

Drought Management FACTSHEET

ALTERNATE FORAGE CROPS WHEN IRRIGATION WATER IS LIMITED

Key Points

1. Choosing annuals versus perennial crops
2. Characteristics of annual forage crops:
 - cereals (in order of drought tolerance): fall rye, spring rye, winter triticale, spring triticale, hard red spring wheat, barley, oats
 - other annual crops such as pearl millet, sunflower, sorghum, sudangrass, corn

Annual Versus Perennial Crops

When irrigation water is limited due to drought conditions, producers may need to change their cropping program to get the most yields possible from limited water. It is important to keep in mind that a well established, productive stand of alfalfa or grass is likely to be your most productive crop, even when irrigation is less than normal.

However, if you have old stands that you were planning to re-seed, or if your cropping system normally includes some annual crops, such as barely-ryegrass or corn silage, you should plan your cropping program based on the available irrigation water.



As droughts are cyclical and are a natural occurrence, with the drought period short-lived relative to the 'normal' conditions, irrigated crop producers are not likely going to switch to very drought tolerant perennial crops (eg crested wheatgrass), as the yield penalty is too great. When irrigation supplies have a short-term reduction, the most logical crop switch is to annual crops that require less water. Annual forages use less water by two basic mechanisms—a shorter growing period, and/or greater water use efficiency. If you are planning to re-seed an alfalfa crop when drought is a possibility, it is wise to adjust management to make the best use of available water for the alfalfa crop:

Consider no-till or minimum till to conserve soil moisture:

- tillage dries the soil and wastes water
- no-till conserves moisture by minimizing soil disturbance, but usually requires the use of a herbicides to control competing growth

Do not seed an annual cover crop:

- annual crops establish more quickly than alfalfa or grass and use up the available moisture
- straight seeded alfalfa establishes more quickly without a cover crop and will be more drought tolerant due to greater root growth. Ensure a weed control program is in place

A new option that may be worth investigating is PC Rye, a new hybrid crop that is a perennial cereal rye. It has many of the characteristics of fall cereal rye, but is a short-lived (3-4 years) perennial, so does not require re-seeding every year. It has potential as a drought tolerant perennial for silage, in place of such crops as barley.

Annual Forage Crops

The most commonly grown alternative forage crops are the cereals-fall rye, wheat, barley and oats. Other options include triticale (both spring and fall types), sorghum, sudangrass and hybrid sorghum-sudangrass. Corn and sunflower are also optional forage crops if silage equipment is available. Inter-crops, such as barley-italian ryegrass, are not generally suited for years when water is short, as annual ryegrass has very poor drought tolerance and is not productive if water is short in late summer. It may be worthwhile to include Italian ryegrass to take advantage of fall moisture that may occur.

The following table provides information on the characteristics of different annual forages.

For more detailed information on any of these crops, refer to the sources listed after specific crop sections or general sources listed on page six.

Table 1 Comparison of Annual Forages - Cereals

Crop	Drought Tolerance	Water Use	Seeding Rate (lb/acre)	Potential Yield ¹	Hay or Silage	Feed Quality	Comments
Fall Rye or Fall Triticale	high	low	80-100	medium	both	med-low	suitable if fall moisture available
Spring Rye	med-high	low-medium	80-100	medium	both	med-low	more drought tolerant than barley
Spring Triticale	medium-high	medium	80-100	medium	both	medium	better feed quality, more palatable than rye
Wheat	med-high	medium	80-100	med-low	both	med-high	lower yield, better feed quality than rye
Barley	med-high	medium	80-100	medium	silage best	med-high	shorter season than other cereals; potential for double crop if sufficient moisture
Oats	med-low	medium	80-100	medium	both	medium	less drought tolerant than the other cereals

1. Potential Yield (tons per acre): high yield = over 5; medium yield = 3 to 5, low yield = less than 3

Table 2 Comparison of Annual Forages - Other

Crop	Drought Tolerance	Water Use	Seeding Rate (lb/acre)	Potential Yield ¹	Hay, Silage, Pasture	Feed Quality	Comments
Corn	medium (but some critical periods for water)	high (80% of alfalfa)	25-30000 seeds/acre	high	silage, grazing	high	feed quality-high energy/low protein; weed control is critical; equipment special
Sun-flower	med-high	med-high	20-25000 seeds/acre	high	silage	high	high oil content; requires specific rations; weed control is critical
Pearl millet	high	low-med	5 lbs/acre	high	all	med.-higher than sudan-grass	new crop grown successfully in Ontario; seed into warm soil; seed not readily available
Forage sorghum-sudan-grass	high	low-med	15 lbs/acre when irrigation limited	high	all	med-low	feed quality concerns-prussic acid and nitrates; seed into warm soil (+12 C)
Forage rape	med-high	med	6 lbs/acre	medium	pasture	high	can cause bloat; have dry feed available

1. Potential Yield (tons per acre): high yield = over 5 ; medium yield = 3 to 5, low yield = less than 3

Notes on Annual Forages

This section will provide a brief description of the annual forages listed in the above tables. For more detail, refer to web links.

A general concern with all annual forages is the potential for **nitrate poisoning**. Nitrate accumulation can occur in any of these forages, especially when the soils contain high levels of nitrogen (from fertilizer, manure or plowdown of legume crops), and/or when they are subjected to some stress during the growing season, such as drought or frost. It is always a good practice to have any annual forages tested for nitrates prior to feeding. If high nitrate levels exist, the feed can usually still be used, but will have to be mixed or fed alternately with low nitrate forages. Putting these crops up as silage will reduce nitrate levels, but they should still be tested.

Fall Cereals

Generally, fall cereals (fall rye, fall triticale and winter wheat) may be useful as annual forage crops in water short years if there is sufficient fall moisture to get them established. If the soil is very dry in September, (with no irrigation available) fall cereals are not a good choice. There should be sufficient moisture for germination and two to three inches of growth prior to winter dormancy.

Fall Rye

Fall rye is a familiar crop to most people, as it has been used as forage, grain and reclamation crop for many years. Its primary characteristics include ease of establishment, good drought tolerance, early spring growth and low palatability and feed quality. In order to obtain acceptable feed quality, it must be harvested prior to heading.

Fall Triticale

Fall triticale is a newer crop, developed as a cross between fall rye and winter wheat. Its primary advantage over fall rye is better feed quality. Production requirements are similar to fall rye—quick establishment, good drought tolerance, best feed quality prior to heading. Triticale is generally a better choice for emergency forage than fall rye, but seed may not be as readily available, so order early.

Winter Wheat

Winter wheat may also be used as a forage crop. It is more palatable than rye and has higher feed quality, but is slower to establish and has lower yield than either fall rye or triticale.

Spring Cereals

The spring cereals, (barley, oats, triticale) that are commonly used as forage crops can produce more forage dry matter on less water than perennials, as they do not need to store nutrients in their roots to survive the winter, as they complete their life cycle in one season. In addition, the spring cereals grow for a shorter period than perennials, (about 100 days), so water demands are lower. Cereals do have a critical water requirement period for grain production, which is of some importance even when grown as forages, as the grain, even at early stages of maturity (milk to soft dough) can add to feed quality. Water stress during early heading to grain filling can reduce feed quality, but may not have much impact on total yield.

Barley

Barley is most commonly grown for cereal silage and can produce good yields of high quality feed if water is available. As it grows for a shorter season than alfalfa, for example, its water requirements are less. If full season water requirements of alfalfa are 36 inches of water, one crop of barley silage may only require about 15 inches of water for a 3 to 4 ton/acre yield. If some of this moisture is from soil storage from winter snow melt, the irrigation requirement will be even less, which can make barley a good choice in water short years.

Oats

Oats are most commonly grown as a cover crop for alfalfa or grass seedings, and often harvested as hay. In water short years, it is not recommended to use a cover crop on perennial seedings, as the cover crop may use all the available water, with the risk of losing the perennial seeding if water is short after mid-summer.

Oats are less drought tolerant than barley, but may be more suitable than barley if harvested as hay. Barley has stiff awns (beard) which can be injurious to stock when dry; oats do not have this problem.

Triticale

Triticale, whether the spring or fall planted type, are similar, as described above. Most commonly grown as a fall cereal, the spring planted triticale is much less commonly used, as it has few advantages over barley and seed is less available. Barley is generally considered to have somewhat better feed quality than triticale, but triticale has better drought tolerance than barley. On sandy soils, where moisture is more of a concern, spring triticale can be a good choice.

Wheat

Spring wheat is not commonly grown as a forage crop, as the other cereals produce higher forage yields. Wheat is very palatable and has good drought tolerance, but the higher yield of the other cereals make them preferred as forages.

Other Annual Forages

Some less commonly grown annual forages are worth considering. These plants are all 'warm season' plants, which means they have a different photosynthetic process, which may not be important to the grower, but has some practical significance. Firstly, these plants all require warmer soils than the familiar cereal crops to germinate. Soil temperature at seeding depth (approximately 2 inches) should be at least 12 degrees C. If seeded into cold soils, germination is poor and an uneven stand results. Secondly, as is suggested by the name 'warm season' these plants require a warm growing season to be productive, so they are not suited to higher elevation areas of the southern Interior, or areas in central and northern BC, where the familiar cereal crops generally produce higher yields more reliably.

These plants may fit in well to a cropping system that takes an early first harvest (cut or grazed) from an old alfalfa/grass field that you plan to re-seed. After the first cut, the soil should be warm enough for good germination for crops such as sorghum-sudangrass or pearl millet, which can provide high yields with very good drought tolerance.



Corn

Corn is grown as a silage crop throughout much of southern BC, and is a high yielding, water efficient crop under the right conditions. Good fertility and good weed control are critical, as well as irrigation systems that are suitable to a tall growing crop. In addition, it has a critical moisture requirement between tasseling and grain filling for good yields and good quality. Therefore, if moisture is limited at this time (typically from mid-July to mid-August) corn is not a good choice. Corn also requires specialized planting and harvesting equipment, although it can be used for winter grazing. Specific corn variety selection and production requirements are available from other information sources.

Sunflower

Sunflowers are not a commonly grown forage crop in BC, but have been used in other areas (Ontario, US etc.), often in conjunction with corn and grown as an inter-crop. Sunflowers have very good drought tolerance and can have high feed quality, but due to their high oil content, are not used as the only component of a ration. Silage is the only practical harvest option and the resulting feed must be used as part of a balanced ration. Although not likely to be grown here as a forage source, they may be of value inter-seeded with corn silage. Information is available online from Manitoba Agriculture (search Sunflower Production and Management).

Pearl Millet

Pearl millet is a new crop that has been developed in Ontario and has potential for southern BC. Results from Ontario trials have shown pearl millet to have similar yield to sudan grass, but with better feed quality. It does not contain prussic acid, as do the sorghum-sudangrass hybrids, and it is suitable for use as pasture, silage or hay. As with the other plants in this group, it is sensitive to frost and cold soils, so planting must be delayed until warm conditions exist. Information is available online from Ontario Ministry of Agriculture (search Cover Crops: Pearl Millet).

Forage Sorghum-Sudangrass

Forage sorghums and sudangrass and crosses between these two plants have been grown extensively as forage plants in many parts of the world, including parts of Canada. Locally they have been grown on a small scale for many years, with good success under the right conditions. These conditions include good fertility, warm seedbeds and weed free fields, although if planted in warm soils, which encourages rapid germination, weeds are less of a problem.

Of concern is feed quality, as both nitrates and prussic acid can be a problem with these forages. On the plus side, these are high yielding, drought tolerant plants that can be planted and harvested without the need for specialized planting or harvesting equipment. They are more efficient in water absorption, have twice as many secondary roots and half as much leaf area when compared to corn. They can go dormant during periods of drought and resume growth when moisture returns. Typically, they are harvested two-three times in a season, and can be strip-grazed. Information is available online from Ontario Ministry of Agriculture (search Forage Sorghum-Sudan Grass).

Forage Rape

Forage rape, and other brassicas, such as kale and turnip, can provide pasture under dry conditions, if there is sufficient moisture to get establishment. Grazing these crops requires some care, as they can cause some problems, such as bloat, iodine deficiency and diarrhea, but they can be useful, especially in the fall. Obtain more information before planning to use these crops.

Other Information Sources

Kamloops Agricultural District
Kamloops Agricultural District Forage Manual
Available online

Alberta Agriculture
Using Fall Rye for Pasture, Hay and Silage
Available online