Soon After Crop Emerges

- For weeds that emerge with the crop
- Also a type of blind cultivation
- Care needs to be taken not to damage or cover crop seedlings
- May need to increase planting rate



Equipment: Rotary Hoe or Harrow



Crop Stage to Rotary Hoe and Harrow

Crop	Pre-emerge		Post-emerge	
	Rotary hoe	Harrow	Rotary hoe	Harrow
Corn	Any		Up to 8"	
Soybean or dry bean	Before crook		1-2 trifoliolate	
Field pea	Epicotyl > 1/2" below soil		Up to 4"	
Oats	Before coleoptile near surface		Not recommended	
Wheat, barley	Before coleoptile near surface		1-3 leaf	
Sunflower	Before hypocotyl emergence		2-6 leaf	4-6 leaf

Source: Endres et al., 1999



Add some arrows and animate

Inter-Row Cultivation



- Between rows
- 3-5 weeks after planting
- Timing is less critical
- More aggressive than post-emergence blind operations
- Use only when necessary (dries soil)

Equipment

- **Cultivators**
- **Rolling cultivators**
- **Rotary tillers**
- **Brush weeders**
- **Rotary cultivators**
- **Basket weeders**
- **Rolling harrows**



Between Row Cultivation: Rolling Cultivator





Basic Guidelines

1. Do operations as infrequently as possible
2. Kill weeds when small
3. Target equipment to weed issue
4. Perform operation when it will be most effective, but also take weather into consideration



Crop Losses

A good rule of thumb is to not exceed 5% crop loss with each weed control operation



Resources

- [Steel in the Field](#)
- [Risk Management for Organic Producers – Weed Management](#)
- [eXtension – Weed Management](#)
- [eOrganic – An Organic Weed Control Toolbox](#)

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