Using weed ecology for management

Chuck Mohler
Cornell University
Outline

• Intro – “Many little hammers”
• Causes of weed mortality through the life cycle
• Thoughts on fertility
• Crop rotation and weed management
• Preventive weed management
• How to use the manual
• Discussion
Many little hammers
Any little hammer
Integration

• Crop rotation
• Crop competitiveness
• Type and timing of tillage & cultivation
• Water and nutrient management
• Mulches
Causes of mortality through the life cycle

Seed dormancy

Seeds

Seed production

Seedlings

Small plants

Large, Mature plants

Fatal germination
Seed predation
Loss of viability

Cultivation
Flame weeding
Seedling predation
Disease
Competition

Cultivation
Mowing

Late
Cultivation
Post-harvest tillage
Crop rotation: two considerations

1. Vary the seasonality of planting --
   - Tillage for spring crops kills off winter annuals like annual bluegrass and shepherd’s purse
   - Tillage for summer crops kills off spring germinating weeds like ragweed.
   - Fall crops allow time for a midsummer fallow to fight purslane.
Crop rotation: two considerations

2. Varying crops allows you to vary management practices
   - Can tine weed corn, peas, snap beans
   - Can cultivate root crops very close to the row
   - Hill up potato and corn to kill in-row weeds
   - Flame weed corn & alliums
   - Straw mulch garlic
   - Short season crops like lettuce do not allow seed production – act like a fallow period
Varying crop seasonality and management practices prevent any one species from getting out of control.

Use short season crops like lettuce and spinach.

Or easily weeded and competitive crops like potato.

To clean up after crops like winter squash where weeds often go to seed.
Over fertilization

• Many weed species are highly responsive to soil fertility.
• Weeds often have 1.5 to 3 X higher N, P, K, & Ca concentrations than the crops they are growing with.
• Excess fertility increases weed growth rates.
Experiment at Martens’ Farm

- Applied 0, 0.6, 1.5, 3, or 6 ton/A of compost.
- Either a high N, high solubility compost, or a more digested stable compost.
- On the graphs “soluble” is about 5 - 5 - 2
- “organic” is about 1.4 - 3.6 - 1.5
Response of corn yield to fertility
Weed response to fertility

- Lambsquarters
- Ragweed
- Foxtail

Fitted curve

Compost rate (ton/a)

Height (cm)
Two basic approaches to organic weed management
Standard management

• reduce weed populations below level at which they cause noticeable yield loss
• Weed populations vary greatly between years
• Yield loss is hyperbolic—no threshold
  – Wild oat in wheat
Preventive management

- Don’t let weeds reproduce
- Requires constant vigilance
- Extra management in early years
- Fallows, hand rogueing
Prevention—management costs
Prevention—yield loss
How to use “The Growers Handbook to Ecological Weed Management”

• Understand the general biology of various types of weeds
• Understand the general principals of ecological weed management
• Identify the critical weed problems on the farm
• Read about the specific biology of the problem weeds
• Devise a management plan that exploits the weaknesses in the species’ biology.