

WEED MANAGEMENT STRATEGIES

INTEGRATED WEED MANAGEMENT

Attention must focus on managing threatened resources (crops, livestock, natural areas, landscapes, etc.) to maintain their competitive ability rather than on eradication of weeds once they invade. Control of undesirable plants without improving management is usually futile. A balanced approach to successfully managing the resource must include the following processes:

- managing the resource to **prevent** weeds from invading
- proper **identification and knowledge** of invasive weed species
- **inventory, mapping and monitoring** of weed populations and damage
- making **control decisions** based on knowledge of potential damage, cost of control method and environmental impact of the weed and control decision
- using control strategies that may include a **combination of methods** to reduce the weed population to an acceptable level
- **evaluating** the effectiveness and effects of management decisions

PREVENTATIVE STRATEGIES

Prevention is the most important but often least used control strategy. Wind, water, wild animals, livestock and man are the major agents of weed dispersal. When weeds are spread by natural agents, control is very difficult or impossible. When man is the weed dispersal agent, carelessness or a lack of understanding of his actions is responsible.

- Sow certified crop seeds. In the long run, cheap seed is usually the most expensive. Certified seed has a lower allowable tolerance for noxious weed seeds.
- Clean machinery and vehicles. Wash farm machinery before transport to clean weeds and mud which contains weed seeds. Tarp grain loads to prevent seed spread.
- Cut weed infested crops prior to weed seed production.

Once weeds have seeded out they can remain a problem for many years due to the process of seed dormancy.

Table 3 Weed-Seed Dormancy

Name of Weed	Years Some Seed Remain Viable (Alive) in the Soil
Chickweed	10
Hedge Mustard	10
Canada Thistle	11 - 20
Oxeye Daisy	11 - 20
Lamb's-Quarters	21 - 40
Purslane	21 - 40
Redroot Pigweed	21 - 40
Shepherd's-Purse	35
Dodder	70
Curled Dock	>80

PHYSICAL STRATEGIES

Tillage

Soil is the principle factor of the environment that the farmer manipulates in crop production. Soil tillage enables the farmer to attack many weed survival mechanisms. For annual weeds, the tillage objective is to prevent seed production and deplete current seed reserves in the soil. This is accomplished by encouraging weed seeds to germinate, then subsequently killing them. With perennials, destruction of the underground parts is sought, as well as the prevention of seed production and reduction of seed reserves.

Tillage kills weeds by:

- Burial of the entire plant. If complete burial is not accomplished and a small portion of the plant is exposed, life may continue. Burial is usually only effective with seedlings.
- Depleting food reserves. This is accomplished by repeatedly removing top growth whenever it reaches sufficient size. Food manufacture can be halted by cutting off the plant tops or burning them. Tillage that breaks the underground parts into pieces is also very effective. This creates more growing points to use up food, and hastens food depletion.

- Exposure of underground parts to frost. The roots of most plants are killed when left on or near the soil surface during freezing temperatures. Fall cultivation followed by spring-tooth harrowing brings underground parts to the surface.
- Exposure of root systems to drying. If many roots remain under moist soil, growth will continue, therefore tillage must be thorough, with the plants fully exposed on the soil surface.
- Encouraging rotting of underground parts. Physical injury to underground parts due to tillage enables the entry of decay causing bacteria.

Spring Tillage: Don't till deeper than four inches. Deep tillage buries weed seeds and temporarily minimizes weed problems, but subsequent tillage will bring these seeds to the surface again. Seeds in the soil can germinate many years after burial - sometimes for up to 40 years or more. Tillage should be designed to catch the first flush of weeds prior to sowing the crop. In moister areas tillage may be designed to control more than one flush of weeds prior to seeding. Post-seeding tillage, if practical, should be done in dry, warm, sunny and perhaps windy conditions so that weed seedlings once disturbed are not able to transplant themselves.

Fall Tillage: Tillage after harvest can effectively kill biennials and suppress perennials. Under suitable conditions in the fall, weed germination may be stimulated making the new seedlings susceptible to frost kill.

Hand Weeding

Annual and biennial weeds and non-creeping perennials can be destroyed by simply pulling them out. This is best done when the soil is moist and before seed is produced. This is only practical of course for small patches or individual plants.

Mowing

When weeds are too numerous to hand pull, too large to effectively destroy by cultivation, or in an area where cultivation is impractical or impossible, they can be destroyed by mowing.

This should be done before they produce seed and as close to the ground as possible. Perennial weeds usually require several cuttings before the food reserves in the roots are exhausted. If only a single cutting can be made, the best time is just prior to blooming because (1) the reserve food supply in the roots is at its lowest level, and (2) viable seed is often produced just after blooming. Perennial sow-thistle begins producing viable seed only three days after blooming and after nine days, 73 percent of the seeds may be viable.

Grazing

The repeated removal of weed top growth by grazing animals, like close mowing, prevents seed formation and gradually weakens underground parts. Horses, sheep, goats, hogs and cattle are effective in destroying many weeds, if they are properly managed. **Grazing animals should not be turned into pastures too early in the spring** before the pasture grasses have made good growth. If grazing is permitted too early, the grasses do not develop a competitive stand and the weeds tend to take over. Ideally, pasture should be subdivided into two or more lots. This permits pasture areas to be grazed in rotation. If managed correctly, more weeds will be cleaned up than if livestock are allowed to roam over a large area and choose the more desirable forage, leaving the weeds to become rank, unpalatable, and over a period of time the dominant pasture plants. By rotating the pastures, desirable forage is encouraged during its rest period and results in healthier competitive pasture plants. Rotation also permits herbicide treatment with a safety margin, enabling the breakdown of the chemical before returning the pasture to grazing.

Burning

In situations when seed production has already occurred, some of the seeds can be destroyed by burning. The effectiveness of burning depends on the duration and intensity of heat produced, plus the maturity and location of the seeds. Mature, dry seeds are more heat resistant than green seeds, which have a high moisture content. Although intense heat will destroy most seeds remaining in plant heads, only a relatively small number of seeds on or below the soil surface can

be destroyed by burning surface trash. Burning weeds over an extended area destroys valuable surface trash that would normally be returned to the soil through decay or cultivation.

In most farming operations, the most appropriate use of burning would be to selectively burn patches of weeds that have headed out by using a large propane torch. The flame can be directed at the mature heads of the weeds and the undesirable side effects of burning can be largely avoided. This is one of the few effective methods of preventing the dissemination of airborne seeds like Canada thistle, sow thistle, etc. Row crop producers sometimes use flaming machines that selectively burn weed top growth between the rows of specialty crops.

Mulching

The principle of mulching is to exclude light from the tops of the weeds until the reserve food supply in the roots is depleted and the weeds starve. Mulches include clean straw, hay or manure, tar paper, sawdust and black plastic. Black plastic is very effective. When the vegetation under the mulch has been destroyed, the resultant bare patch must be re-seeded with competitive vegetation to prevent new weed introductions.

CULTURAL STRATEGIES

Cultural control uses plant competition or cropping practices to suppress weeds, either through use of smother or competitive crops and crop rotation.

Crop Rotations

Certain groups of weeds are almost always associated with specific crop rotations because:

- They are able to compete well with that crop.
- They are not destroyed by the herbicides and cultivations that normally accompany production of the crop.

Continuous cropping to small grains, for example, results in an increase in weed populations, chiefly annuals. Perennial forage crop plantings or permanent pastures favour development of perennial weeds like Canada

thistle and quackgrass. Repeated plantings of the same crop favour the development of insects and diseases that result in weak or patchy stands that are easily invaded by weeds.

Summer annual weeds in grain plantings can be reduced by rotating to perennial forages or to row crop production where practical.

Once perennial forage crops are established and well managed, cutting for hay will suppress annual and perennial weeds, and eventually the competition will eliminate annual weeds.

Fall seeded crops such as fall rye or winter wheat provide increased early season competition to seedling weeds and the early harvest enables a partial summer fallow for the balance of the season.

Despite rotating crops, intensive summer fallow is often the only cultural alternative on land severely infested with perennial weeds such as Canada thistle and quackgrass. Summer fallow is designed to suppress growth, prevent seed production, deplete seed reserves in the soil and starve weed roots.

Plant Competition

The use of plant competition is one of the cheapest and most useful general weed control practices available to all farmers. Competition uses one of nature's oldest laws - survival of the fittest. Weeds are strong competitors by nature. If not, they would fail nature's survival tests. Certain weeds that can best compete under a certain set of circumstances always tend to dominate.

As mentioned earlier, weeds compete with crop plants for light, soil moisture, soil nutrients, carbon dioxide, and space. For example, one mustard plant from germination to maturity uses twice as much nitrogen and phosphorus, four times as much potassium, and four times as much water as one well developed oat plant.

As a general rule, for every pound of weed growth produced, about one less pound of crop growth is produced. Usually, early weed

competition reduces crop yield far greater than late season weed growth. It naturally follows then, that early weed control is exceptionally important. Late season weed growth may not seriously reduce yields, but it can make harvesting difficult, lower crop quality, and add to the reservoir of weed seeds in the soil.

Crop Establishment

As a general rule, the first plants to germinate and emerge in an area tend to exclude all others. Therefore, it is critical when considering plant competition as a weed management tool to establish a vigorous dense crop. Important factors that affect germination and emergence include the viability of the crop seed (percent germination), soil temperature, availability of moisture, and physical resistance to seedling emergence by the soil. These factors are influenced by the soil type, physical condition of the soil, depth of planting, the firmness of soil around the seed, the degree of soil compaction above the seed, and the formation of surface crusts after planting. The final stand will also be influenced by post-emergent stress due to weeds, diseases, insects and adverse weather conditions. Crop germination, if planting has been correctly done, is generally rapid and predictable. If pre-seeding weed growth has been killed, at least a temporary advantage has been gained for the crop. This initial advantage can be lost however, if effective post-seeding herbicide application or tillage is not undertaken to control late emerging weeds.

FACTORS LEADING TO MAXIMUM CROP COMPETITION TO REDUCE WEEDS

Prepare Good Seedbed - Stale Seedbed

Technique: A good seedbed is prepared, but no seeds are planted. After a good growth of weeds have emerged, they are killed using a non-selective herbicide with no residual effect in the soil. The crop is then planted with as little disturbance of the soil as possible to avoid bringing fresh weed seeds to the surface. This technique controls the all important first flush of weeds.

Rate of Seeding: Heavier seeding rates can be used to reduce weed competition in areas where sufficient moisture is available. This applies to seeding completed at the regular time, as well as in a delayed seeding program. The recommended heavy seeding rate varies from 25 to 100 percent more seed, depending on the crop and the location. However, it should be remembered that heavy seeding rates should be used together with other cultural and chemical control measures to be most effective.

Date of Seeding: Different weeds have different preferences for germination. Weeds such as many of the mustards and wild oats germinate best in cool conditions and are therefore more of a problem in early sown crops. Redroot pigweed and green foxtail prefer warmer soils and therefore germinate later. Late seeding allows for tillage or pre-seeding herbicide control of early germinating weeds. Early seeding results in crop competition with later germinating weed species. By varying crop seeding dates weeds have difficulty adapting.

Crop Variety: It is important to choose a variety of crop plant that is well adapted to local conditions of soil, water, climate and disease resistance.

Fertilization: The fertility of the soil affects both the vigour of crop plants and the vigour of weeds. Many weeds can utilize fertilizers as well as or better than crop plants. Nevertheless, if most of the weeds are suppressed or killed by tillage or herbicides, the extra vigour given to the crop by fertilizers will make them better competitors. Placement of the fertilizer in the crop rows has an advantage over broadcast fertilization because most of the fertilizer is directly available to the crop.

Cultural Weed Control

Cultural practices aimed at achieving good establishment of new alfalfa seedlings and maintaining the stand in healthy condition are of

paramount importance in reducing losses due to weeds. Cultural controls can be summarized as follows:

1. Eliminate perennial weeds prior to seeding through the use of intensive cultivation, if practical, or by treating with a non-residual herbicide such as Roundup (glyphosate).
2. Use only clean certified seed. Some weeds can lie dormant in the soil for up to 70 years or more so don't sow weed seeds along with alfalfa by purchasing cheaper but weedy seed.
3. Thorough pre-seeding cultivation to destroy weed seedlings.
4. Timely seeding when soil temperature is warm enough to promote quick germination and establishment.
5. Prepare a smooth, even seedbed to promote uniform germination.
6. Mow or clip to prevent annual weed growth and seed set. Mowing will have little effect on perennial weeds whose growing points are close to the ground such as dandelion and weedy grasses.
7. Maintain proper soil fertility.
8. Maintain good soil moisture.
9. Follow a crop rotation. Row crop cultivation can control perennial broadleaved and grassy weeds.
10. Cut crops before weeds go to seed.
11. Avoid overgrazing in early fall. This will aid in preventing depletion of root food reserves needed to minimize winter injury.