Cultural Weed Management

Objectives:
Students will be able to discuss what constitutes a cultural weed management practice and be able to give examples of such practices and benefits and short comings.

References: Upadhyaya and Blackshaw 2007, Liebman et al. 2001

Cultural "concerned with the fostering of plant growth"

Cultural weed management involves the use of crop management practices to the benefit of the crop so that it grows more competitively than the weeds.

Cultural practices that can be used to manage weeds:

- Crop spp., cultivar selection, early and uniform establishment, transplanting
- Planting pattern, row spacing, crop density, delayed seeding, use of water, fertilization
- Crop rotation, intercropping, and use of silage, green manure, and cover crops.

Many cultural practices enhance the crop's ability to compete with weeds.

Crop Species

Table 3.1 students should discuss the table.

Table 3.1 Relative competitive ability of crop species with weeds.

Order of decreasing crop competitiveness	Country	Reference
Barley > rye > wheat > linseed	Canada	Pavlychenko and Harrington, 1934
Barley > oats = canola = field peas	UK	Lutman *et al.*, 1993
Rye > oilseed rape = field peas	Denmark	Melander, 1993
Oats = rye = triticale > canola > spring wheat = spring barley > field pea = lupin	Australia	Lemerle *et al.*, 1995
Oats > barley > wheat	UK	Seavers and Wright, 1999
Spring wheat > canola > sunflower	USA	Holman *et al.*, 2004

- Choose a strongly competitive crop.
  Cereals > Oil seed crops>grain legumes

- Poorly competitive crops: short stature, low early vigor eg *Lens cularis* (lentil).
  Use only in fields with low weed populations due to effective management in previous crops.

- Competitive crops contribute to more sustainable systems
  - Reduced dependence on herbicides
  - Slow development of herbicide resistant crops
  - Decreased chemical inputs into the environment

Cultivar Selection

Cultivars within crop species often differ in competitiveness with weeds due to:

- Morphological and physiological characteristics
  - These can interact with environmental factors.
- Older, taller crop cultivars are often more competitive that semi-dwarf types.
- Cultivars should be selected or bred for competitiveness
  - Success will depend on being able to influence the morphological and physiological traits without incurring penalties such as loss of disease resistance or reduced yield and quality.
- Little work has been done in this area to improve the ability of crops to tolerate or suppress weeds.

Fig. 6.6 and 6.7 and Table 6.4 (Liebman et al., 2001)

Students to review the information and discuss.

Table 6.4. *Characteristics of four potato cultivars*

Cultivar	Emergence	Canopy closure	Falling over	Branches per seed piece	Plant size	Foliage density	Maturity
Green Mountain	6/14	7/5	7/28	15.2	Very large and spreading	Dense	Very late
Norchip	6/15–16	7/7	7/28	4.7	Medium-large and upright	Dense	Early
Sebago	6/16–17	7/9	7/11	6.0	Large, erect to spreading	Sparse	Very late
Katahdin	6/16–17	7/8	7/11	3.1	Medium to large and spreading	Sparse	Late

Source: Yip, Sweet & Sieczka (1974).

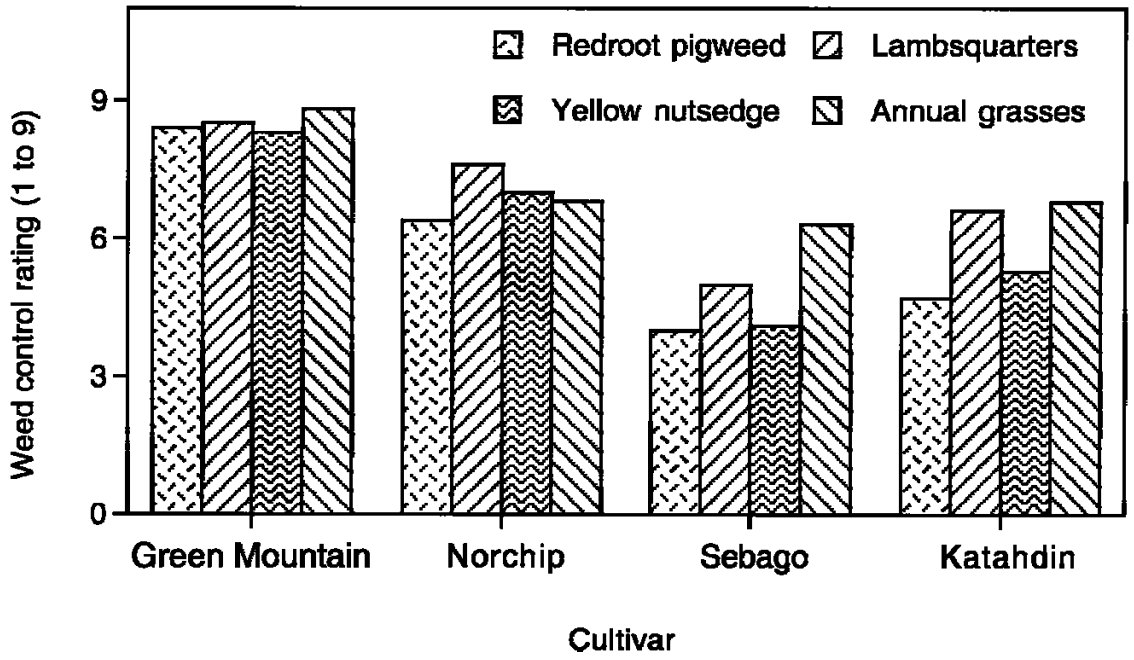

Figure 6.6 Weed control ratings (1 no control, 9 full control) in four potato cultivars in mid-August. Weed management consisted of one inter-row cultivation plus hilling. (Drawn from data in Yip, Sweet & Sieczka, 1974.)

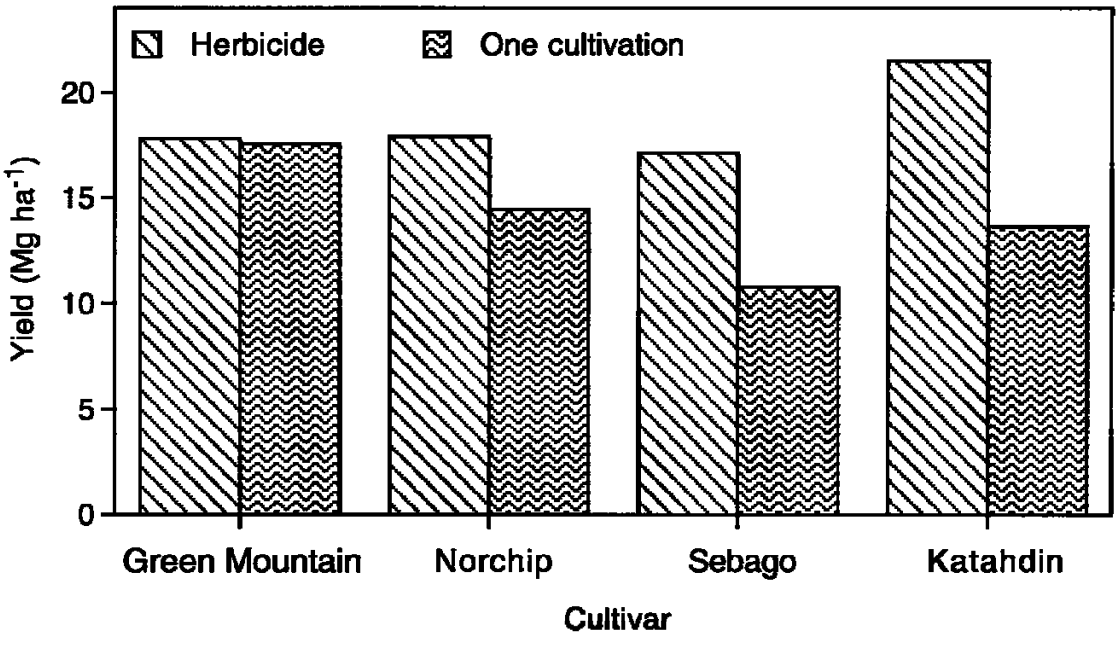

Figure 6.7 Tuber yield for four potato cultivars receiving either herbicide (linuron) plus hilling, or one cultivation plus hilling. (Redrawn from Yip, Sweet & Sieczka, 1974.)

Early and Uniform Crop Establishment

How can this impact weed management?

Healthy Crop Seed

- More rapid germination
- Higher percent germination
- Simultaneous emergence to reduce intraspecific competition and to reduce weed germination and establishment.

Optimal Seeding Depth

- Uniform depth – synchronized emergence
    - Too shallow – uneven germination in dry soil
    - Too deep – depletion of seed reserves for emergence

Sowing in Unsuitable Soils

- Poor emergence
- Tillage for seed bed preparation
- Use of appropriate equipment in conservation tillage systems.

Use of primed seeds

Seed priming: (osmopriming or osmoconditioning)

- Increases % germination
- More rapid germination
- Differences greatest under adverse conditions such as cold and hot soils (lettuce in Arizona)

Groot et al. Seed Testing International, 2004 (No. 127) 12-15

- In cold spring soil, microbial activity is low and nutrients become less readily available in comparison with the use of synthetic fertilizers in conventional farming.
- A vigorous seedling with a fast growing root system may improve the uptake of minerals and improve the establishment of the crop. In this respect vigorous, healthy seedlings may be even more important for the organic farmer than for the conventional farmer. Moreover, faster growing seedlings can improve competition with weeds for nutrients and light.

- They found that primed seeds from onion and carrot had a faster establishment in organic soils compared to non-primed seeds. Two months after sowing, the roots and shoots of plants from primed seeds were larger than those of plants from nonprimed seeds.
- Differences did not persist to the end of the growing season.
    - Favorable growing season plants from non-primed seeds caught up.
    - Under less optimal conditions, for instance when the crop is attacked by diseases during the season, the initial faster growth of primed seeds can benefit the organic farmer.

<u>Transplanting</u>

Use of transplants – provides a competitive advantage vs weeds.

- Hand or machine
- Used for rice and many vegetable crops.
- Substantial initial size advantage of crop over weeds.
    - Minimum weedfree period for directed-seeded tomatoes was 70 d compared to 35 d for transplanted.
- Transplanted maize is less susceptible to *Striga* spp.
- More costly: Direct seeded rice becoming more widespread due to cost of labor and increased water efficiency
- Transplants – cost of purchase or level of farm management needed for on farm production may limit its use. Some crops are not well-adapted to transplanting.