Mechanical Weed Management in Organic Crops

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Mechanical Weed Management in Organic Crops

• Necessary to understand in a system context
  – What role does tillage play in your farming system?
  – What tillage tool is critical for your farming system?
• Tillage or lack of tillage affects vertical and horizontal distribution of weed seed and vegetative propagules

Tillage and cultivation

• Timing and weed size are critical
• Tilling in fall can eliminate winter annuals and biennials along with injuring perennials
• Spring tilling can eliminate first flush of summer annuals
• Most effective methods are burial to ½ inch or cutting at soil surface

Tillage and selectivity

• Selectivity is the ratio between weed control and crop injury
• Selectivity greatest when crops differ from weeds in:
  – Growth habitat
  – Emergence time
  – Maturity time
• Weeds with short emergence period better controlled than those with longer emergence period

Tillage and cultivation

• Vary your tillage and cultivation tools to fit the situation
• Cultivation is best done when weeds are small
• Shallow tilling when weeds are in the white thread stage will avoid bringing up weed seed
• Burial versus uprooting versus cutting
  – Burial works best for small weeds especially in the crop row
  – Burial best done when crop is larger than the weed
  – If burying small weeds soil must be dry

Tillage and cultivation

• Burial versus uprooting versus cutting
  – Aim of uprooting is to eliminate soil-root contact
  – Uprooting weeds works best when the soil is damp
  – Remove as much grass roots as possible because growing point is near soil surface
Tillage and cultivation

- Burial versus uprooting versus cutting
  - Slicing or cutting can effectively destroy shoot-root connection
  - Best done when soil is dry
  - Some hoes such as stirrup hoe are designed to be pulled over soil surface to cut off weeds
  - Some weeds such as purslane and crabgrass will reroot

Stale seedbed

- Soil tilled early
  - Encourages early weed flushes
- Delay cropping until main flush of weed emergence has passed
- Emerged weeds killed with shallow tillage, flaming, or organic herbicides
  - Do not till below $\frac{1}{4}$ to $\frac{1}{2}$ inch

Blind tillage

- Shallow tillage of entire field after crop seeded
- Stirs soil above level of crop seed placement
  - Causes desiccation and death of tiny germinating seed
- Most effective when soil fairly dry and weather warm
- Provides the crop after emergence about a 10-day weed free period
- Examples: rotary hoes, flex-tine harrows, chain link harrows

Example 1: Rotary hoe

- Rotary hoes designed for low or high residue fields
- Can be used PRE or POST as long as crop more deeply rooted than weed

Rotary hoe

- Advantages
  - Rapid to use
- Disadvantages
  - Large seed crops only
  - Don’t hoe bean crops in crook stage
  - Will not kill green weeds

Example 2: Flex-tine harrows

- Used broadcast over and between crop rows
- Most efficient when weeds are in white thread or cotyledon stage
- Rely on differences in emergence and rooting depth of crop versus weed
- Small seeded weeds best control
Flex-tine Harrows

- **Advantages**
  - Operated at fast speed
  - Do not require much modification
  - Break soil crusts
  - Sections over crop row can be lifted to avoid injury

- **Disadvantages**
  - Primary action of postemergence harrowing is weed burial
  - Need to cover 1 to 1.5 inches
  - Cultivation timing is critical
  - Does not control grasses at any stage
  - Only controls broadleaves less than 4 leaves
  - Must be integrated with more aggressive cultivator
  - Can reduce stand when used before crop well-rooted

Between-row cultivation

- Should not be primary weed control
- Selectivity can be low
- Implement when weeds one inch tall and crop large enough to not be covered by dirt
- Usually requires more than one pass
- Examples: finger weeders, brush hoe, spyders + tension weeders

Finger Weeder

- **Advantages**
  - Excellent in-row weed control
  - Lightweight tool can be used with small tractor
- **Disadvantages**
  - Timing critical – very small weeds (up to 1 inch), crop must have sufficient stem strength
  - Between-row weed control poor
  - Slow, precise tillage is necessary

- Manufacturer: Buddingh Weeder Co.
  - 7015 Hammond Ave., Dutton, MI 49316
  - Phone: (616) 698-8613

Brush Hoe

- PTO-driven plastic bristles rotate on horizontal plane, ripping weeds from soil
- Very aggressive
  - Shields above soil to protect crop row
  - Operator on rear seat required to steer shields over crop row

Source: European Weed Research Society
Brush Hoe

• Advantages
  – Can control weeds up to ten inches tall
  – Effective on slightly moist soils
  – Soil passing under shields smoothes weeds in crop row
  – Dust layer from brushing delays new weed germination

• Disadvantages
  – Requires two operators
  – Cultivated crops must have same spacing
  – Implement is costly
• Manufacturer
  – Baertschi FOBRO, 1715 Airpark, Grand Haven, MI 49417, Phone: (617) 847-0300, Fax: (616) 842-1768

Summary

• Integrate mechanical weed management with farm goals and systems
• Maximize selectivity
• Minimize weeds emerging with crop through blind tillage
• Do not use cultivation as primary weed management method