Cattle Producers Handbook

IRRIGATED PASTURES FOR LIVESTOCK

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Forage Production Goals:

A well-managed irrigated pasture can supply most of the nutritional requirements of grazing animals. Managed irrigated forage is high in digestible nutrients. Livestock animals harvest the crop so limited labor is required to maintain pasture production.

With proper management, irrigated pastures can persist and be exceptionally productive for decades. Irrigation, fertility and grazing management are keys that contribute to longevity, production and forage quality within a sustainable irrigated pasture system. At a high level of management and irrigated pasture will tolerate three or four times the animal stocking rate as the same pasture at a lower level of management. High economic returns from the cattle and beef produced have been recorded from well-managed pastures. Agricultural economic professionals agree that well managed irrigated forage operations are stable and net returns compare favorably with other farm and orchard crops.

Prior to establishing an irrigated pasture, time should be spent setting forage production goals. These goals should be compatible with the soil and water resources, livestock goals, livestock species and the quality of life considerations for everyone involved in the operation. The goals are important and will influence the management decisions a producer makes, such as, which plant species to select and what grazing system is used.

The four primary areas of irrigated pasture and forage production include fertility, water management, seeding/seed varieties and fencing. Successful irrigated pasture management and forage grazing principles revolve around these four subjects and management issues.

ESTABLISHMENT

Planning:

Planning for an irrigated pasture should include an evaluation of the soil resource, the availability of irrigation water, the level of management desired, climate and topography, elevation and livestock type. Productive pastures can be established on a wide range of soil types, providing the plant varieties are matched to the soil type.

Modern high voltage-low amperage electric fence chargers and advancements in fence wire have revolutionized grazing. The number of pasture divisions or paddocks should allow 21 to 30 days of rest and regrowth between grazing during the growing season. A rest period, while not unvarying, will allow the forage plants to reach recommended height for grazing and help maintain a strong, healthy and prolific pasture. Pasture plant height is more important to productivity than days of rest. Plant height should not be grazed below four inches during the grazing season. Forage plant growth is logarithmic, doubling in height every 2 weeks during the growing season. Grazing below 4 inches has a negative effect on pasture production, by increasing the time necessary between grazings. A pasture grazed to 4 inches will grow back to 8 inches in height in two weeks. A pasture grazed to 1 inch is only 2 inches in height in two weeks of rest and will need a full 6 weeks of rest and growth to make the minimum grazed height of 8 inches again. Irrigated pasture divided into six to eight grazing paddocks with four to five days of grazing in each paddock approaches an ideal management and production balance for most producers. Higher density, short duration grazing will require more pasture divisions, but can be

much more productive. Production reaching and approximately 2,000 pounds of beef per acre can be achieved under high management levels

Planting Suggestions:

Pasture can be established in either spring (mid-April to early May) or late summer (August to October). There are several advantages to the late summer seeding date. Competition from annual weeds will be significantly less. Fall seeded pasture germination occurs faster and higher production levels during the first grazing year will be seen. With spring seeding, most of the grazing season will be lost establishing the pasture; it should not be grazed until fall. A fall seeded pasture will be ready to graze during the following spring.

The production and harvesting of an annual forage crop (barley, oats, triticale or wheat) prior to seeding pasture in the late summer works into many management operations and decreases competition from weeds.

Seedbed Preparation:

Good soil-to-seed contact is the essential goal of seedbed preparation. Ideally, the seedbed should be fine but firm. The soil needs to be firm enough to allow moisture to move upward to the seed.

A firm seedbed will hold moisture close to the soil's surface; helps control the depth at seeding and provides anchorage for young seedling roots. To obtain a firm seedbed several methods may be used. One method is plowing to bury surface residue, then disking and harrowing until the seedbed is fine. Packing or rolling of the seedbed may be necessary to firm the seedbed using this method. Another method is to rototil the soil. A harrow may need to be used to finish seedbed preparation in this case.

There are several makes and models of pasture interseed and no-till seeders. Most of these seeders can be used to establish or to renovate existing pastures without any additional tillage being needed. Some of these drills or seeders work better than others in rocky or high organic trashy situations. Under the right situations an interseed drill is Avery effective, efficient tool in the establishment, renovation or upgrade of pastures. Many professionals believe that forage variety genetic improvement is approximately a fifteen percent annually. If this is true, in theory, an interseed drill should be used to upgrade fifteen percent of a forage operation each year.

Seeding Depth:

Seeding depth is critical and often affects pasture plant population. Forage grasses and legumes seeding depth should never exceed 1/2 inch in fine and loamy textured soils. Depth exceeding1/2 inch will drastically diminish plant population. Smaller seed sizes require less depth, so when seeding a pasture mix, the depth should support the smaller seed size. The ideal depth of most forage seed is 1/4 inch and less. It is far better to have exposed seed than seed planted at over 1/2 inch. The keys to a good plant population are soil/seed contact, proper seeding depth and high germination rate "fresh" seed. Forage seed germination rates decrease rapidly, sometimes 50% each year after the first year. It is important to check the germination rates and the year of recommended use.

Seeding Methods:

Several different ways can be used to plant a pasture. Probably the best method is the use of a Brillion seeder, which is designed to plant small sized seed. The Brillion deposits the seed between two sets of corrugated roller packers, giving an excellent soil-to-seed contact and places the seed at the depth of 1/4 inch.

Disked grain drills can be successful by using either a very shallow setting of the disks or setting the disks down approximately an inch and disconnecting the seed delivery tubes. Dragging a chain or a roller/packer behind the drill can be of benefit.

Broadcast method can be used also. If the broadcast seeding method is used, packing or rolling the soil should be done before and after the broadcasting of the seed. This will give better soil-to-seed contact and greatly enhance seedling survival. Harrowing after broadcast seeding is not recommended because much of the seed will end up being too deep.

Frost-seeding is a method that is used in other countries more than in the US. This method works well, but timing is critical and some species work better using this method than others. Frost seeding is a method of planting irrigated pasture most commonly used in spot seeding of an open area or in rejuvenation of an existing stand. The seed is broadcast on the soil during the very early spring (January/February) when the soil is frozen in the morning but is thawed in the afternoon. The freeze-thaw occurring each day will work the seed into the soil. This method of seeding is widely used in other areas of the world. Some species of grass (ryegrass) and most legumes respond well to this method of seeding.

An interseed or no-till pasture drill or seeder is a good option and an implement to put on a professional grazers wish list. Pastures can be established, renovated or updated with the newest varieties with an interseed drill or seeder. Several models of interseed drills are available. The drill should be selected to match the site and soil to be seeded. Some makes and models work well in rocky areas while others excel in high trash or organic situations.

Plant Selection:

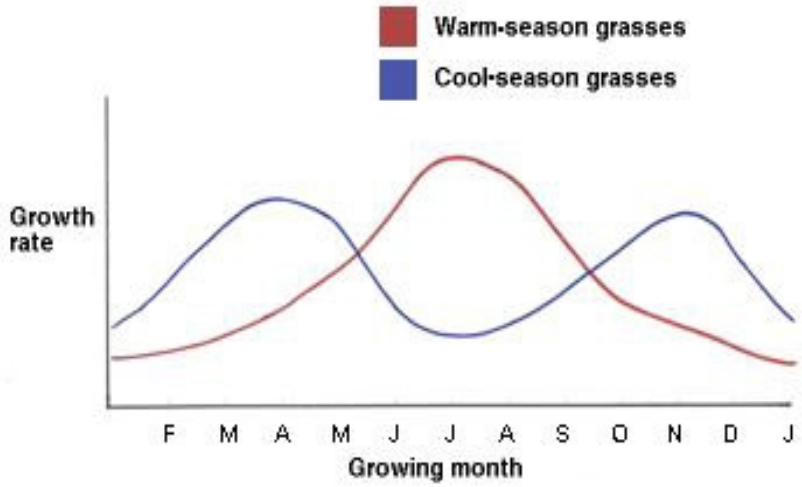
The selection of plant species for irrigated pastures will depend on forage production goals, soil type and condition, soil pH, subsurface moisture, availability of water, climate, the physical attributes of the pasture and, to some extent, species of animals that will graze the pasture. Some forage species are more suited for some management regimes, soil types and conditions than others. For some situations a single grass species or a grass-legume mix is recommended, but the highest producing irrigated pastures are single species legume. High management and precautionary grazing practices are needed with straight legume pastures to prevent bloat.

Seasonal variation in the growth rate of forage plants is normal. Cool season grasses such as orchard grass, tall fescue and ryegrass are most productive in the first two or three months of the growing season. Growth and production taper off as temperatures increase in the summer and then a smaller second growth period occurs in the late summer and fall. Legumes such as alfalfa, clovers and trefoils produce most of their growth as the temperatures rise in the summer. A combination of cool season grass and legume pasture will take advantage of species growth curves. As the cool season grass species growth is slowing in the summer the legume species growth is increasing. In combination a cool season grass and legume mix can stabilize the forage production during a grazing season. The combination of warm season and cool season grasses to alleviate the “slump” that occurs during warm weather with cool season grasses is being worked on, but has not been successful. Cool season grasses tend to be too aggressive for warm season grass plant population establishment. The elimination of the “slump” in cool season irrigated pastures is an area of research focus and need.

In deep, well-drained soils, the most commonly recommended grasses are orchard grass, perennial ryegrass and tall fescue. All three species are high producing and palatable to cattle. Perennial ryegrass is not as winter hardy, but is the easiest to establish and reestablish by frost-seeding or over-seeding. Ryegrass has a relatively shallow root system which makes it more dependent on scheduled irrigation. Orchard grass has several varieties that mature at different times, early, mid versus late. If the pasture is going to be an orchard grass-legume mix it is recommended that a middle-to-late maturing orchard grass variety be seeded. This will bring the maturity of the grass and legume closer together at the beginning of the growing season for easier

management. Tall fescue has some new varieties that are excellent producers and very palatable. Some older varieties of tall fescue lack palatability. Tall fescue tends to come out of dormancy faster than orchard grass or ryegrass and is easier to establish than orchard grass. Tall fescue varieties can be stockpiled for use during the winter while orchard grass and ryegrass due not stockpile well. Tall fescue varieties that are totally endophyte free are the only varieties recommended for irrigated forage.

For wet or alkaline type soils or areas that get abused such as in pathways or around stock tanks, tall fescue varieties are recommended. Care should be taken to purchase only certified endophyte free tall fescue seed. Certified tested fresh seed is always preferred to non-certified. The little extra cost when amortized over twenty years of a forage stand is not significant.



Inoculation of Legume Seed:

One of the reasons to include legumes in the pasture mix is the ability legumes have to fix nitrogen from the air and deposit it into the soil. This is done by bacteria in nodules on the plant's roots in a symbiotic relationship. The nodules containing nitrogen are sloughed during the winter so the nitrogen is available the next season. Legume nitrogen fixing can significantly lower the need for chemical fertilizers in pasture. Always check to be sure that legume seed has been pre-inoculated with the nitrogen-fixing bacteria before planting. If it has not been pre-inoculated or you are not sure, the seed should be inoculated prior to planting. Use the inoculum that is specific to the seed you are going to plant and follow the labeled directions. After inoculation the seed should be kept out of direct sunlight until it is planted.

Companion or Nurse Crop:

In most, regions of the Pacific Northwest nurse or companion crops seeded during pasture establishment is **not recommended**. Historically, companion crops were recommended in situations where wind erosion was a significant problem. Companion crops do not help forage plant establishment. They have a negative effect on establishment due to shading, competition for moisture and nutrients. Tests show a significant decrease in forage plant population when a nurse crop is planted at the same time.

Fertility Management:

It is wise to take soil samples before planting a pasture to determine the amount and type of fertilizer needed. There are fertility variations not only between farms but between fields on the same farm. Soil tests are essential in the development of a cost effective fertility program.

Annual soil testing is the best tool available to maintain adequate soil nutrients. Soil testing eliminates the guesswork involved in deciding what and how much fertilizer to use. Soil testing should include macronutrients, such as nitrogen, phosphorus, sulfur, potassium and micronutrients such as boron, molybdenum and zinc.

Some of the newer varieties of pasture forages need higher levels of nitrogen to produce to the maximum level. High production forage mixes may need nitrogen levels approaching 200 pounds of available nitrogen per growing season.

Under ideal conditions, in laboratory and greenhouse cultivation, forage mixes can produce 20 tons per acre. Fertility is one of the major limiting factors in forage production. Soil sampling and nutrient evaluation is one key to maximum production. Livestock remove approximately 20% of the available nitrogen through grazing and deposit the remaining back on the paddock in the form of manure. Without soil testing it is impossible to know soil nutrient levels.

Fertility Timing:

Often pasture fertilizing is a non-scheduled event getting done as it warms up enough to work in the field. Pasture fertility should be of high importance and scheduled for maximum forage production. An early application of nitrogen at 200 centigrade degree days (T=200) has been shown to increase forage production in irrigated pastures by more than 30 percent over the same application on March 15th of each year. The T=200 application is very important in maximizing forage production in irrigated pasture. The T=200 time is much earlier than “normal” application time and will vary from site to site. Forage plants are active beneath the ground for many weeks before anything is active or green above ground. Having nutrients available at the ideal time can make a great deal of difference in annual forage production.

Nitrogen (N): Grasses are heavy users of nitrogen; responding well to levels of 200 pounds of available nitrogen. In order for irrigated pastures to stay healthy, vigorous and productive they need an adequate supply of nitrogen. The amount of nitrogen required depends on: 1) The density of the stand; 2) Species of forage plant; 3) Length of growing season, and 4) Management. Some management factors that will influence nitrogen needs are irrigation, grazing management, percentage of legumes in the pasture and if the legumes were inoculated.

In legume or grass-legume pastures containing 50 percent or more of a well-nodulated legume, little fertilizer may need to be applied. With grass-legume pastures containing less than 50 percent legume, 80 to 150 pounds of actual nitrogen per acre may need to be applied. With legume mixes care must be taken to not apply more than 80 pounds of actual nitrogen at any one time because it may inhibit the nitrogen-fixing bacteria in the nodules of the legume plants. Nitrogen applications can be used to control or “knock back” the population level of legumes if pastures become too heavy with legumes.

In stands composed mostly of grass, but not 70% forage plant populations, applications totaling 150 pounds of actual nitrogen per acre may be advisable. High yielding grass pastures with 90% forage plant populations may require totals of 240-320 pounds of actual nitrogen for maximum production.

Nitrogen is easily leached through the soil profile and beyond the pasture root zone. Ideally, nitrogen application should be divided into several (3-4) applications during the growing season. Nitrogen application should be lower in the fall than in the spring because leaching of unused nitrogen can occur over winter. No one application should be more than 80 pounds of nitrogen per acre. Management to control over-irrigation is important to prevent nitrogen leaching.

Nitrogen is cost effective even at $1,000/ ton. Each dollar of nitrogen often has a $9 to $12 return in forage production.

How much nitrogen: In irrigated forage production the first 40 to 60 pounds of nitrogen per acre is the most efficiently used. These lower rates will increase forage production approximately 50 percent. In cool season grasses 100 to 120 pounds of nitrogen applied in the spring can easily increase forage production 100 percent over the same unfertilized pasture site. The next 80 pounds of applied nitrogen per acre gives a more modest, but significant and still cost effective increase in forage production.

Phosphorus (P): Phosphorus is required by plants for strong root growth and meristem production. It is especially important in the establishment of new pastures, because it promotes early development of the plants, increases root growth and hastens maturity. Phosphorus does not move through the soil profile and is needed by plants in very small amounts. If phosphorus is needed it is recommended that it is applied in the fall.

Legumes require more phosphorus than grasses. It is important that phosphorus is adequate to support strong stands of legumes within the pasture. Soil testing is important to monitor phosphorus, because phosphorus is expensive.

During the last several years phosphorus deficiencies have been found in many pastures and grass hay fields within the Pacific Northwest.

Potassium (K): Potassium or potash is important for the hardiness of disease resistance of grasses. In areas where land leveling has been done there is a need to check for adequacy.

Sulfur (S): Sulfur is essential to new growth in a plant. It is often deficient. There are several products available to provide sulfur, so it may be necessary to contact a local fertilizer supplier to find the most economical product available.

There are several other micronutrients like Zinc and Boron that need to be checked in soil testing. Most of these are needed in very small amounts, but if deficient they should be applied.

PH: The ideal soil pH for irrigated pasture is 7.0. A soil test is necessary to learn the pH of the soil within your irrigated pasture. At acidic pH levels (less than 5.5) liming may be needed to obtain maximum production levels. At basic pH levels (7.5 or above) it may be necessary to change grass species or to apply acidifier-type fertilizers like ammonia sulfate for several years before maximum production can be realized.

PLANT SPECIES FOR IRRIGATED PASTURES

Below is a table showing the recommended seeding rates of some of the species of irrigated pastures. From personal experience, I tend to exceed the recommended rates of seed application per acre. An irrigated pasture, if managed well, has an indefinite productive life. Spending an additional $20 per acre when amortized over ten to twenty years is a good investment. An over-population of plants has a higher desirability than an under-population of plants. An over-population of plants has a tendency to inhibit annual weeds, undesirable species and lowers the need for herbicide use. Don't be cheap with the seed and make sure to plant only certified seed.

Soil Conditions & Plant Combinations	Seeding Rate (lbs. Ac)		Remarks
Well Drained	**Alone**	**In combination**	

Orchard Grass	15-30	7-15	Very palatable, highly productive, good with alfalfa in a mix.
Alfalfa	10-18	5-9	Good production, manage for bloat.
Perennial Ryegrass	15-30	5-15	Very palatable, productive, dormant in heat, easy to establish, frost-seeds well.
Tall Fescue	15-30	5-15	Tolerates low fertility, wetter sites, and hardy.
Red Clover	10-15	5-7	Productive, short-lived, not recommended for sheep.
White Clover, New Zealand, Birdsfoot Trefoil	8-10	4-5	Productive, palatable, longer-lived, frost-seeds well.
Soil Conditions & Plant Combinations	**Seeding Rate (lbs. Ac)**		**Remarks**
Wet Soils	**Alone**	**In combination**	
Meadow & Creeping Foxtail	6-12	3-6	Good in cool, moist areas, medium palatability
Reed Canary Grass	15-20	7-10	Good on flooded sites, drought tolerant, lower palatability.
Alsike Clover	8-10	4-5	Adapted to wetter soils, productive, palatable, and short-lived.

Grazing Management:

Grazing management is the key to high-yielding, sustainable, high-quality pastures. A flexible grazing system needs to be established that can adapt to seasonal plant growth variations and change when needed. Monitoring of the plants and animals is needed to have a successful grazing system. Managing a grazing system with a mindset of being a grass farmer is the key.

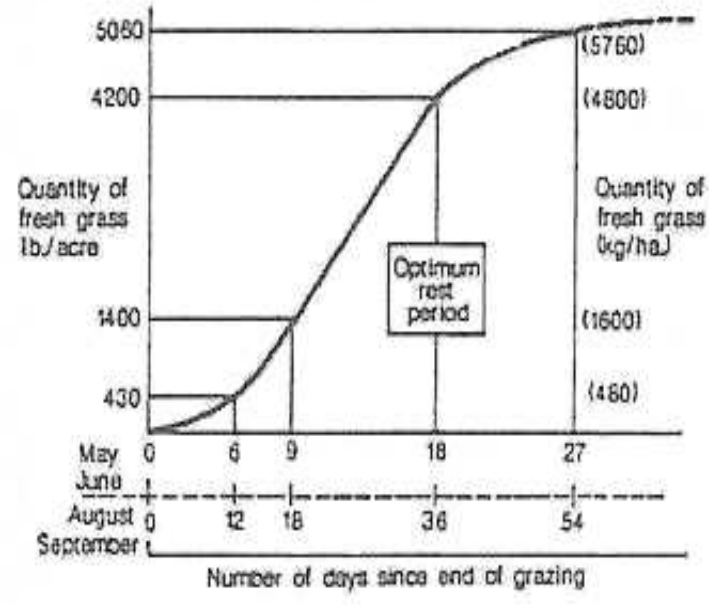
It is very important to understand a little about grass physiology to be a successful grass farmer. The grass calendar starts early in the year. Forage plants are active below ground for a considerable length of time before anything starts happening above ground. Grass plants start growing above ground when the average air temperature hits 43 degrees. If the temperature, for example, is 25 degrees in the morning and 62 degrees in the afternoon on February 23rd, the pasture has started growing. Animals should be removed from the pasture until a height of8-inches is accomplished. Leaving animals on an early-growing pasture severely lowers total annual production due to damage to meristem formation, elongation and production. It is also important to understand that in August and September of every year the grass plant sets itself up for the following year's production. Every meristem forming every stalk and blade of grass for the next year is produced at this time of year. It is critical that the pasture is not overgrazed or stressed and is adequately fertilized in the fall. Leaving additional stubble height (5 inches) from mid-August until mid-September or until dormancy occurs, is of great benefit during the following year.

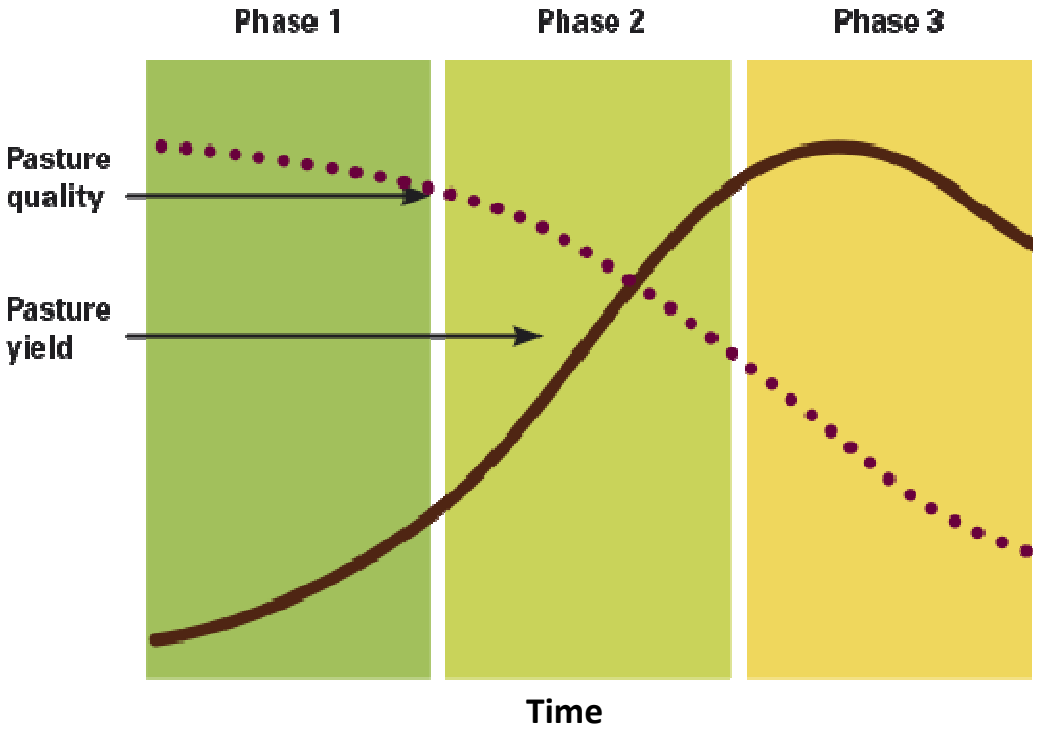
There are several generalized rules to follow in grazing. Start grazing in the spring when forage has reached an average height of at least 8 inches. Remove animals when an average stubble height of 3 to 4 inches remains. Allow enough rest time to return height to 8 inches before re-grazing occurs. The rest time will vary within the growing season.

Irrigated pasture grows logarithmically during most of the growing season, doubling in height and volume in each two week period of time. Knowing this, a manager leaving 3 inches of stubble at animal removal, can expect the height to double to 6 inches in 2 weeks. In two additional weeks the forage will be 12 inches in height and can be re-grazed. If the manager

grazes to 1 inch in height it will take 6 weeks to return to a grazing height of 8 inches. A top manager can get maximum utilization of each paddock of pasture by grazing down to 4 inches, resting the paddock 2 weeks, and then re-grazing when 8 inches is achieved. A major goal in grazing is to keep the grazed plants within stage 2 of the forage plant growth cycle. As seen in the figure below, stage 1in plant growth is below the recommended growth height, it is detrimental to graze. Stage 3 of plant growth is reproductive, plants slow their growth and prepare for dormancy during this stage. A manager should have a goal of grazing each paddock at least 5 times during the growing season for top forage and beef production.

The closer a grazing system manager can come to a hay producer's management schedule the higher the production level of the pasture. A hay producer swathes (3 inches height) the crop and removes it as fast as possible. Rest and re-growth occurs before the next cutting when the system repeats. The system of cutting or grazing then rest/re-growth can be as flexible as the grazing managers' goals. Highest production of an intensive grazing system moves the animals to new paddocks twice a day. This system has a very high level of management. A grazing system set up with 8 to 10 paddocks and a flexible livestock stocking rate, yield high production and leisurely management responsibility levels.





Winter Feeding on Pasture:

The practice of winter feeding livestock on pasture has had mixed reviews. Manure and organic matter has value on pasture, but is not necessarily an asset in a confined winter feeding area. A confined feeding area can be more labor efficient and may have less winter feed wastage than winter feeding on pasture. Winter feeding on pasture requires a mental paradigm shift. Feeding on pasture puts the manure and any wasted feed on the pasture where it is an asset. Livestock normally use only 20% of what they consume, so 80% is deposited on the pasture for future use by forage plants. If 100 tons of winter feed is used during the winter, think of it as 80 tons of organic matter being put back to use. Most of the nitrogen, phosphorus and high levels of micronutrients are put back on the pasture as an asset.

Bloat Prevention and Control:

Management is the key to reducing bloat associated with irrigated pastures:

1. Do not graze irrigated pastures before they obtain 8 inches of growth in the early spring. The height later in the season is not as important as the first growth.
2. Do not turn livestock out into irrigated pasture containing legumes when the animals are hungry. Fill the animals with roughage before turning them out. Do not let them get hungry before moving them into the next paddock. A swath of pasture can be mowed and left to wilt before turning the livestock out on pasture.
3. Sell any chronic bloaters that end up in your herd.
4. Turn the animals out into the pasture in the evening with only a few hours of grazing left in the day.
5. Plenty of fresh water and trace minerals should be available at all times.

6. Feed a product containing poloxalene to reduce bloat from alfalfa and clover pastures. This must be fed for approximately two (2) weeks prior to turn out to maximize effectiveness and must be continued while the animals graze.
7. Combining 10 pounds of plain clothes-washing soap (Tide) with a 50-pound bag of trace mineral to be very effective in reducing the incidence of bloat. A key to this system is that the animals must be consuming at least an ounce of the trace mineral mix each day. Another key is to make sure the animals have been consuming the product for two (2) weeks prior to turn out.
8. Liquid clothes detergent (nothing with enzymes, bleach or fragrances) put into a water trough water works very well in controlling bloat from pastures or in situations with high levels of forage legumes. I poke pin holes in the soap container and drop it into the automatic water trough.

Trace Minerals:

Trace minerals are an important part of a grazing system. Animals cannot reach their potential if any of many trace minerals are inadequate. In many regions hard trace mineral blocks are not recommended as livestock need to spend too much time licking a hard block to get the level of trace minerals needed. Central Washington is severely deficient in selenium and mildly deficient in copper (warning – copper can be toxic to sheep). A granulated trace mineral product is recommended for all livestock species in Central Washington. In many locations of Central Washington high level of salt (20% and above) is not needed nor advised. Trace mineral consumption should be monitored so that cattle are consuming an ounce per head per day, (sheep ¼-ounce per head per day). Salt is a consumption-limiting ingredient in most trace minerals. Many trace mineral products made outside of the region contain 70% to 90% salt. These high-salt products are not designed for this region of the country. Salt, selenium and copper levels should be set so the animals can consume the necessary levels without spending a great deal of time away from grazing. The consumption is easily checked by measuring out, for example, 10 pounds of trace mineral. Ten pounds is 160 ounces. If 10 cattle are in the pasture they should consume the 160 ounces of trace mineral in 16 days.

Trace mineral mixes are available that contain ionophores (Bovatec or Rumensin). These products aid in the digestion of forages within the rumen and have been shown to be of benefit. Ionophores are also active against coccidia, a common livestock parasitic problem.

Trace mineral mixes are also available incorporated with larvacides. This will reduce flies and pests that use manure as a lifecycle site.

Producers should consult an experienced animal nutritionist to find a reliable trace mineral supplement designed for the region. A trace mineral from an area may not be recommended in another area just 50 miles away.

Weed Control:

A well-established, adequately-fertilized pasture with higher than 70% forage plant population is the best method of control for annual and perennial weeds. Well-managed pastures rarely have weed problems. The presence of weeds, or an increase in the number of weeds, is an indication of a management problem. The most common problems are improper grazing, improper irrigation and poor fertility management. Occasionally, additional control measures are needed.

Correct weed identification is necessary for control. Most perennial weeds are susceptible to herbicide at the bud or early flowering stage of development. Annual weeds are, in general, most susceptible at an early vegetative stage. Rules and recommendations for chemical control of weeds change from year to year. The best thing for a producer to do would be to contact the local county Extension educator for current recommendations. Clipping or grazing can often be

used to manage weed infestations without herbicide use. Annual weeds growth points are near the plant tips, so mowing or grazing will remove the problem annuals in most cases.

Irrigation Management:

Irrigation schedules should be set in relation to the species demand, climate and soil type. Grass requires an even supply of moisture within the root zone for optimum growth and production.

Irrigated pastures use approximately 30-inches of water per acre during the growing season. Drastic over-watering and under-watering reduces production, health and longevity of forage plants. Different soil types require different irrigation schedules. In a loam type soil irrigation may be needed every 7 to 10 days. In a sandy type soil irrigation may be needed every 4 days or more frequently. An extremely vigorous pasture with a high level of production and a dense plant population will need more frequent irrigation than a lower producing pasture. A pasture manager using a soil probe can take all of the guesswork out of irrigation scheduling.

For optimum production a soil probe should be used to monitor the available moisture in the root zone of the pasture. Pastures should be irrigated when they reach 50% soil moisture holding capacity. For most soil types in the region, when a ball of soil probed from the root zone fails to stay in a ball in your hand, 50% of the available moisture is gone. If the soil fails the ball test then it is time to irrigate again.

Organic Matter:

Each 1% increase in organic matter increases soil water storage by 4 gallons per square meter. Pasture, managed grazing and winter feeding on pasture all greatly increase soil health and soil organic matter. Pasture acreage starting below 1% organic matter can increase to and remain at 2 % to 3% organic matter under managed intensive grazing and winter feeding on pastures. Irrigated pasture is the best and highest carbon sequestration crop on record. Annually 8 tons of carbon is sequestered or fixed using managed grazing practices. For each 1% of organic matter, 17 tons of carbon is fixed in irrigated pasture management.

Renovation of Existing Pastures:

An irrigated pasture should contain a plant population of at least 70% forage plants. This can be checked by counting the plants within foot square locations randomly selected throughout the pasture. If too much bare soil or too few plants of forage species are present within your random test spots, pasture renovation is needed.

Renovation or upgrading of existing pastures is almost a science in itself. Some professional pasture managers believe that 15% of existing pasture acreage should be renovated each year. There are positive changes in grass genetics each year. To take full advantage of new genetics and technology some irrigated pasture upgrading should be done yearly. An interseed drill is the best way to renovate pasture stands. This drill is designed to deposit seed in small trenches or cuts made by the drill within the existing forage stand. A packing wheel rolls the trench shut giving the seed good soil-to-seed contact. The new variety will eventually work into being the majority of the forage stand.

Frost-seeding can also be used to renovate pastures. Soil-to-seed contact is needed for this to work. Any seed not making it to the soil will not sprout. Tight grazing of the area to be renovated is advised. After broadcasting seed livestock can be used to help plant the seed using hoof action. Some forage varieties like ryegrass, prairie bromes and legumes work better than others using this method. Some forage varieties such as orchard grass and tall fescue are poor frost-seeders. Contact your local Extension office for more information.

Use of Annual Crops for Winter Forage:

Winter feed costs are the largest expense in cattle production. In some operations winter feeding costs are 70% of total operational costs. Managing winter feed resources and forage assets to minimize winter feed costs is a key to profitability in the normal cow/calf operation every year.

The use of annuals as winter feeds has been done for many years. Brassicas (turnips, kale and radish family plants), oats, wheat, barley and triticale are examples of annuals with grazing value for fall, winter or spring grazing. Summer seeding field tests using mixes of spring and winter triticale varieties has given excellent results in fall and early spring grazing. The spring variety in the mix is used to produce fall grazing. The winter variety in the mix over-winters and produces early spring forage. Triticale mixes have produced up to $11 of forage for each dollar spent and reduced winter feeding up to 80 days in field tests. Brassica mixes, when seeded in fall can produce 5 to 7 tons of forage per acre for late fall and winter grazing of cattle. Extending the grazing season with annuals is cost effective and a management practice that should be explored.

Stockpiling of forages can also be used to decrease winter feed costs. A late summer and fall growth period of at least 70 days can be used to build a stockpile forage supply for winter grazing. If cool season grass or a grass/legume mix is going to be stockpiled for winter it is recommended to fertilize with 40 to 60 pounds of nitrogen early in August for maximum stockpile production. Some cool season grass species stockpile and some do not. Tall fescue is the best cool season grass stockpile species. Tall fescue in combination with alfalfa is highly productive, high quality and is commended winter stockpile mix.