

A production guide for coastal British Columbia and the Pacific Northwest S. Bittman, O. Schmidt and T. N. Cramer

# CHAPTER 4 Weed Management



- Do weeds affect forage yield?
- Weeds affect forage quality and it's not all bad
- Anti-quality factors
- Effect of weeds on commercial value of forage
- Weed lifecycles
- Strategies for weed management

Weeds are nothing more or less than unwanted plants that compete with the crop for moisture, nutrients and light. In crops other than forages, weeds clearly add nothing to the crop and often contaminate it. However, in forage crops all plants are harvested and used so the impact of weeds is less clear.

### **Do weeds affect** forage yield?

Weeds tend to fill gaps in forage stands. Hence, eliminating these weeds might result in no immediate yield increase and could actually diminish forage yield. It can be assumed that most weeds produce less herbage than

Further information on weed identification is available in the Field Guide to Noxious and other Selected Weeds of British Columbia (1998), published by the British Columbia Ministry of Agriculture & Food. Visit the internet site at "www.agf.gov. bc/agric/ipmweb/WEEDGUID/ weedguid.htm" adapted forage crops. If weeds were as productive they, might in themselves be planted as the forage. Indeed, scientists have discovered that aggressive and vigorous grassy weeds like quackgrass and barnyardgrass have surprisingly low yield potential compared to the forages that they compete with.

Weeds are successful because they are particularly adapted to invade, spread and reproduce. Most weeds

have evolved to prolifically produce seeds and rhizomes but this is at the expense of useful herbage. Once they are established in gaps, weeds are poised to exploit any weakness in the crop. Forage crops have been developed for high yield and disease resistance, but some weeds are better adapted than forages to tolerate grazing and clipping, injury by pests, diseases or environmental stresses such as cold, drought, soil compaction, treading, and so on. As these environmental and biological stresses weaken the forage, adapted weeds expand their occupation (Fig. 1). Quackgrass contains allelopathic substances (natural plant toxins) that can inhibit the growth of adjacent tame forage plants. This property assists quackgrass in gradually dominating a forage stand.

In a study on a stand of orchardgrass with 10 - 20% dandelion, manually eliminating the weed increased forage yield by only 7%. In this example the use of 2,4-D for dandelion control would likely



Fig. 1. Dandelion poised to expand into space made available by decline of diseased orchard grass (see Chapter 6).

result in some economic benefit. However, the greatest benefit of controlling encroaching weeds may be delaying the decline of the host forage crop that the weeds would otherwise help to bring about. Because weed-forage interactions are complex, we have little information on economic thresholds (weed population at which economic gain from controlling weeds offsets the cost of the control measure) for control of weeds in forage crops.



Fig. 2. Perennial sowthistle.



l sow- Fig. 3. Lamb's quarters.

### Weeds affect forage quality – and it's not all bad

Weeds may lower or improve the nutritional quality of a forage stand. Several annual weeds (such as redroot pigweed and lamb's quarters) and perennial weeds (including dandelion, Canada thistle and perennial sow-thistle) have nutritional quality equivalent to alfalfa when harvested at the same time. When these weeds are harvested along with the forage crop, they may improve the feeding quality of the silage. Research in Saskatchewan has shown that broadleaf weeds have a better balance of copper and molybdenum than either cultivated or volunteer grass species on pasture, so cattle are less likely to experience copper deficiency on weedy pastures.

First-harvest dandelions that are in bloom typically contain about 3 percentage points less protein than orchardgrass, but dandelions that are mostly in a vegetative stage in later harvests have similar protein content to that of orchardgrass. In feeding trials, dandelions often equal orchardgrass in palatability, either in pasture or as properly cured hay. The overall digestibility and the digestibility of the plant protein (see Ch. 7) are similar in dandelions and alfalfa.

Quackgrass, like dandelions, has reasonably good nutritional value. While quackgrass is maligned as a weed, the

grass is used as a parent in grass breeding programs for its nutritive value and palatability. Protein content and palatability of quackgrass and timothy are similar according to some reports in the literature. Other studies have shown that quackgrass has 3 percentage points less crude protein content than orchardgrass at the flowering stage.

In contrast, other common weeds such as shepherd's-purse, curled dock, smartweed (lady's thumb)

and foxtail are usually lower in nutritive value than forage grasses and therefore undesirable as a feed component.





Fig. 4. Curled dock.

Fig. 5. Lady's thumb.



Fig. 6. Wild mustard.

### Anti-Quality Factors

Weeds often introduce undesirable nutritional factors that must be considered:

- Excess moisture: Dandelions contain up to 7% more moisture than alfalfa and require at least an extra day to dry before baling. To make matters worse, weeds usually form compacted swaths and tedding often shatters their leaves resulting in losses. Hay comprised of a considerable amount of dandelion or other large-leafed weeds often turns black and moulds.
- Tainting flavour of milk: Many weeds in the mustard family such as stinkweed and wild mustard contain anti-quality factors that can taint milk flavour.
- Nitrates: At some growth stages and under specific growing conditions weeds such as redroot pigweed, lamb's quarters, Canada thistle, barnyardgrass and smartweed can contain toxic levels of nitrates.
- Toxins: Some of the common poisonous weeds found in Coastal forages include tansy ragwort, buttercup, bracken fern and field horsetail. None of these weeds should be grazed or fed to livestock in large quantity.



Fig. 7. Tansy ragwort.

### WEEDS AS ENVIRONMENTAL INDICATORS

Weeds in crops are as often the result of a problem as the cause of it. Weeds readily find spaces caused by such environmental factors as poor drainage, inadequate fertility, high or low pH, soil compaction, disease and insect attack, and poor harvesting and grazing practices. Encroachment by dandelions indicates weakening of the forages by factors such as winter injury, disease and insects. Buttercups and bog rush (slough grass) prefer wet soils, hence are indicative of poor drainage. Bracken grows best under acid soil conditions while foxtail barley prefers high pH soils. Perennial bluegrass species and bentgrasses indicate overgrazing, and annual bluegrass appears on compacted soils. Horsetail often indicates light, dry soils with coarse texture and low organic matter. Table 1: Seed production and dormancy of some common weeds.

Weed	Number of seeds produced per plant	Number of years that seed may remain viable in soil
Canada Thistle	630/stem	11-20
Chickweed		10
Dandelion	15,000	
Curled Dock	29,500	80+
Barnyardgrass	7,160	
Green Foxtail (millet)	34,000	
Lamb's Quarters	72,450	21-40
Redroot Pigweed	129,000	21-40
Lady's Thumb	19,000	
Shepherd's Purse	33,500	35
Tansy Ragwort	150,000	

### Effect of weeds on commercial value of forage

If the forage is sold, discounts of about 1% for each percentage of weeds are often imposed on weedy hay, up to a weed percentage of 20 - 25%. Hay containing more than 20 - 25% weeds is usually not marketable. Concern about the nutritional quality of the weeds may be a factor in the rejection of forage. Therefore, when the forage is destined for sale, the use of herbicides may be justified at relatively low levels of weed infestation.

In fields that are badly infested with weeds, herbicide applications will likely not result in production of sufficient additional tame forage to compensate for the weeds that were removed. Furthermore, new weeds may re-invade the new openings. Therefore, these fields should probably be removed, at least temporarily, from commercial hay production.

# Weed lifecycles

An understanding of the way weeds grow helps in planning management to control

their growth and possible spread. Weeds fall into four categories based on their growth habits: summer annual, winter annual, biennial and perennial.

#### Annual weeds

Some annual weeds grow best in warm temperatures while others prefer cooler conditions. Summer annual weeds complete their entire growth cycle, from germination to seed formation, in one growing season. Common examples of summer annual weeds are redroot pigweed, lamb's quarters, annual smartweed, barnyardgrass, and yellow or green foxtail. Many of the summer annual weeds grow best in very hot temperatures and tolerate drought remarkably well, thanks to a specialized physiology (called C-4 metabolism) not enjoyed by any of our perennial forages. These weeds do not germinate until mid-May, so seeding in early spring or fall is the best and cheapest way to avoid these nasty pests.

Winter annual weeds germinate in the cooler and moister conditions of late summer or fall and typically produce a rosette of leaves in the fall. Examples include shepherd's purse, annual bluegrass and corn spurry. In our coastal climate, these plants may continue to grow through much of the winter and then surge in the early spring and complete their lifecycle well before summer. Many of the weeds that behave as winter annuals may also germinate in early spring, long before the summer annuals.

Annual weeds do most damage to new forage stands but also invade established stands damaged by pests or harsh winters. The firm, fine and nutrient-rich seedbed prepared for small-seeded forages is equally well-suited for germination and establishment of weeds. Well-established and vigorous forage stands fend off invading annual weeds and, over time, help to reduce populations of weed seeds in the ground. Thus, growing forages after several years of corn reduces the weed load.

### Biennial and perennial weeds

Biennial weeds germinate one season and complete their growth cycle by shedding seed in the following year (e.g. common burdock, bull thistle, wild carrot). Perennial weeds live for more than two years, by definition, and some may live almost indefinitely. Perennial weeds often found



Fig. 8. Barnyardgrass.



Fig. 9. Shepherd's purse.



Fig. 10. Corn spurry.

Chapter 4 = Page 55

Table 2. Viability of weed seeds after passing through various classes of livestock

Weed Name	Horses	Cattle	Swine	Sheep
Canada Thistle		No	Yes	Yes
Chickweed	Yes	Yes	Yes	Yes
Curly dock	Yes	Yes	Yes	Yes
Dandelion	No	No	Yes	Yes
Green Foxtail	Yes	Yes	Yes	Yes
Smartweed			Yes	No
Lamb's-quarters	Yes	Yes	Yes	Yes
Quackgrass	Yes	Yes	No	No
Tall Buttercup	Yes	Yes	Yes	Yes

in forage crops, such as quackgrass, velvetgrass, bluegrass, curled dock and Canada thistle are very difficult to control. These weeds increase as the stand ages, until eventually renovation is required. Growing corn for a year or two after grass helps reduce the load of perennial weeds from the field.

#### Weed Seeds

Important to consider in making a weed control decision is the weeds' reproductive potential. Most weeds are successful as a result of perennial root survival, high seed production, and long-term seed dormancy and viability. Understanding these aspects can help answer the question "If I don't control it now will it continue to spread and increase my management costs?"

### **Strategies for weed management**

#### 1. General

Start with a clean field where perennial weeds have been controlled.



Fig. 11. Broadleaved dock.

Page 56 = Chapter 4

- Use high-quality clean seed and species that are well-suited to your area and soil conditions. Note that certified seed has very low allowable levels of weed seeds, especially those classified as primary noxious weeds.
- Use establishment techniques that favour the forages and not the weeds. This includes early planting, good seedbed preparation, and uniform shallow seeding, with greatest attention to forages that are slow to establish.
- Once established, vigorously growing forages will keep out most weeds. It is difficult for weeds to get started in a dense, well-managed grass or grass/ legume stand.

### 2. Weed control before seedbed preparation

It is best to control perennial weeds before seeding takes place. Perennials such as quackgrass, curled dock or Canada thistle are very difficult to control once they are established in grass or legume stands. Also, root pieces from many of these plants can be spread by cultivation equipment when the seedbed is being prepared. Many of these root pieces will produce new plants very rapidly.

If perennial weeds are present in the field you are planning to seed, the most successful control is usually obtained by applying the herbicide glyphosate (Roundup®, Touchdown®, and Victor®). Glyphosate is sprayed onto the perennial weeds before the field is cultivated. In spring, the perennial weeds must have at least 20 cm (8 in) of active growth before they are sprayed.

Late fall application usually gives excellent control with glyphosate because the plants are moving carbohydrates into the crowns and the herbicide will be carried along to the crown and roots where it will produce the greatest effect. Another advantage of fall application is that the sod will be killed and begin to break down over winter. This saves time and produces a better seedbed in spring.

Complete control of perennial weeds, especially dandelions, will not be accomplished with a single herbicide application. Additional herbicide or tillage operations will likely be required before complete control of perennial weed species is achieved.

Can perennial weeds be controlled by tillage alone? The strategy is to repeat tillage frequently, whenever root pieces begin to regrow, until all the food reserves are depleted. Success using tillage will depend on the type of perennials being controlled, how much root reserve they have, growing conditions and the amount of time available to utilize this technique. The technique works best under good growing conditions. If the soil is very dry, the root pieces will become dormant so tillage will have little effect.

### THE MANURE CONNECTION

Be aware that many weed seeds remain viable after storage in silage or hay and passing through the animal. In fact, the passage through the animal's digestive tract may actually induce dormant weed seeds to break their dormancy and germinate. Thus, weedseed-containing manure applied to fields will continue the weed growth cycle (See Table 2).

Seed stored in solid manure for 4-5 months, or heat-composted (60 C or 140 F) for 3 weeks will lose viability hence breaking the weed-animal-manure application cycle.

### 3. Control of weeds during seeding and establishment

Seedling forages do not compete well against the many species of annual weeds that germinate at the same time as the forage. Weeds are much easier to control when they are seedlings, before they have suppressed the forage stand. Species with sluggish seedlings (e.g. tall fescue, reed canarygrass, timothy) are the most susceptible to weed competition whereas those with very vigorous seedlings (notably the ryegrasses) need much less weed management.

#### A. NURSE (COMPANION) CROPS (SEE CH.6)

Cereal companion or nurse crops can be used to compete against weeds and reduce likelihood that a herbicide will be needed (Table 4). The cereal nurse crops should be planted at half the usual seeding rate, about 40 - 50 kg/ha (35 - 45 lb/ac), at the same time as the forage. At higher seeding rates, the cereals will themselves compete too much with the forage. It is most important to harvest the nurse crop early, not later than the soft dough stage, to release the forage seedlings from competition for light and water. Companion crops allowed to grow tall might be lodged (knocked over) by wind or rain, smothering the forage seedlings underneath. Research at PARC (Agassiz) showed that use of a nurse crop made it unnecessary to apply herbicides when establishing either perennial ryegrass,

# Table 3. Seedling vigour affects amountof weed infestation in new stands ofperennial forages

Туре	Weed content	
Perennial ryegrass	30%	
Orchardgrass	45%	
Mix (Orchard + ryegrass)	39%	

Table 4. Companion crops reduce weedsin newly seeded grass crops at PARC(Agassiz) in 1986-1988

Establishment Method	Weed content Initial harvest
No weed control	65%
Herbicide	41%
Barley companion crop	22%
Oats companion crop	24%

orchardgrass or a mixture of the two.

A variation on companion cropping used by some farmers is to seed a shortlived vigorous grass (such as Italian or perennial ryegrass) with the slower establishing, more persistent orchardgrass or tall fescue. The persistent grasses are expected to eventually take over the sward, while the short-lived grasses prevent weed encroachment. The key to success appears to be balancing the seed populations to ensure that the ryegrasses are not overwhelming. While the ryegrasses are less competitive than cereals initially, they remain adversaries for a much longer time.

Researchers at Kamloops Research Centre have shown that, under irrigation, Italian ryegrass seeded under barley will regrow rapidly after the barley is harvested for silage. At PARC (Agassiz), Italian ryegrass has been established with success under field corn harvested in mid- to late September. The ryegrass has survived



Chapter 4 = Page 57

most winters and produced well the next year.

#### **B. CLIPPING AND GRAZING**

Timely clipping or grazing is commonly used to reduce competition and production of new seeds by annual weeds. Clipping or grazing when the stand is very young can cause wheel and hoof damage including rutting, poaching and compaction of fields that are still soft. Left too long before clipping or grazing, forage seedlings will be suppressed. Excessive weed competition and new weed seeds will be produced. Most annual weeds will not regrow after clipping because their growing points are removed but there are exceptions, such as barnyardgrass, which will regrow and continue to produce seed even if cut very close to the ground. The forage seedlings do regrow quickly after weeds are clipped. Clipping encourages the grasses to produce more tillers, making the sod more dense and competitive.

It is important to remove the excessive clippings from the field in some way. This will prevent smothering of the young forages and remove any weed seeds from the field. Forage stands are often clipped with flail harvesters that put the forage and weeds into a wagon. The harvester should have very sharp knives to minimize damage to the small forage plants. Speed of recovery is faster with clean cuts made by sharp knives. The collected herbage will consist mainly of weeds. Before feeding the weeds, consider impact of the weeds on forage quality (see Pg. 54).

#### C. HERBICIDES

Herbicides can control many broadleaved weeds during establishment but few herbicides are available for controlling grassy weeds. Inexpensive herbicides for broadleaved weed control, such as MCPA amine 500, are effective when used correctly. A common reason for failure is late application. Best control is achieved when the weeds are at the 2 to 4-leaf stage. Note that most grassy annual weeds are heat-loving and do not germinate until May. Planting forages in April or earlier will minimize the effect of the pernicious annual grassy weeds.

#### 4. Weed control in established forages

Good forage management is essential to prevent encroachment by weeds. A

well-established, properly fertilized forage crop will exclude weeds. If grassy weeds become a problem, it is almost impossible to get rid of them without completely renovating the stand. Fine-leafed grasses (bluegrass and bentgrass — see chapter 3) will fill in areas where the forage has been killed out by compaction, traffic and overgrazing. These weedy grasses are usually unproductive.

In many cases, broadleaved weeds in established forages can be controlled with a herbicide. The herbicide used will depend on the grass and legume species. how the crop is being used and which broadleaved weeds are present. Proper weed identification is essential so you can select the right herbicide. It is important to find out grazing or cropping restrictions that apply for the herbicide you are going to use. For example, if you plan to treat curled dock plants with Banvel 480 at the recommended rate of 2.0 L/ha (26 oz/ac), you must wait at least 7 days before allowing dairy cattle to graze the treated field.

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