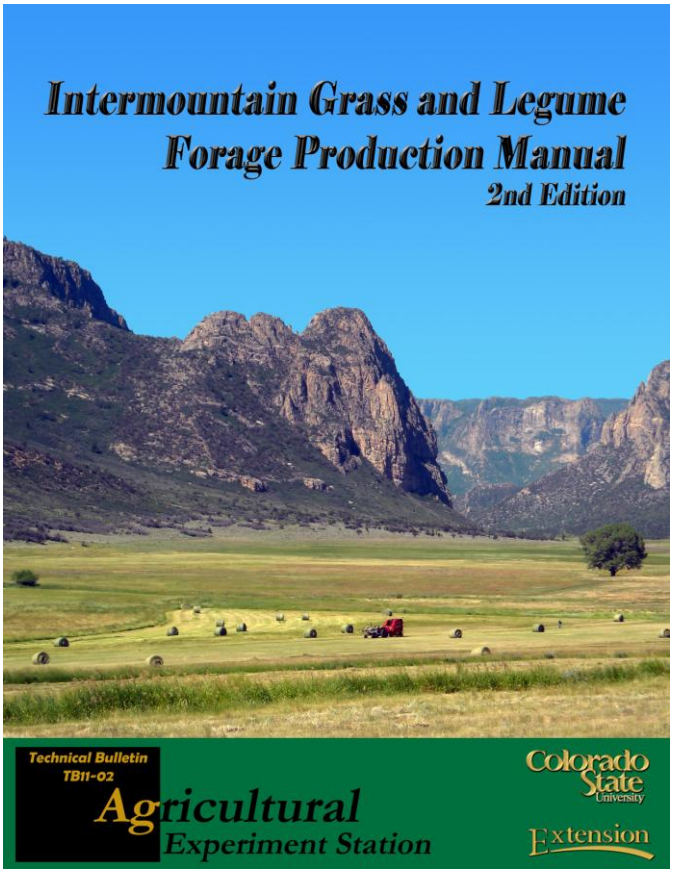

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Section I

Irrigated Pasture/Mountain Meadows

Chapter 2

Plant Species Selection

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Irrigated Pastures and Hayfields

One of the first decisions that must be made when renovating or establishing an irrigated pasture or hayfield is which species to plant. Mixtures are generally preferred over single species, and the number of species to use in a mix will vary. Generally, it is best to plant no more than three grass species per mix with the addition of a legume, if desired. Mixtures generally result in better overall stands. Soil type, topography, moisture, and soil depth will vary over a given field. Single species may result in thin stands or basically no stand in particular parts of the same field. In other words, native rangeland, pastures, and meadows do not exist as monocultures, but rather have a mix of plant species in any given area.

However, there are situations that may warrant establishing a single species for both hay production and intensive rotational grazing programs. These situations may require different management practices compared to mixed species pastures or hayfields. Other factors to consider when selecting species are different site elevations, water availability (precipitation and irrigation), soil textures, and whether the plants will be used for hay production, grazing, or both. Before selecting a particular species, there is a need to review and understand the types of grasses growing in your area and how a grass plant grows and survives.

The intermountain region is dominated by cool-season grasses. Cool-season plants are most productive during the spring and fall when temperatures are cooler and moisture is available. During the warmer summer months, they tend to go dormant or semi-dormant, depending on how much water is available. This is often referred to as the "summer slump" period. Examples of cool-season grasses are: smooth brome, orchardgrass, ryegrasses, wheatgrasses, tall fescue, reed canarygrass, and Kentucky bluegrass.

Warm-season plants grow primarily during the summer months. Examples of warm-season grasses are: blue grama, buffalograss, big bluestem, little bluestem, sideoats grama, sand dropseed, and switchgrass. One of the main reasons warm-season grasses do not grow well in western Colorado is that it is too dry in June when warm-season species generally initiate growth. However, some warm-season grasses have produced good tonnage in test plots under irrigation in this area of Colorado.

How Does a Grass Plant Grow?

Grass plants are comprised of tillers. For some species, tillers grow in tightly compacted bunches, hence the term bunchgrass (e.g. orchardgrass, meadow brome, and tall fescue). Other grass species have stolons or rhizomes from which tillers arise to form what are known as sod-forming grasses (e.g. Kentucky bluegrass, smooth brome, and buffalograss). Stolons and rhizomes are basically stems that grow horizontally either above (stolons) or belowground (rhizomes) and contain buds from which tillers initiate.

An individual grass tiller is comprised of a growing point, stem, leaves, roots, and dormant buds. The buds that initiate to form new tillers are generally located on nodes at

the base of the tiller and are known as basal buds. There are also axillary buds located on nodes along the stem, but these generally do not form new tillers. As mentioned above, grass plants that have stolons or rhizomes also have buds located at the nodes on these structures from which new tillers grow. Once buds break dormancy, they produce a new tiller with a new growing point. If that growing point is removed, then another dormant bud must initiate to produce a new tiller.

Dormant buds must survive the winter in order for grass plants to live from year to year

The time required for a grass plant's bud to break dormancy after a tillers growing point is removed depends on the species. Grasses are classified as having either cyclical or continuous tillering.

Cyclical species have buds that remain dormant until heading occurs on the initial tiller. Examples are smooth brome and intermediate wheatgrass. Continuous tillering grasses have buds that are initiated periodically throughout the growing season. Examples are orchardgrass, meadow brome, tall fescue, and Kentucky bluegrass. The grass species that have performed well over the past several years in the intermountain region are listed in Table 1 and 2.

Seeding Rates and Putting Together Seed Mixes

For seeding of irrigated pastures and hayfields, a general rule of thumb is that you should plant approximately 40 Pure Live Seeds (PLS) per square foot. For extremely small seeded species like timothy or redtop, the number of seeds planted per square foot is often doubled to about 80. The seeding rates recommended in Table 2 are based on pounds of pure live seed planted with a drill. If you broadcast your seed, then the seeding rate should be doubled.

Pure live seed accounts for the purity and germination of each seed lot and allows you to calculate the percentage of seed in a given bag that should actually germinate once planted. Since no seed lot has 100% purity and 100% germination, the amount of bulk seed that needs to be planted to obtain the PLS rate listed in Tables 1 and 2 will always be higher and needs to be calculated.

For example, smooth brome seeded for irrigated pasture or hay on well-drained soils has a recommendation of 13 lbs PLS per acre if planted with a drill as a single species (Table 2). If the seed purchased has a purity of 95% and a germination of 90%, then the bulk seed rate can be determined utilizing the following formula:

$$\text{lbs/ac Bulk Seed} = \frac{\text{lbs PLS/ac}}{\text{\% Purity X \% Germination (from seed tag)}}$$

$$\text{lbs/ac Bulk Seed} = \frac{13 \text{ lbs PLS/ac}}{0.95 \text{ X } 0.90} = 15.2 \text{ lbs Bulk Seed/Ac}$$

The above amount of smooth brome would be needed if planting a single species and using a drill. The broadcast seeding rate for this particular seed lot of smooth brome would be 30.4 lbs/ac (2 x 15.2).

When planting a 3-way mix of smooth brome, orchardgrass, and meadow brome, the percent of each species desired in the mixture should be multiplied by the single species rate listed in Table 2. This calculation will result in the seeding rate for each species. For example, if equal proportions of each species are desired in the mix, then each rate listed in Table 2 (13 lbs smooth brome, 3 lbs orchardgrass, 22 lbs meadow brome) would be multiplied by 1/3. This would result in 4.3, 1.0, and 7.3 lbs PLS/ac for smooth brome, orchardgrass, and meadow brome, respectively, in an irrigated

Table 1. Non or Limit-Irrigated Pasture. Seeding rates listed are for individual grasses or legumes in pure stands and drilled. If a mixture is preferred, no more than three grass species and a legume are recommended. If seed is broadcast, double the seeding rates.

Altitude - Less than 6,000 ft. **Moisture Range - Less than 12" total precipitation**	
Species (Varitey)	**Seeding Rate (lbs./Acre)**
Siberian wheatgrass (P-27, Vavilov, Vavilov II)	4
Indian ricegrass (Nezpar, Paloma, Rimrock)	6
Western wheatgrass (Arriba, Barton, Rosana)	7
Thickspike wheatgrass (Critana)	7
Pubescent wheatgrass (Luna, Manska)	9
Crested wheatgrass Bunchgrass (Nordan) Sod-former (Fairway) Hybrid, bunchtype (Hycrest, CD II)	 4 4 4
Tall Wheatgrass (Jose)	11
Galleta	6
Sand dropseed	0.2
Altitude - 6,000 - 7,500 ft. **Moisture Range - 12 - 16" total precipitation**	
Siberian wheatgrass (P-27, Vavilov, Vavilov II)	4
Indian ricegrass (Nezpar, Paloma, Rimrock)	3
Western wheatgrass (Arriba, Barton, Rosana)	7
Russian wildrye (Vinal, Swift, Bozoisky Select)	5
Crested wheatgrass Bunchgrass (Nordan) Hybrid, bunchtype (Hycrest, CD II)	 4 4
Pubescent wheatgrass (Luna, Manska)	6
Intermediate wheatgrass (Oahe, Amur)	9
Smooth brome (Manchar)	7
Basin wildrye (Magnar, Trailhead)	6
Alfalfa (Ladak)	3
Altitude - above 7,500 ft. **Moisture Range - 16" precipitation and above**	
Smooth brome (Manchar, Lincoln)	7
Meadow brome (Regar, Paddock, Fleet, Cache, Montana)	11
Intermediate wheatgrass (Amur, Oahe)	5
Orchardgrass (Latar, Potomac)	3
Slender wheatgrass (Primar, San Luis)	6
Alfalfa (cold tolerant, nematode and disease resistant varieties)	5
Tall fescue (Endophyte-free or with novel endophyte)	5
Cicer milkvetch (Monarch, Lutana, Windsor)	8

Table 2. Irrigated Pastures and Hayfields. The seeding rates listed are for individual grasses or legumes in pure stands and drilled. If a mixture is preferred, no more than three grass species and a legume are recommended. If seed is broadcast, double the seeding rate.

Soil Type-Well Drained	
Species (Variety)	**Seeding Rate (lbs./Acre)**
Smooth brome (Manchar, Lincoln)	13
Orchardgrass (Latar, Potomac)	3
Intermediate wheatgrass (Amur, Oahe)	20
Tall fescue (Endophyte-free or with novel endophyte)	8
Timothy (Climax, Itasca)	3
Meadow brome (Regar, Paddock, Fleet, Cache, Montana)	22
Alfalfa (Nematode-disease resistant varieties)	10
Red clover (Kenland, Redland, "medium red")	6
Cicer milkvetch (Monarch, Lutana, Windsor)	10
Sainfoin (Eski, Remont)	30
Birdsfoot Trefoil (Norcen, Leo, Empire)	5
Soil Type-Poorly-drained/Wetlands/Sub-irrigated	
Red top	1
Reed canarygrass (low alkaloid varieties)	5
Creeping meadow foxtail (Garrison)	3
Tall fescue (Endophyte-free or with novel endophyte)	8
White clover (Ladino)	3
Alsike clover	3
Strawberry clover	3
Red clover	3
Soil Type-High Salt Conditions	
Tall wheatgrass (Jose)	12
Hybrid wheatgrass (Newhy)	10
Tall fescue (Endophyte-free or with novel endophyte)	8
Basin wildrye (Magnar, Trailhead)	11
Birdsfoot trefoil (Norcen, Leo, Empire)	5
Strawberry clover	3

pasture or hayfield mix. The bulk seeding rates for each species would then need to be calculated using the above formula.

Generally no more than 3 grass species are suggested per mix, but there are always exceptions

By now, it should be evident that each individual must determine their management goals when selecting mixes of grasses and legumes for their particular situation. Each species has its strengths and weaknesses. Tables 3-6 contain some general characteristics of the species recommended in Table 2.

Before plants can be selected for seeding, a number of questions must be answered. A plan or goal needs to be established. Selection of species will depend on whether they are used only for hay production or only for grazing or a combination of both. Other factors for consideration are differences among species in palatability and grazing recovery rate; tolerances to salinity, waterlogged soils, drought, and cold; and any potential toxicity to livestock such as endophyte infected tall fescue.

Common Irrigated Grasses

Smooth brome is one of the most common grasses planted for irrigated pasture or hay. It spreads by rhizomes which form a dense sod resulting in good hay and pasture production. Other characteristics of smooth brome include fair tolerance to salty and wet soil conditions, good drought and cold hardiness, and excellent palatability. Because of the strongly rhizomatous growth habit of smooth brome, it can become sodbound and must be fertilized with adequate nitrogen to avoid productivity declines over time. On the plus side, it is one of the most productive cool-season grasses in the spring. However, productivity of smooth brome tends to drop off significantly during the hot summer months. This is sometimes referred to as the "summer slump" period which is characteristic of many cool-season grasses.

Orchardgrass is another commonly planted grass that provides good hay and pasture production. It is an extremely palatable bunchgrass that has one of the most rapid recovery rates following grazing. Another positive trait is that it does not suffer from the slump in productivity during midsummer compared to smooth brome. However, it has poor tolerance to salty and wet soil conditions and only fair drought and cold hardiness. Adequate soil moisture going into the fall can help minimize winterkill potential during cold, dry, open winters.

Meadow brome is less commonly planted compared to smooth brome and orchardgrass, but its use has increased in recent years. It often comes mixed with smooth brome and orchardgrass in irrigated pasture mixes sold by local seed companies. Meadow brome is a bunchgrass that has the palatability and quick regrowth of orchardgrass, but unlike orchardgrass, it is more drought and winter hardy. It also does not suffer significantly from summer slump.

Tall fescue is the most widely seeded grass in the United States. Compared to smooth brome and orchardgrass, it is earlier maturing. Tall fescue is a bunchgrass with good hay and pasture production, excellent salt tolerance, and good tolerance to wet soil conditions. Drought resistance is fair and cold hardiness is good. It is one of the most productive cool-season grasses available, but is not as palatable compared to many other grasses. Therefore, it is generally best to plant tall fescue as a monoculture. Palatability of newer varieties has been improved considerably and all varieties withstand heavy grazing. Some tall fescue varieties contain an endophyte (fungus that lives within the plant cells) that can lead to fescue toxicosis; therefore, only endophyte-free varieties should be planted. There is also a new variety (MaxQ) that contains a novel or

friendly endophyte which does not cause toxicosis, but does give the plant drought and insect resistance.

Reed canarygrass is a sod-forming grass mainly seeded in pastures or hayfields prone to high water tables. It has moderate salt tolerance, excellent winter hardiness, and good drought tolerance. This is a large leafed grass with rapid grazing recovery.

Creeping meadow foxtail is another sod-forming grass that is tolerant to high water tables and saturated soil conditions. The main drawback to this grass is that it continuously produces seed stalks through the growing season which can lower forage quality when put up as hay. Therefore, creeping meadow foxtail is best used for intensive grazing. With adequate nitrogen fertility, it produces an abundance of leafy growth that is readily consumed by livestock. With intensive management, many of the growing points that would normally produce seed stalks are removed during grazing which helps keep the plant in a high quality, vegetative state.

Intermediate wheatgrass is a tall, moderate sod-forming grass that produces high yields, has excellent drought and winter hardiness, fair to good salt tolerance, but a relatively slow grazing recovery rate. Grazing should take place in the spring since this grass can become unpalatable as the summer progresses. It is often mixed with alfalfa to improve forage quality of the hay or pasture. Because of its drought tolerance and relatively low water requirement, it can also be used in dryland and limited irrigation situations. Pubescent wheatgrass is very similar to intermediate and the 2 are often found together in mixes for dryland or limited irrigation applications. Pubescent wheatgrass plants are hairy and tend to be more drought and winterhardy compared to intermediate.

Hybrid wheatgrass is a cross between bluebunch wheatgrass and quackgrass. It is a weakly rhizomatous sod-forming grass that has good drought and excellent salt tolerance. Although it does well under dryland or limited irrigation, it produces an abundance of highly nutritious, palatable forage under irrigation for pasture or hay production. Newhy is the only variety available and it is an excellent choice to plant on extremely salty soils since its salt tolerance is roughly equivalent to tall wheatgrass.

Each species has positive and negative characteristics

For the most part, only cool-season grasses are planted in the intermountain region for pasture or hay production. All of the above grasses are cool-season. There are a few warm-season grasses that could potentially be used for forage. Switchgrass and little bluestem have been cultivated under irrigation. Switchgrass, especially, has shown promise in western Colorado as a pasture or hay grass. However, both of these grasses have only been tested on small acreages.

Common Irrigated Legumes

Alfalfa is the most common legume planted for hay production either alone or in mixtures with grasses. It has fair salt tolerance and withstands drought, but cannot grow in wet or high water table areas. Grass-alfalfa pastures used for grazing should definitely not contain more than 50% alfalfa to minimize the incidence of bloat. Although no pasture that contains alfalfa is ever completely bloat safe, pastures with less than 30% alfalfa will generally be safe to graze. Monitoring and managing the animals appropriately is always important to avoid major bloat problems. Waiting a minimum of a week after a killing frost to graze alfalfa or grass-alfalfa mixtures can reduce the risk of bloat.

Clovers are another important group of legumes grown for hay and pasture. There are many different varieties within each of the three main species. Alsike has poor salt and drought tolerance, but good tolerance to flooding and high water tables with excellent winter hardiness. It is known to cause 2 ailments in horses: alsike clover poisoning and photosensitization, so caution must be exercised when feeding horses hay or grazing pastures with alsike clover in them.

Red clover also has poor salt tolerance. It is not as tolerant of wet soil conditions as alsike clover, but is much more tolerant compared to alfalfa. It also do not withstand drought, but has excellent winter hardiness. Red clover is known to cause "clover slobbers" in horses. This condition is caused by a fungus on the clover, and while not life threatening, it is messy and can lead to dehydration if the affected horse is not removed from the clover.

White clover has excellent palatability and is usually grown with grasses, primarily for grazing. It has poor salt and drought tolerances and medium winter hardiness.

All clovers can potentially cause bloat, but are generally mixed with grasses for grazing which significantly minimizes any incidences of bloat. Clovers are shorter lived than alfalfa and are more susceptible to severe weather. They prefer cooler and wetter conditions for maximum productivity.

Other legumes that can be considered for the intermountain region for hay or pasture are sainfoin, birdsfoot trefoil, and cicer milkvetch. All 3 are especially well suited for grazing because they are non-bloating legumes, but each have some faults and, therefore, have not been planted to a large extent. Sainfoin is extremely palatable to both livestock and wildlife, but does not withstand high water tables, overwatering, and competition from other plants. Birdsfoot trefoil holds its quality better than alfalfa and tends to be long-lived once established, but stands are difficult to establish due to poor seedling vigor. Cicer milkvetch is also long-lived once established and can spread by rhizomes, but stands are also difficult to establish due to poor seedling vigor and a hard seed coat that inhibits germination. Seed of cicer milkvetch should be scarified just prior to planting to improve germination.

Mountain Meadows

Grasses

All of the grasses described above for use in irrigated pastures and hayfields can also be planted at higher elevations in mountain meadows. Following are some additional species and points to consider when selecting species for use at high elevations.

Orchardgrass, because of its growth characteristics, may winter kill, especially during dry, open winters. This does not happen very often, but should be taken into account if considering planting this species at high elevations.

Creeping meadow foxtail is well suited for growth in mountain meadows. Because it is tolerant of flooding and high water tables, creeping meadow foxtail thrives in the saturated soil conditions typically found in many flood irrigated mountain meadows. This species blooms two to three weeks before smooth brome or orchardgrass, so it must be cut early for high quality hay.

Other cool-season grasses that would work at higher elevations include timothy and redtop. Timothy generally does not do well at lower elevations because of hot summer temperatures. However, it does grow well at higher elevations in cool temperature and good moisture situations. It can provide high quality forage, primarily for hay. Redtop is another cool-season grass adapted to wet soil conditions. Its ability to withstand cold winters makes it a good choice for higher elevation pastures or hay meadows.

Legumes

The legumes that were mentioned in the pasture section can be grown successfully at higher elevations with some additional recommendations.

Alfalfa will grow and persist if the right varieties are chosen. Many of the newer varieties do not persist. Old varieties such as Vernal and Ranger are extremely cold tolerant and do well. Alfalfa does not tolerate high water tables or saturated soil conditions as mentioned earlier, so the right site must be chosen and application of irrigation water must be controlled to avoid drowning out alfalfa.

Red and alsike clover are more tolerant of the wet soil conditions typically found in many mountain meadows, so they are excellent choices for planting in those environments compared to alfalfa.

Mammoth red clover is considered the single-cut variety and is extremely winter hardy which fits the typical hay production system practiced in mountain meadows. Unlike at lower elevations, red clover tends to persist more than 3 years.

All of the other legumes mentioned in the pasture section would have similar traits at higher elevations.