Cultural Weed Management

Crop diversification for weed management

Upadhyaya and Blackshaw (2007); Liebman et al. (2001);

Wubs et al. (2005): http://library.wur.nl/way/bestanden/clc/1785298.pdf

Liebman and Staver (2001) propose 2 general principles for managing weeds through crop diversification:

1. Weeds should be challenged with a broad range of stress and mortality factors through the use of crop sequences containing dissimilar species and disparate management practices.
2. Crop mixtures and sequences should be designed to maximize capture of light, water, and nutrients by crops and prevent utilization of those resources by weeds.

Crop Rotation

Growing two or more crops in sequence on the same piece of land.

- Silage, Green Manure and Cover Crops
- Include crops in rotations that are suppressive of weeds.

Silage crops often harvested before weeds produce mature seed.

- Limit addition of seed to the weed seed bank.
- Barley silage decreased wild oat density in subsequent years.

Green manures and cover crops Compete with weeds for resources – fill the niche that would normally be occupied by weeds.

- Living plants and decaying residues can release (phytotoxic substances) allelochemicals that suppress weeds:
    - Rye, oat, barley, sorghum, mustard contain compounds that directly inhibit weed seed germination and growth or breakdown into phytotoxic compounds.
- Residues can be used as organic mulch to suppress weeds – physical barrier to emergence and soil microclimate modification: weed seeds often need light and/or fluctuating temperature for germination and these are affected by cover crop residues.
- Provide habitat for weed seed predators

Use crops that establish quickly and have high biomass production and dense canopies.

Intercropping

Growing two or more crops simultaneously on the same piece of land. Can include mixtures of annuals, annuals/perennials, perennials/perennials.

It allows improved crop productivity, minimized risk of crop failure, and weed suppression. Some second crops are grown for the sole purpose of suppressing weeds: living mulches.

(Students should discuss the difference between living mulches and cover crops)

More common in Asia, Africa, and Latin America than in North America and Europe

- Velvetbean (*Mucuna cochinensis*), lablab (*Lablab purpureus*), and tropical kudzu (*Pueraria phaseoloides*) have been used to suppress cogongrass (*Imperata cylindrica*) in corn and cassava.
- Intercropping leguminous non-host crops such as soybean, cowpea can be used for sustainable control of the parasitic weed *Striga hermonthica* in sorghum (*Sorghum bicolor*) and maize by depleting the seed bank through stimulation of suicidal germination.
- Intercropping can be used for weed management in weakly competitive crops such as leek (*Allium porrum*). Using celery as an intercrop inhibited weed emergence and growth.

Replacement intercropping: density of the mixture is the same as the density of a sole crop.

Additive intercropping: density of the mixture is the sum of the densities of the sole crops.

Different spatial patterns:

- Mixed intercropping: no special pattern crops totally mixed.
- Intra-cropping: different species alternate within rows.
- Row intercropping: Alternating 1 or 2 rows of a crop with another crop.
- Strip intercropping: Multiple rows of each crop are alternated.
- Multistorey intercropping: Tall perennial with shorter biannual or annual crops – agroforestry and orchards.

Different timing:

- Relay intercropping: one crop is sown later than the other when the first is almost mature.

- Sowing a fast developing crop (nurse crop) with a slow developing crop (forage) or perennial legumes such as clover.

Mechanism of action:

Limits resource capture by weeds.

Disadvantages:

- Mechanization is difficult, but this may be overcome by using strip intercropping.
- In conventional systems use of pesticides may be limited since both crops may not be on the same pesticide labels.
- May result in reduced crop quality in vegetables.

Integrating cultural measures

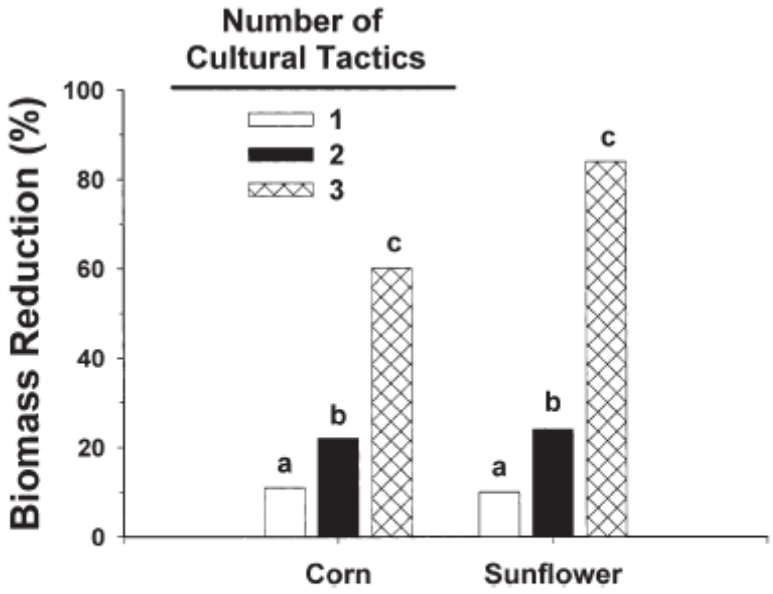

Fig. 4. Synergism of cultural tactics on suppression of weed biomass in corn and sunflower. Tactics include increased seeding rates, narrower row spacing, fertilizer placement, and delayed planting, with treatments compared with the conventional system used by producers. Bars with an identical letter within a crop are not significantly different based on Fisher's Protected LSD (0.05). Means for single tactic treatments did not differ from the conventional system (adapted from Anderson, 2003).

- Several tactics combined together can give more consistent and effective weed management than individual measures.
- Cultural measures: narrower row spacing, higher plant population, or delayed planting.
    - 50-cm vs 78-cm row spacing.
    - 18,200 plants/ha vs 16,000 plants/ha.
    - 2-wk delay in planting compared with normal planting date.
- With sunflower, 1 cultural tactic reduced weed biomass 5 to 10% compared with conventional practices used by producers.
- 2 practices used together resulted in 20 to 25% weed biomass suppression.
- Weed biomass was reduced almost 90% when three tactics were integrated together.
- A similar trend occurred in corn with narrow row spacing, higher plant population, and fertilizer placement.