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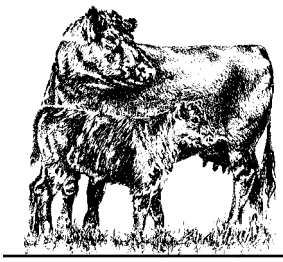

Cattle Producer's Handbook

Range and Pasture Section 591

Irrigated Pasture Grass and Clover Selection for Areas without Summer Rain

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A major advantage of irrigated pasture over dryland range is having more forage species planting options because of supplemental water provided with irrigation. Pasture managers have the ability to choose the appropriate forage to match the key attributes of the pasture. These key attributes include irrigation, grazing management, soils, climate, and seasonal forage needs.

This fact sheet is intended to be useful to those developing permanent pasture. Therefore, all grasses discussed in this fact sheet are perennial, which means they live for 3 or more years. The information presented applies primarily to areas of the West characterized by cool, wet winters and warm, dry sum-mers. It is assumed that without irrigation, the soils would become too dry for plants to survive summer drought.

In some cases, however, pasture species such as orchardgrass (berber) and tall fescue (prosper, flecha) have varieties with summer dormancy traits that allow their use in dryland situations. However, the goal of this fact sheet is to highlight options for increasing forage availability in areas that experience summer drought, thus, discussions are limited to the varieties within species that readily respond to irrigation.

Key Attributes for Initial Consideration

Irrigation

The availability of irrigation water will determine whether it is possible to plant species such as orchardgrass and perennial ryegrass, which will require a timely source of water all summer long. Deep-rooted grasses may be a better fit when circumstances such as irrigation district deliveries make the irrigation intervals farther apart than what is optimal. If water is available for only a limited duration, grasses with the ability to induce dormancy once the irrigation water supply is exhausted may be required. In this case, plant species such as intermediate wheatgrass, smooth brome, or meadow brome may be required.

For shorter lengths of drought the orchardgrass varieties Paiute, profile, or Paiute 2 may be possibilities. In mild summer climates, some deep-rooted grasses such as tall fescue may also work in systems with a limited amount of irrigation water.

Management Options

The main ways to harvest irrigated pasture forage is haying and/or grazing. Depending on the market conditions and other ranch resources, a producer may want to choose one or the other or a combination of both.

Haying Management—The quality of hay from irrigated pasture is strongly influenced by the species used. However, forage quality is influenced more by plant maturity than the species harvested. A dramatic drop in quality (energy and protein) occurs as the plants become more mature. Hay fields harvested in the vegetative stage are of higher quality but lower yield than those harvested later in the plant cycle.

Multiple cuttings during the growing season can help maintain the quality of hay produced. Cutting 30 to 45 days after the previous harvest will generally provide reasonable yield and high quality hay. However, multiple cuttings do require more resources (fuel, labor, etc.).

A combination of haying and grazing can maximize production. By haying during the early rapid growth phase, a producer can harvest forage that may otherwise mature faster than the animals can eat it. These hayed pastures can then be added to a pasture rotation system to provide additional forage later in the growing season. This can help to reduce the presence of sharp awns from tall forage and alleviate problems in cattle such as pink eye. In addition, all pastures may be hayed and the aftermath used for grazing later in the season.

Grazing Management—Traditional grazing is either continuous (set stocked season long) or rotational, management-intensive grazing, or a combination of methods for irrigated pastures. It is important to understand the growth cycle of plants in your area to determine a grazing plan.

The selection of pasture species can assist grazing management based on five influential factors. Several of these factors are interrelated:

1. Selecting pasture species with similar growing points.
2. Selecting pasture species with similar palatability.
3. Selecting pasture species with similar growth rates.
4. Determining if there is a need for tolerance of excess grazing pressure.
5. Selecting pasture species based on seasonal need for forage.

Grazing management seeks to efficiently harvest pasture growth while maintaining a desired stand of pasture plants. Plants diminish from the planted pasture when they are grazed below their growing point. The height of the growing point can be different between grasses (bermudagrass is low, perennial ryegrass is high). It is usually easy to find by looking for the place just above ground level where leaves and stems begin to branch. Grazing pasture plants below the growing point decreases the carbohydrate reserves that the plant needs for energy because it must replace both the growing point and then leaf area.

Leaf area provides the platform for photosynthesis, which then helps build carbohydrate reserves. If plants are grazed to a level that is higher than the growing point, the leaves can be quickly replaced, allowing the plant to rapidly recover the carbohydrates lost during growth. Recovery is much slower and burns far more carbohydrates if plants are grazed below the growing point. Repeatedly grazing a plant at or below the growing point depletes its carbohydrates stores, weakens the plant, and lessons its ability to compete for light, water, and nutrients with weeds and other plants. Table 1 provides general grazing height guidelines to help avoid grazing below growing points on specific forage species.

Selecting pasture species with similar palatability makes it easier to uniformly graze a pasture. Cattle have natural tendencies to selectively graze some plants over others. Complimentary species such as orchardgrass and ryegrass work well together because they have similar palatability so they are equally desirable to cattle. Conversely, cattle will consume ryegrass readily over other species such as tall fescue. Combining these two grasses leads to heavily grazed ryegrass below the growing point and under-grazed fescue, which makes the fescue even less enticing to the cattle eventually leading to the demise of the ryegrass in the pasture. This is important regardless of continuous or rotational grazing, although rotational grazing may lesson this effect.

Pasture plants with similar growth rates are especially useful when pastures are grazed rotationally. If planted species have similar growth rates, they recover from grazing at equal rates making the optimal rest between grazing intervals the same. Most irrigated pasture species have diminishing quality as they mature or accumulate growth. If one species has a faster growth rate than another, palatability will switch to the species with the slower growth rate.

Pasture managers that have planted species with two different growth rates are forced to choose a grazing interval based on either the slower or faster growing species. If the slower growing species is chosen, the faster growing species is provided too much rest and will become over-mature and much less palatable. If the faster growing species is chosen, the slower growing species will not be provided enough rest and will eventually diminish as part of the pasture composition.

If pastures are grazed heavily and/or it is not possible to intensively manage grazing then it is best to select a grass that is highly grazing tolerant. For most areas in the western states this would be a tall fescue. In some instances, Kentucky bluegrass would fit this need if the operator is willing to give up some yield, especially in the summer, for pasture longevity. For some warm dry climates, such as southern California, this would best be done with bermudagrass.

Climates with mild winters and warm summers may also find value in dallisgrass for this situation. If intensive-grazing management or mild set stocking is not

Table 1. Growth height for grazing/haying pasture forages.

Forage species	Minimum leaf length reached before initiating grazing	Minimum stubble height to remain after grazing or hay harvest
	(inches)	(inches)[1]
Kentucky bluegrass	6	3
Smooth bromegrass	8	4
Meadow bromegrass	8	4
Reed canarygrass	10	6
Tall fescue	8	4
Orchardgrass	8	4
Timothy	8	4
Creeping foxtail	10	4
Tall wheatgrass	10	8
Intermediate wheatgrass	8	4
Siberian wheatgrass	6	3
Crested wheatgrass	6	3
Russian wildrye	8	4
Alfalfa	14	3
White clover	8	3
Red clover	6	3
Alsike clover	6	3
Sweet clover	8	4
Trefoil	8	3
Sainfoin	12	6
Milkvetch	8	4
White dutch clover	4	2

[1]This is the minimum stubble height that should remain after the grazing period or hay operation. When a grass-legume mixture is harvested for hay, generally use the most limiting stubble height for the mixture.

Source: Utah State Intermountain Planting Guide

possible, then it is best to avoid planting grasses such a perennial ryegrass and orchardgrass because they will rapidly drop out of the pasture composition.

In many colder climates the timing of grazing readiness may impact plant species choices. In some cases this may dictate several different species be planted in different pastures to help grazing management. For example, intermediate wheatgrass tends to mature later in the season than smooth brome. If you tend to graze one pasture before another in a similar fashion year after year you may want to stagger the timing of maturity by the plant species selection in the pasture. Thus, you could plant smooth brome in one pasture and intermediate wheatgrass in another.

Another scenario with a milder winter may have an early grazed pasture with perennial ryegrass because it starts growth early in the season. Likewise, if you want to stockpile forage for October, November, and December grazing then tall fescue would be the choice to plant. In cooler climates tall fescue grows longer into fall than do most other grasses.

Soils

Soils that are used for irrigated pasture should have enough available water storage to economically match water use with irrigation. This means that in most cases soils are not as limiting a factor for irrigated pastures as they are on dryland sites. However, some sites have factors such as pH imbalances and excessive subsurface moisture that will dictate the pasture species available for planting. In these cases soils may dictate that pastures be planted to tall fescue for extreme pH values and grasses such as reed canarygrass for excessively wet pastures.

Climate

Because irrigation is being provided, climatic influences related to temperature become most critical. The two most important temperature factors are winter lows and summer highs. For example, orchardgrass, timothy, smooth brome, and tall fescue in most cases do well in areas with low winter temperatures where perennial ryegrass and most warm season grasses do not. On the other hand, timothy and smooth brome do not do well in areas with extreme summer temperatures such as California's Central Valley where tall fescue and most warm season grasses thrive.

Warm vs. Cool Season Grasses

Photosynthetic pathway dictates whether grasses are warm or cool season plants. Generally, the warm season (C_4) grasses are more efficient in water and nitrogen use in hot climates. Their growth is better during the hot July and August months than the cool season (C_3) grasses. The cool season grasses produce more forage during the spring, fall, and during the winter if the climate permits. Warm season grasses are not adapted to cool intermountain climates.

Common members of the warm season grasses include dallisgrass, kikuyu, and Bermudagrass. Common members of the cool season grasses include perennial ryegrass, orchardgrass, tall fescue, timothy, bromes, wheatgrass, bluegrass, and wildrye.

Descriptions of Common Grasses

Below are brief descriptions for many of the commonly chosen forage grasses in irrigated pastures. Table 2 provides general characteristics of these grasses that can help in comparing their differences.

Perennial Ryegrass—This is one of the most palatable and high quality grasses available. The many varieties are due to the international popularity of perennial ryegrass. Because of its palatability, perennial ryegrass does require that close attention be paid to grazing management for it to remain vigorous in pastures where it occurs with less palatable forage species. A primary limitation of perennial ryegrass is that it is not tolerant of excessively cold winters. It can persist in warm climates if provided ample irrigation, although it will have a slump in midsummer production.

Table 2. Characteristics for selected grass species.

Species	Quality/ palatability	Yield potential	Longevity	Winter hardiness	Drought-limited irrigation tolerance	Wet soils/ Flooding tolerance	Saline/ Alkaline soils tolerance
Perennial ryegrass	+++++	High	Low/medium	+++	+++	++++	+
Orchardgrass	+++++	High	Medium	++++	++	+	+
Tall fescue	++++	High	Long	+++++	++++	+++++	+++
Timothy	+++++	Medium	Long	+++++	+	++++	+
Smooth brome	+++++	Medium	Medium	+++++	++++	++	++
Intermediate or pubescent wheatgrass	+++	Medium to high	Long	+++++	+++++	++	++++
Bermudagrass and kikuyu	++/+++	Medium	Long	+	++	+++	++++
Dallisgrass	+/+++++	Medium	Long	+	++	+++	++++

+++++ Excellent ++++ Good +++ Medium ++ Fair + Poor

Perennial ryegrass production can be high in fall and spring. It makes an excellent companion to orchardgrass. Perennial ryegrass is not long lived and will require reseeding to maintain the stand. Producers are advised to select varieties that are endophyte-free for pasture.

Orchardgrass—Orchardgrass is a great companion with perennial ryegrass where the ryegrass provides more spring and fall forage, while the orchardgrass does not have near the drop in midsummer production. Like perennial ryegrass, orchardgrass will require careful grazing management to remain a substantial component of a pasture mix. It must be grazed properly or it will disappear rapidly.

Orchardgrass is also capable of being the sole grass species in a pasture planted with legumes. This is common in many pastures and hay fields because orchardgrass displays good quality and is more winter hardy than perennial ryegrass.

Tall Fescue and Meadow Fescue—Tall fescue and meadow fescue are among the best sod forming grasses available. They spread by short rhizomes. They are tolerant of most grazing systems, which is why it is frequently the best choice for horse pastures. They have the ability to accumulate over mature, coarse growth, which can cause cattle to avoid consuming them when other grasses are available. Newer tall fescue varieties with softer, finer leaf blades have improved palatability over the older "Oregon" and "Fawn" types, however, they still do not match ryegrass in palatability so it should not be planted with this species.

Tall fescue and meadow fescue are long lived. Producers are advised to select varieties that are endophyte-free for pasture. Tall fescue has traditionally been used far more in the U.S. than meadow fescue.

Timothy—Timothy is able to do well in the intermountain areas with cold winters. It does not do well in warm arid climates. Timothy hay is highly valued in horse markets because of its high fiber content. It is common for timothy to be hayed and the stubble pastured for the duration of the growing season.

A negative side to timothy is that its regrowth after cutting is not as good as some alternative species such as orchardgrass or tall fescue. Additionally, timothy's growing points are elevated, which when cut too close to the ground, greatly delays its regrowth.

Smooth Brome—Smooth brome is winter hardy, has good drought tolerance, and, once established, can be more resilient than orchardgrass and tall fescue if grown in colder areas. It is not adapted to warm arid climates. It spreads by rhizomes (underground stems) creating a sod with a thick root mass. Smooth brome is low in fiber and has excellent forage quality for grazing and hay if harvested before advanced maturity. Although rhizomatous, it is compatible with legumes.

Meadow Brome—Meadow brome is similar to smooth brome, except that it has awns, hairy leaves, and less prolific rhizomes. Its regrowth potential and heat tolerance is slightly better than smooth brome. Meadow brome is cold tolerant but does not survive even short periods of flooding.

Intermediate and Pubescent Wheatgrass—Intermediate and pubescent wheatgrass are best used in situations where water is limited and will likely run out before summer ends. They are usually considered dryland grasses and their use is common to extend the green feed period. The pubescent varieties are usually slightly more tolerant of adverse weather conditions and soils with less available water storage.

They make good fall, spring, and early summer growth but are mostly dormant in winter even in mild winter areas. This makes them tolerant of cool winters in the intermountain area. They will go dormant in mid to late summer if no water is available. They are not vigorous in regrowth from a spring cutting so will usually lend themselves to scenarios with single cutting hay situations.

Kentucky Bluegrass—Kentucky bluegrass is a low growing grass that is tolerant of close grazing, which has made it popular in horse pastures. It is not a highly productive grass. Kentucky bluegrass does well in humid climates, but will go dormant with high summer temperatures, which limits its area of adaptation.

Reed Canarygrass—Reed canarygrass is usually reserved for seasonally saturated sites. Its flood tolerance is excellent. It is highly productive and regrowth after grazing is rapid, however, it easily becomes over mature and loses palatability. Reed canarygrass is also quite drought tolerant once established.

Prairie Grass and Grazing Bromes—Prairie grass and grazing bromes are biennial or short lived perennial grasses that have excellent forage quality. Both can be maintained in rotational grazing pastures if they are allowed to complete seed production, but they will diminish from original stand densities in just a few years. Some stand maintenance is practical because they will continue to produce seed heads throughout summer with adequate irrigation.

The prairie grasses are susceptible to head smut, which has limited popularity because the smut destroys glumes in the plants making it impossible to make seed for stand maintenance. Seed may be treated to help the problem. Compared to the prairie grass, the grazing bromes are resistant to head smut, slightly smaller, more prostrate in growth, slightly less productive, but more grazing tolerant.

Festulolium—Festulolium is a new grass developed by crossing meadow fescue with Italian or perennial ryegrass. The intent is to combine the hardiness of fescue with the quality of ryegrasses. Depending on the

crosses, the results are highly valuable and each cultivar needs to be evaluated individually. Check for local forage trials before planting.

Bermudagrass and Kikuyu—Bermudagrass and kikuyu are warm season grasses that are dormant in fall, winter, and spring. They are excellent sod forming grasses that can be productive where adapted. They will not do well in cool climates and are outperformed by other species in climates with mild summers. Both spread by rhizomes and stolons (below and above ground stems) as well as by seed that leads to a quick sod development.

A drawback to their dense sod formation is that it is highly competitive with any clover component of the pasture. This means that production and pasture quality are highly dependent on the application of nitrogen fertilizer without the benefit of nitrogen fixation from legumes. Although hardy in warm summers they have a distinct disadvantage of not having spring or fall production in mild climates.

Dallisgrass—Dallisgrass is a warm season grass that does well in the midsummer warm months in arid climates with mild winters. It is dormant in fall, winter, and spring. Unlike bermudagrass, dallisgrass is caespitose, meaning it grows in tufts or clumps. The caespitose growth makes it compatible with legumes. Although it does not have high seed germination, the plants produce an abundance of seed throughout the summer growing season. Thus, it spreads rapidly where it is adapted. It likes warm, arid summers with mild winters.

Dallisgrass is hardy and has a rapid growth rate in midsummer. It does not require it, but response is good to intensive grazing management. Its forage quality is low, but surprisingly, it has high palatability.

Legumes

The planting of legumes in a pasture provides a highly digestible addition to the fiber component provided by grasses. Legumes also make available a limited amount of nitrogen for surrounding pasture grasses. The fixation of atmospheric nitrogen by legumes only occurs if the planted seed is inoculated with rhizobia bacteria immediately before planting. Once populations are established, these bacteria inhabit the soil and infect clover roots forming a symbiotic relationship through the formation of nodules that provide the legume with its nitrogen requirements. Some of the nitrogen produced in this process can be mineralized into an available form for surrounding grasses. Legume production is noticeably stunted from the lack of nodule formulation if the correct inoculant is not used, or if the rhizobia are killed because the inoculant is old, or not incorporated into the soil soon after seeding.

Bloat is a serious problem caused by the legume fraction of the pasture. Although the legumes greatly help increase pasture quality and fix atmospheric nitrogen, their over consumption by cattle can cause bloat. Bloat occurs when cattle are unable to release the gases developed in the rumen.

Bloat on pasture is almost always associated with over consumption of legumes on pasture, which is why it is always advised to have the grass composition of the pasture greater than the legume portion. Twenty to 30 percent and never more than 50 percent clover is recommended for pastures. Bloat guard products in the form of blocks and ionophores can help lesson bloat problems, but do not eliminate the threat.

Legumes that have an upright growth stature such as alfalfa and red clover or large leaves such as white clover are associated with the most frequent cases of bloat. Non-bloating legumes such as trefoil, cicer milkvetch, and sainfoin can be used to lessen the percentage of the bloat causing legumes in the planting mixture.

Below are general descriptions of commonly planted legume species. Many varieties are within the most common legume species. Comparisons of common legume characteristics are in Table 3.

White Clover—White clover is one of the most productive perennial clovers where it is adapted. It is not deep rooted but spreads rapidly with above ground runners called stolons. Its abundant production and high quality makes it prone to causing bloat. White clover is not drought tolerant but is capable of good yields even in arid areas as long as adequate irrigation is present. White clover also contains estrogenic compounds that can cause complication with fertility if consumed in quantity.

Table 3. Characteristics for selected legume species.

Species	Yield potential	Longevity	Winter hardiness	Drought tolerance	Wet soils/ Flooding tolerance	Saline/ Alkaline soils tolerance
White clover	High	Medium	++++	+	++	+
Strawberry clover	Medium	Medium	++++	++	+++++	+++
Birdsfoot trefoil	Medium	Medium	++++	++	++++	++
Red clover	High	Short	++++	+	++	+
Alfalfa	High	Long	+++++	++++	+	++++
Sainfoin	Medium	Medium	++++	++++	+	++++

+++++ Excellent ++++ Good +++ Medium ++ Fair + Poor

Strawberry Clover—Strawberry clover is slightly less productive than white clover but has a reputation for being hardier. It withstands wet conditions better than white clover and is more prostrate in growth, which makes it better able to survive close continuous grazing. It can take cold winters but is not adapted to drought conditions. It is productive in warm summers if given adequate irrigation. Plant it in situations of high pH and salt conditions. Strawberry clover is not as long lived as white clover.

Birdsfoot Trefoil—Trefoil has the advantage of being one of the few legumes that does not cause bloat. It is one of the least palatable legumes and is not usually outright rejected by cattle. Trefoil is a broadly adapted clover being able to survive in many different adverse conditions. It is not as tolerant of wet soils as strawberry clover but is more so than white clover. It is more drought tolerant than either strawberry or white clover. It will withstand pH acidity down to 5.5 and as an alkaline to 7.5.

Red Clover—Red clover has upright growth making it better suited for hay production rather than grazing. This short-lived perennial legume must be allowed to reseed itself in order to maintain its presence in a field. For this reason, it is not as popular as strawberry or white clover. It has a high production potential but is not suited to adverse conditions. Red clover has a high bloat potential and contains estrogenic compounds that can cause reproductive problems if consumed in quantity.

Alfalfa—In general, alfalfa is a high yielding legume but should be grazed with caution. Alfalfa does have the potential to cause bloat in cattle. It is highly palatable and winter hardy. Alfalfa is not a good choice in areas prone to flooding or with a high water table. It is an especially good forage source in conjunction with grass species when grazed in a rotational or strip system. Selection of a grazing tolerant variety of alfalfa, along with good grazing management, is critical because it has higher growing points than white or strawberry clover. Grazing plants excessively or without rest will cause them to decline from the pasture.

Sainfoin—Sainfoin is a non-bloat legume that can be used in hay or grazed either alone or in a mix. It is highly palatable and may be preferred over alfalfa by livestock and wildlife. Sainfoin does well on a single cutting hay scheme or rotational grazing because regrowth tends to be poor. Additionally, sainfoin should be allowed to naturally reseed every 2 to 3 years for reestablishment. Sainfoin needs to be grown on well-drained soil.

Cicer Milkvetch—Cicer milkvetch is a perennial legume with a rhizomatous root system. This type of root system makes it fit best with non-rhizomatous grasses such as orchardgrass and tall fescue. It should not be planted with smooth brome, meadow brome, or reed canarygrass. It is best suited for grazing purposes because of its higher moisture levels compared to other legumes and because close grazing sparks the formation of new shoots better than higher cut hay harvests. It is a non-bloating legume.

Alsike Clover—Alsike clover is a cross between white clover and red clover. It is short lived with an upright growth habit. Stand maintenance requires that it be allowed to set seed before cutting or grazing. It has medium production potential compared to other clovers. It is popular due to its excellent winter hardiness, making it suitable to mountain pastures and meadows. It also tolerates some flooding but does not tolerate drought or high temperatures. Photosensitization toxicities have been associated with horses consuming alsike clover. Though much of the reasoning behind the toxicity is not understood, alsike clover is best left out of horse pastures.

References and Sources for More Information

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