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Grazing Systems and Management for Irrigated Pastures in New Mexico

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Grazing Systems and Management for Irrigated Pastures in New Mexico

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Irrigated pastures are used for a variety of reasons in New Mexico. Some are used for generating income or reducing feeding costs, because it is cheaper to harvest forage crops with animals than with equipment. Other pastures are not used specifically for generating income. They might be used for horses or hobby livestock, by ranchers for a variety of reasons, or even as sources of hay.

This publication offers recommendations for New Mexico's irrigated pasture managers based on research conducted by scientists with New Mexico State University's Agricultural Experiment Station and in other states, as well as feedback from producers. These recommendations are subject to change as more information becomes available.

Circular 585, "Species Selection and Establishment for Irrigated Pastures in New Mexico" is available from your county Cooperative Extension Service office or through New Mexico State University's College of Agriculture and Home Economics Web site at www.cahe.nmsu.edu/pubs/. Other resources that provide more information about topics covered in this publication are available from those sources as well. Several are mentioned by name in this publication.

GRAZING SYSTEMS AND METHODS

Grazing systems. There are two basic types of pasture systems, rotational stocking and continuous stocking. Other systems are variations or a compromise of these. Rotational stocking systems involve subdividing a pasture into paddocks and forcing animals to graze intensively. Paddock size can be flexible if using portable fencing materials and should be determined by the amount of forage the animals require for a specified period, usually seven days or less. Pasture species, soil type/land productivity, animal species and number of animals all affect paddock size. The goal is to force animals to use a majority of the pasture's forage before being moved to a fresh paddock and to allow a sufficient rest for that paddock before being grazed again. The number of paddocks used is determined by how intensively the manager wants to graze the pastures. A shorter grazing period (three days or less), in which all forage above a minimum level is removed, maintains diet quality better than longer periods (four to seven days) but requires more paddocks and labor. Rest periods generally are only slightly shorter than what is used for hay management of the same species (21 to 28 days for rotationally stocked alfalfa versus 28 to 35 days for alfalfa hay).

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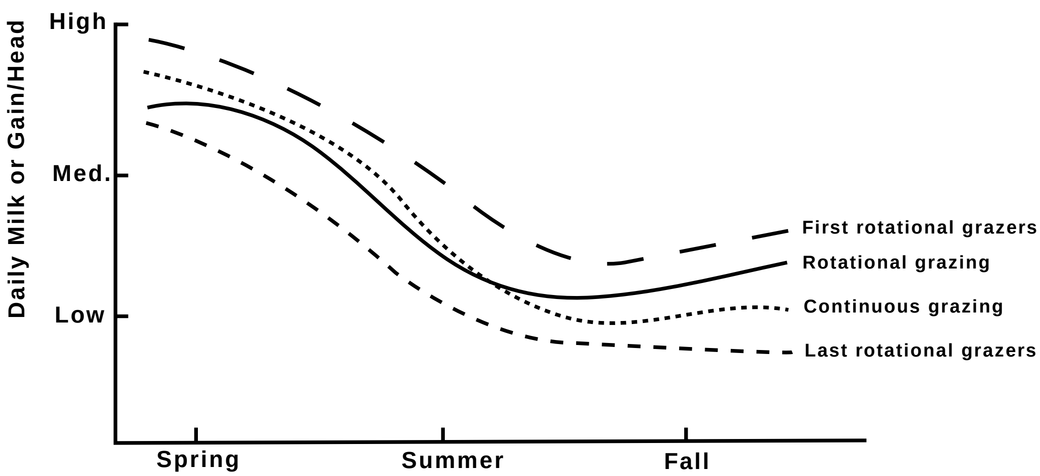

Figure 1. The potential production per animal across seasons using different grazing systems and methods (Source: Allen, V. G. 1999. Irrigated Pasture Grazing School. New Mexico State University's Agricultural Science Center at Tucumcari. Aug. 5, 1999).

In a continuous stocking system, animals remain in the same pasture for an indefinite period. Many producers (pasture managers) prefer this system, because there is less fencing cost and less animal handling labor than for rotational stocking systems. Returns per acre have been thought to be lower with continuous grazing due to lower stocking density or reduced animal performance (fig. 1). Generally, pasture species' seasonal growth patterns produce too much forage at some time during the season and not enough the rest of the time. This leads to poor pasture use, selective grazing and pasture quality decline, which reduce animal performance. To prevent early overproduction, many growers stock the pasture heavier and run out of feed when productivity declines. However, recent research at NMSU's Agricultural Science Center at Tucumcari shows that if producers use an appropriate stocking density and pay attention to pasture health, there is no difference in animal gain per acre between furrow-irrigated, mixed tall wheatgrass and grazing-tolerant alfalfa pastures stocked with yearling beef cattle rotationally or continuously all season (mid-April to late September). Pasture rest is achieved in continuously stocked pastures when defoliation is limited, such that plants retain enough leaves (photosynthetic material) for maintenance and growth for grazing. There may be a fine line between overgrazing and underuse in continuous stocking systems. Stocking density should be based on the land's long-term productivity and carrying capacity.

Rotational grazing increases the management focus on the forage removal rate and ability to forecast forage use. However, when this same management level is applied to continuous grazing systems, similar results can be achieved,

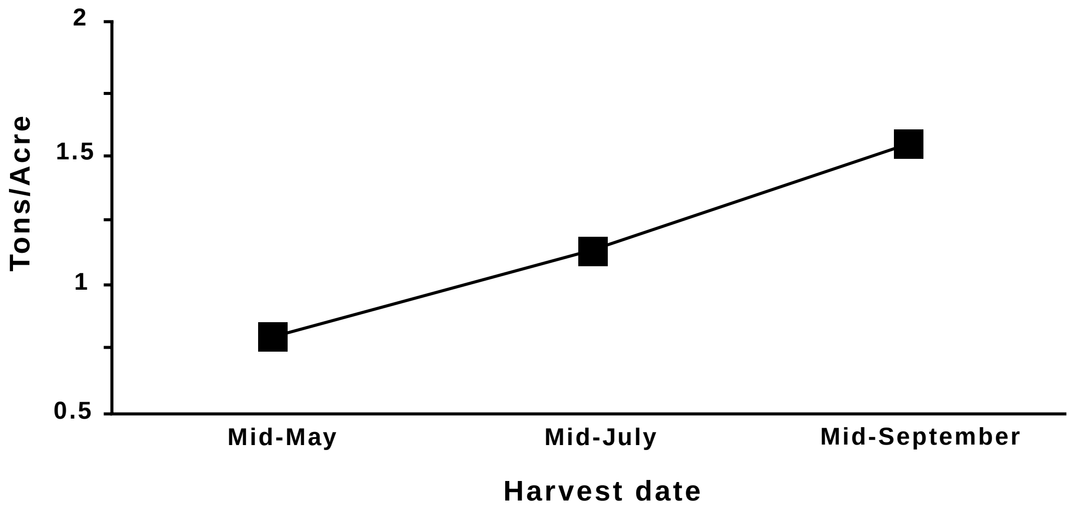

Figure 2. Seasonal yield distribution of stockpiled irrigated tall fescue pastures at New Mexico State University's Sustainable Agriculture Science Center at Alcalde, 1998-2001. Nitrogen (40 lb/acre) was applied in early April and after harvest in mid-May and mid-July.

although forecasting may be more difficult. Another benefit of the continuously stocked alfalfa-tall wheatgrass might be a reduced incidence of bloat. Nonetheless, using a bloat preventive is recommended. Bloat is discussed in more detail later in this publication.

A third grazing system that is a compromise between rotational and continuous stocking uses stockpiled forage. In this system, forage is allowed to accumulate longer than in a traditional rotational stocking system, and the grazing period also is longer, often as long as or longer than the stockpiling period. Stockpiling warm-season grasses may be for all or any part of the season. For cool-season grasses and mixtures, stockpiling usually lasts only about two months. In the case of monoculture grasses, it typically is preceded by a nitrogen fertilizer application (fig. 2). Stockpiled pastures are grazed until available forage is removed to a specified level. Continuous stocking allows animals to trample and soil ungrazed areas, wasting stockpiled forage. However, strip-grazing or rotational grazing prevents trampling and soiling over the whole pasture and allows for stockpiling to begin on grazed-down areas. Generally, stockpiling uses two pastures with animals rotating between them. Stockpiling works well with many monoculture grasses or grasses mixed with most legumes. Clovers and birdsfoot trefoil are good choices for stockpiling; alfalfa is the least favorable. Bromegrasses and other species with "soft" leaves do not stockpile well. Most perennial warm-season grasses are good for stockpiling but quality will be lower than with cool-season species.

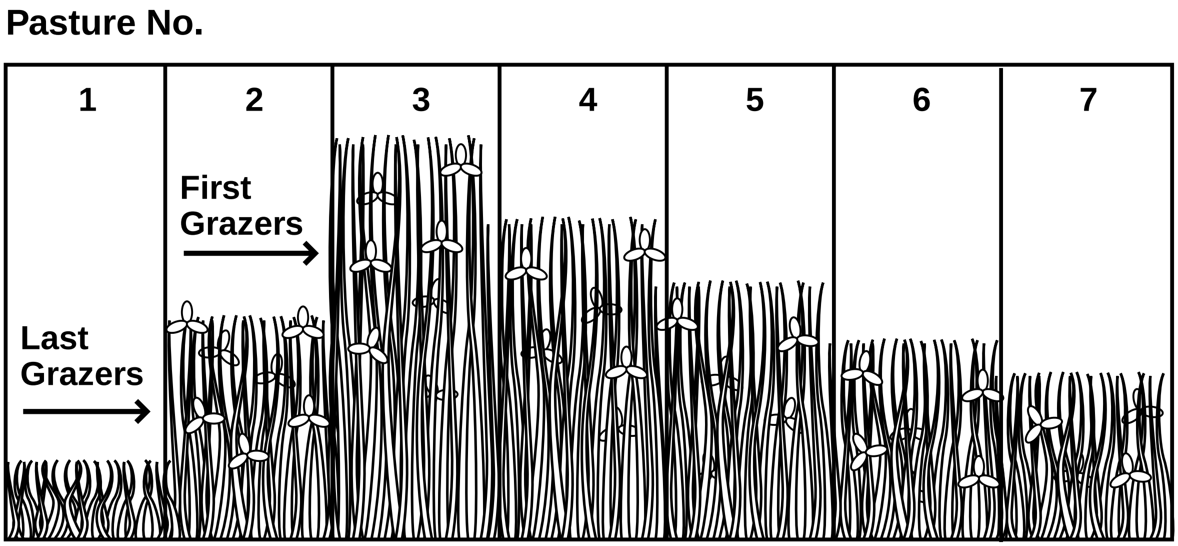

Figure 3. Available forage when using leader-follower (first and last) grazing in rotationally stocked pastures (Source: Allen, V. G. 1999. Irrigated Pasture Grazing School. New Mexico State University Agricultural Science Center at Tucumcari. Aug. 5, 1999).

Grazing methods. Animal performance can be enhanced within each type of grazing system, particularly when different classes of livestock are kept on the farm. Two such methods are leader-follower, or first-last grazers, and creep grazing. Each of these gives higher-producing animals access to higher-quality forage. For example, in a beef cow-calf operation, the leader-follower method allows stockers to graze the paddock first and harvest the higher-quality forage. This method fits well with rotational stocking. Once quality has declined to a specified level, the stockers are moved to another paddock and cows and nursing calves are brought into the first paddock to clean up the leftovers (fig. 3). The grazing and rest periods can be the same as for a traditional rotational stocking system, but the grazing period is divided between the two animal classes.

Creep grazing can be used with any grazing system. A gate or small opening is provided between the pasture and a higher-quality forage area through which only smaller animals can pass (fig. 4). In a rotational stocking system, the creep gate would be between the paddock grazed by cows and the next paddock to be grazed, similar to a leader-follower grazing method. In fact, leader-follower grazing can be used in combination with creep grazing. In a continuous stocking system, the creep gate is between the pasture and an adjacent field set aside for hay production or sown with annual forages. Creep grazing might reduce some of the stresses associated with weaning, because animals become accustomed to grazing in separate pastures.

PASTURE DESIGN

Many factors are involved in pasture design, including management goals, soil type, irrigation technique, field shape and watering points. Accommodation of all of these factors must be driven by available capital and the prospect of profit or pleasure. The design goal in any pasture system is to make pasture or paddock size meet the forage demand of a group of livestock for a specific time period and to provide regular or continual access to water and supplements.

Management goals. Management goals determine how intensively the manager wants to rotate cattle, which determines the amount of time that animals are to use a pasture or paddock. Some producers prefer to use very small paddocks and move animals daily or even twice a day. Others prefer a continuous stocking system that almost relieves them of animal handling responsibilities altogether. It is likely that some animal rotation increases productivity of both the pasture and the animals. However, recent research at Tucumcari indicates that animal productivity per acre might not be compromised in lower intensity systems with a grazing-tolerant variety alfalfa and an appropriate stocking density.

Soil type. Soil type affects land productivity. Some land units may be more or less productive than others. Paddock size needs to be adjusted so that animals can flow through paddocks in a rotational stocking system, allowing a sufficient rest period for each paddock and maximum forage use. There is not much concern in continuous stocking systems for rest periods, because plants should not be stressed to the point of needing a rest, if properly stocked.

Irrigation. Pasture design takes into account irrigation management. For surface-irrigated (flood and furrow) fields, each pasture or paddock should be irrigated as a unit, without interfering with management or use of other fields.

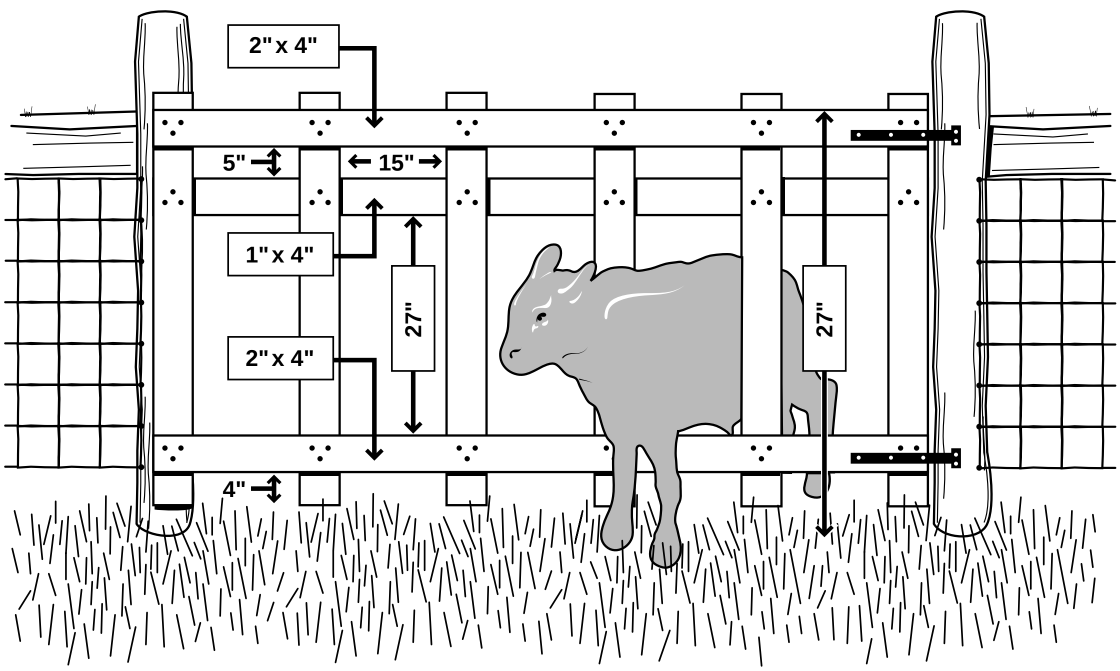

Figure 4. A 12-foot creep gate to allow smaller animals (up to 700 lb) access to higher-quality forage areas (Source: Allen, V. G. 1999. Irrigated Pasture Grazing School. New Mexico State University Agricultural Science Center at Tucumcari. Aug. 5, 1999, adapted from Blazer et al., 1986).

It may be necessary to use long, thin pastures or paddocks, so that the water stays within the paddock rather than crossing a fence. For sprinkler-irrigated pastures, the sprinkler should pass through the portion being grazed without applying any water. Special gates have been designed to allow sprinklers to cross fences without damaging them or interfering with the flow of electricity to the rest of the fence. Continuously stocked pastures should be cross-fenced, so that animals can have continuous access to pasture, water and supplement but be temporarily excluded from portions being irrigated. Exclusion is only necessary until the ground is sufficiently dry to prevent hoof damage to the pasture plants.

In rotationally stocked systems, irrigations generally are applied to all paddocks at the beginning of the growing season and then after each paddock is grazed to promote regrowth for the next grazing cycle. For continuously stocked pastures, water should be applied as needed to sustain productivity. Fencing should be used to exclude animals during furrow or flood irrigation.

Water and supplements. Every pasture needs an area set aside for cattle to access water and supplements. This usually is where cattle will loaf unless shade is available elsewhere. Water and supplements should be located away from shady areas to encourage animals to roam and graze throughout the pasture. Water and supplements should be located in well-drained areas. Placing them on a slope or providing a platform of firm soil or gravel helps move water away so that the area does not become muddy or excessively rough. In continuous stocking and stockpiling systems, water and supple-ments should be located near the pasture's center, particularly for larger pastures (up to approximately 120 acres if circular). This also will work for larger, rotationally stocked paddocks. In smaller pastures, waterers may be placed in the fence line between two paddocks or pastures, minimizing installation and maintenance costs.

Water needs to be safe for livestock (Guide M-112, "Water Quality for Livestock and Poultry"), always available, fresh, and offered in a way that keeps animals from standing in it. Water can be kept fresh by providing at most a week's supply at a time. Automated waterers using a float system that refills tanks as they are emptied can be installed to water lines using garden hoses. If water is not directly available to the pasture via a pipeline, portable tanks can be used and refilled whenever visits are made to check on pasture or animal condition. Pastures should be visited on a regular basis in any system to make sure fences are secure, check livestock for illness, and make sure the water and supplement supply is adequate. For situations in which a larger stock tank (pond) is used, it would be best to fence cattle out of the tank, if possible, and provide a smaller tank with a float to give access to water.

Supplements, even in block form, should be kept in feeders to minimize ground contact, loss, or deterioration. Research at NMSU's Corona Range and Livestock Research Center indicates that animals are more likely to visit open than covered feeders and stay long enough to ingest a satisfactory amount of the supplement. Supplements should include salt and minerals, mainly calcium and phosphorus. Other supplements, such as monensin, are growth promoters and are labeled only for certain livestock classes. Monensin also is known to reduce the likelihood of bloat, as is poloxalene. These products should be made available to animals for a day or two prior to grazing pastures that contain bloat-inducing species, such as alfalfa, clovers and small grains. They should never be allowed to become depleted or deteriorate to the point that animals refuse to consume them. For protection, livestock grazing bloat-inducing pastures need to ingest the bloat preventive every day.

When using leader-follower or creep grazing methods, the calves or yearlings can be enticed into the higher quality forage area using a supplement feeder stocked with an intake-limited concentrate ration. This also will provide an energy supplement to promote growth. Be sure to provide salt and mineral supplements and bloat preventives in both pastures, so that all animals have access to them at all times.

Parasite and fly control. Flies and parasites should be controlled throughout spring and summer. Each animal should be treated for protection against internal and external parasites during the spring and summer grazing seasons. There are several methods to control flies, including ear tags, dust bags, back rubbers, pour-ons and sprays. At least two different methods should be used to prevent the flies from building up immunity to one method. Insecticide ear tags can be installed when animals are treated for parasites in late spring. Dust bags or back rubbers can be placed such that animals have to come in contact with them when coming and going for water or supplement. A new fly control method has been developed and tested in North Carolina that uses bug zapper technology. It should be placed such that animals must walk through it on a regular basis.

Shade and wind protection. Other factors that promote animal comfort and, therefore, performance include shade and wind protection. Providing an area out of direct sunlight offers more comfort during rumination. Also, photosensitivity (sunburn) might be reduced when forages that cause it are included in the pasture. Wind protection might be especially important during the winter for newborns, to reduce illness, or to provide a snow-free area for loafing.

Distance to water, supplements and other amenities. Research at the Forage Systems Research Center in Linneus, Mo., indicates that animals regularly will walk 800 ft to their water source. Longer distances may reduce water intake and/or grazing time. Animals spend time lying in pastures between grazing sessions rather than going to water. Or when they do come to water, they spend more time loafing in the alley. Shorter distances may cause paddocks to be too small, requiring managers to move cattle more often than desired. Beef yearlings at Tucumcari were continuously stocked on 180 x 950 ft monoculture grass pastures. Two to three times each day, animals were observed grazing from the alley (where water was located) at one end of the pasture to the other end and back. Daily gains averaged 1.7 lb/hd for a total of 350 lb of beef gain/acre during the grazing period (early May to mid-August). Little or no shade was available in most of those pastures.

Fencing. There are many fencing designs available on the Internet as well as from dealers. Producers should look at available options and decide what will work best for their particular irrigated pasture program to keep animals where they should be and maintain the flexibility that the pasture system demands.

In rotational stocking or stockpiling systems, paddocks should be fenced so that each can be managed individually without interfering with any other, particularly for irrigation. Set aside an area that is near the pasture, but not part of it, to provide water, supplements and loafing. This area should be easily accessible from all paddocks. For pivot-irrigated pasture systems, paddocks may be arranged like pie slices with the common area at the center. This might make connections to the water supply more convenient since that's also where the irrigation water supply is located. In pastures irrigated by side-roll or surface irrigation (flood or furrow), paddocks are more likely to be in a line at a right angle, or nearly so, to the direction of water movement. An alley above the ditch usually is satisfactory. Cattle easily become accustomed to wooden bridges covered with dirt, especially if manure is mixed in. However paddocks are laid out, gates are needed that allow the animals access from the pasture to the common area but prevent them from entering pastures being rested or stockpiled.

Generally, perimeter fences should be more structurally sound than internal fences. If electric or high tensile fencing is used, animals should be trained to the fence before being left unattended. When using electric fencing, perimeter fences should include at least one hot wire and one ground wire. Single-strand hot wires may be sufficient for internal fences. Be sure to design electric fences so that opening a gate does not interrupt electricity flow to other parts of the fence. Temporary fencing is available that can be valuable for internal fencing in a rotational stocking system. Since these materials are easy to install and remove, paddock size can be adjusted based on available forage and animal demand to provide pastures for a set time.

MANAGING ESTABLISHED PASTURES

Animal Management

Bloat protection. Bloat results from a foam formed in the rumen that prevents the animal from expelling gas by belching. Gas pressure continues to build up and, unless relieved, can kill the animal by suffocation. Bloat's exact cause is not well understood, but certain proteins produced by the plant are believed to cause the foam. Pastures containing alfalfa, clovers (except berseem), sweetclover and small grains can cause severe bloat problems. The higher the percentage of these species a pasture contains, the greater the chance of bloat. Maintaining grass levels above 50 percent helps to reduce bloat incidence but does not prevent it.

New growth generally is higher in quality and more likely to cause bloat than more mature growth. Additionally, pasture quality generally declines over time due to grazing. Care should be taken when turning animals into a fresh pasture. It is best to fill hungry animals with dry hay first.

Bloat seems more prevalent during cooler times of the year (spring and fall), when legume growth is more rapid. Additionally, dew is more likely during these times, which increases bloat incidence. Changes in weather also play a role in the likelihood of bloat. Increases in relative humidity, decreased temperature or increased wind have been associated with increased bloating. Low precipitation or low soil water-holding capacity, leading to low soil moisture, also has been implicated. It is possible that when precipitation (or irrigation) does occur, the bloat-inducing species begins rapid growth.

Relative levels of sodium, potassium, magnesium and calcium in the forage also may have a role in bloat. When forage low in sodium and potassium and high in magnesium and calcium is grazed, the likelihood of bloat increases. Levels of these nutrients in the forage can be related to soil levels, so soil test results might indicate which fields have an increased likelihood of bloat.

Even if special care is taken to avoid bloat, it is recommended that a bloat preventive, such as monensin or poloxalene, be available a day or two before and throughout the time bloat-inducing forages are fed or grazed. These products work well, but only if animals ingest the required amount of the compound every day. Bloat preventives are available mostly in dry form as block or loose supplement for top-dressing feed bunks. However, liquids also are available that can be used in watering systems or mixed with molasses.

Even when all precautions are taken, some loss (up to 3 percent) is likely to occur, because individual animals may not eat enough bloat preventive to be protected. Also, some animals are more susceptible to bloat than others, and some animals might be more genetically predisposed to bloat.

Determining livestock numbers. Live-stock numbers or paddock size (stocking density) can be determined by estimating how much dry matter each animal will consume or waste during the grazing period. The grazing period length in a pasture or paddock can be estimated with a little math. One animal unit month (AUM), allowing for about 25 percent waste, is considered to be about 1,000 lb of air-dry forage (33 lb/day). Animal units (AU) may be made up of different ages and classes of livestock based on the following: mature cow and calf = 1.00 AU, bull = 1.25 AU, beef/dairy yearling = 0.60 AU, horse = 1.25 AU, and sheep = 0.20 AU. Forage yield can be estimated roughly by harvesting a known area to ground level and allowing the material to air-dry before weighing or by weighing it fresh and using a standard dry matter estimate (0.20 for alfalfa or 0.25 for grasses). Experienced pasture managers often can use forage height and percent ground cover to estimate forage availability. So, these factors also should be measured or estimated at sampling time and compared to harvested availability estimates to gain experience. Forage availability (in lb) of a mono-culture grass (25 percent dry matter) pasture is then calculated as:

$$\frac{\text{Fresh weight (lb)} \times 0.25 \times 43{,}560 \times \text{pasture area (acres)}}{\text{Harvested area (sq ft)}}$$

Intake of cool-season forage species by beef cattle is limited when forage availability drops below 1,000 lb/acre (fig. 5). Grazing period length can be estimated by:

$$\frac{\text{Forage availability (lb)} - (\text{pasture area (acres)} \times 1000 \text{ lb/acre})}{33 \text{ lb/day} \times \text{no. of AU}}$$

This will give an estimate of how many grazing days a pasture or paddock will provide. However, it could be an under-estimate, particularly in a system that uses continuous stocking or long rotations because the pasture will continue to grow while being grazed.

In some cases cograzing different animal species is beneficial to maximizing forage use. For instance, sheep and goats can graze more closely than cattle and might be useful for cleaning up a pasture after cattle. On the other hand, horses are spot-grazers and other livestock might be used to harvest areas horses leave ungrazed.

Grazing management. Grazing management for newly established pastures is discussed in Circular 585.

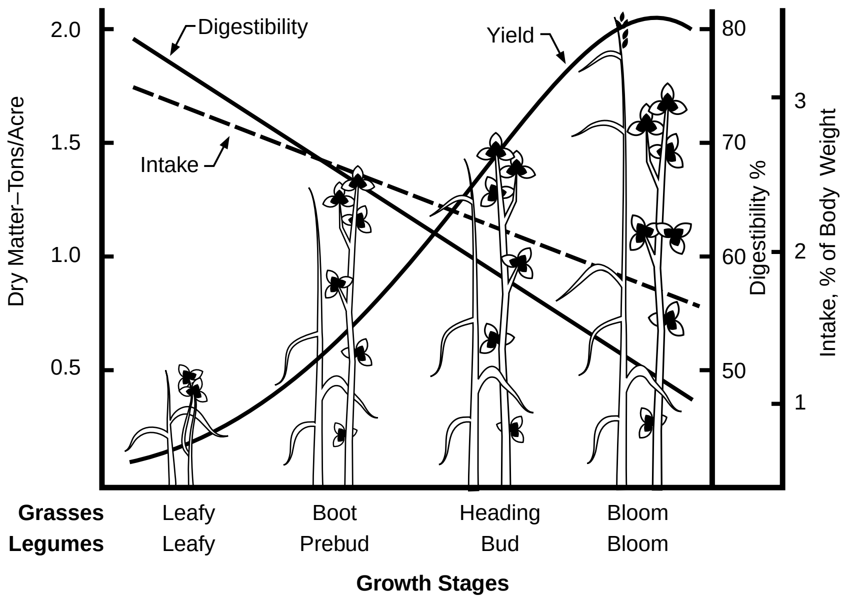

Figure 5. Relative yield, quality and intake of grasses and legumes (Source: Allen, V. G. 1999. Irrigated Pasture Grazing School. New Mexico State University Agricultural Science Center at Tucumcari. Aug. 5, 1999).

An established irrigated pasture's forage yield and quality depends largely on grazing/harvest management. While yield will continue to increase as the plant grows, palatability, digestibility and, thus, intake of most species decline rapidly after flowering (heading in grasses) (fig. 5). Immature forage is much higher quality and provides better animal gains. But grazing too early or too often leads to more frequent defoliation and inhibits the next growth cycle of individual plants and overall pasture yield. Lower yields lead to lower animal intake and performance. Continued frequent defoliation (over-grazing) leads to weak, noncompetitive plants, weed invasion and eventual stand loss. Grazing too infrequently allows plants to become overmature, which also leads to reduced intake and performance, because the forage will be refused by animals or is not high enough in quality to meet dietary needs. A balance between forage yield, quality and use must be achieved to harvest as much forage as possible, hold waste to a minimum and maintain palatability and nutritive value without compromising pasture health. This usually involves preventing overgrazing or underuse and permitting sufficient, but not excessive, pasture rest.

Most legumes in established pastures should be grazed at or near early bloom. Plant maturity, or length of rest period, is not as critical for grasses as for legumes. However, monoculture grass pastures should be 6 to 12 inches tall before grazing, depending on plant species. Bunch-type or upright species will be taller than creeping types. Animals will be removed from irrigated pastures before forage becomes limiting to intake. This usually occurs when availability (forage above ground level) falls below about 1,000 lb/acre. When monoculture cool-season grasses and most legumes fall below 3 to 4 inches, animals cannot get enough to eat, and there may not be enough leaf material to promote regrowth. For upright legumes like alfalfa and sainfoin, remove animals when stems are 6 to 8 inches tall and nearly defoliated. Manage alfalfa-grass pastures for the alfalfa. Grazing-tolerant alfalfa varieties and perennial warm-season grasses, such as bermudagrass and old world bluestem, retain more leaf area below the grazing horizon. But forage availability can still limit intake. A taller stubble height (6 to 10 inches) should be left for warm-season annual grasses.

Plant Management

Fertilization. Fertilizing a good pasture stand properly improves forage yield, palatability and nutritive value. In addition, proper fertilization can enhance stand life, weed control, disease tolerance and water-use efficiency. Pastures like all other crops require relatively large amounts of nitrogen (N), phosphorus (P) and potassium (K). It is impossible to provide a standard fertilizer recommendation because of the variability in pasture composition (species and proportion of plants in the pasture), soils, climate and water. However, NMSU gives guidelines for irrigated pasture fertilization (Guide A-128, "Fertilizer Guide for New Mexico"). The guidelines are useful for replacing nutrients removed in the previous growing season. Test soil occasionally (every three years or so) to verify that the applied fertilizers are meeting the needs of the pasture without having a surplus or that there are no deficiencies in minor (micro) nutrients. Managers of permitted animal feeding operations are required to soil test fields receiving manure applications at least every year.

Nitrogen, the nutrient most often deficient in the soil, is essential for vegetative growth of all species. Deficiency symptoms include poor growth and yellowing (chlorosis) of the leaves. Nitrogen is a mobile nutrient and can be leached out of the root zone by heavy precipitation or irrigation. Therefore, it is best to apply it in split rather than single applications. This not only reduces the chance of leaching but also lessens the likelihood of injury to the plants from fertilizer (salt) burn and allows more efficient use of the nutrient. An added benefit to decreased leaching is the reduced potential of nitrate contamination in ground water. Perennial cool-season grasses can use up to 250 pounds of nitrogen per acre per year. This should be applied in as many applications as possible made throughout the growing season at rates up to 50 or 60 pounds per acre. The first application should be made when the grass begins to green up in the spring but not until irrigation water is available or precipitation is imminent. Subsequent applications can be at uniform intervals throughout the growing season. In a test at Tucumcari, furrow-irrigated tall wheatgrass yields declined when the nitrogen schedule changed from three applications of 50 lb/acre to two applications of 75 lb/acre. Nitrogen can be applied to pastures at any time, but it should be done in conjunction with irrigation or imminent precipitation to help incorporate the nitrogen and prevent volatilization. Nitrogen uptake and use is more efficient if the plants are actively growing before the application and provided adequate moisture after to incorporate the fertilizer. In the test at Tucumcari, tall wheatgrass responded very well when precipitation or irrigation occurred within two weeks before and after the nitrogen application, even when it was applied in mid-December. Producers might benefit from scheduling nitrogen applications one to two weeks after a significant rainfall and watering in the nitrogen. Introduced perennial warm-season grasses and all annual grasses also respond well to nitrogen fertilization, even when applied at higher rates of 100 pounds per application. In New Mexico, bermudagrass probably can use up to 500 pounds of nitrogen per acre per year, making it desirable as a catch crop for nitrogen in dairy or poultry manure. Native grasses like blue grama will decrease productivity if too much nitrogen is applied.

Using nitrogen fertilizers on irrigated pastures can be reduced greatly or avoided altogether with grass-legume mixtures. In most cases, the legume will fix enough nitrogen to meet the needs of the mixture. See Circular 585 for more information.

Commonly, phosphorus is deficient in New Mexico soils. It is rapidly tied up in soils with a high pH, becoming unavailable to plants. But unlike nitrogen, phosphorus is not leached readily from the soil, even in its plant-available state. Phosphorus is essential for both legumes and grasses. Legumes are more sensitive to phosphorus deficiency, because they require more phosphorus than grasses. Deficiency symptoms include stunted growth and/or purpling of the leaves. Much of the plant phosphorus ingested by grazing animals will be returned to the soil in manure. To replace phosphorus taken up in pastures, apply 100 pounds of P_2O_5 per acre per year in a single application made in late winter or early spring. As previously mentioned, occasional soil testing will help determine how much phosphorus should be added. More phosphorus must be replaced if any of the forage is harvested as hay. If soil testing indicates low phosphorus levels, applications over several years might be necessary.

The botanical composition of grass-legume pastures can be altered by fertilization. When nitrogen is reduced and phosphorus is increased, the legume tends to become the dominant species. And the opposite occurs when nitrogen is increased and phosphorus is reduced.

New Mexico soils generally are high in potassium, and its application to crops has not been beneficial in the past. As with phosphorus, legumes are more sensitive than grasses to potassium deficiencies, symptoms of which include white specks on leaves, excessive wilting and top or marginal burn of older leaves. Soil tests using water extractable potassium might give a better estimate of potash needs in New Mexico soils than sodium acetate tests.

Grass tetany. Grass tetany is a magnesium (Mg) deficiency in animals that can occur anytime, generally from fall through spring. Any or all of the following conditions can contribute to grass tetany: cool temperatures, wet conditions, rapid grass growth, recent nitrogen and/or potassium applications, low soil magnesium levels, high soil potassium levels and imminent or recent birth. Soil magnesium, nitrogen and potassium are related to forage levels. Low forage magnesium or high forage potassium can limit magnesium absorption by animals. Classic symptoms include nervousness or twitching, paralysis in the hindquarters and death.

Although low soil magnesium can be corrected easily with fertilizer, the problem actually might be high soil potassium, which is prevalent in New Mexico and leads to high forage potassium. Analyzing forage for potassium, calcium (Ca) and magnesium during periods of rapid growth is the best way to determine if grass tetany will be a problem in a particular pasture. The tetany ratio [K/(Ca+Mg)] of 2.2 or above indicates risk. A ratio of 2.5 or above indicates high risk. Animals grazing pastures with a tetany ratio of 2.2 or above should be offered a salt-mineral supplement that delivers 0.5 to 1 ounce of magnesium per day. Some animals might not consume enough of the supplement, so grass tetany might occur occasionally. If it does, ask your veterinarian to treat the animal immediately.

The potential for grass tetany also can be reduced with timely nitrogen and potassium applications. First, apply potassium at levels recommended based on soil test results. Then, apply potassium in late spring after the danger of grass tetany subsides. Nitrogen applications to cool-season grass pastures should be split into multiple applications of 50 to 60 lb/acre distributed uniformly across the growing season. Using grass-legume mixtures is another option. In addition to providing the grass's nitrogen requirement, legumes reduce the likelihood of grass tetany, because legume forage usually is much higher than monoculture grass forage in magnesium. See Circular 585 for more information about grass-legume mixtures as well as Guide B-809, "Controlling Grass Tetany in Livestock".

Irrigation. A good, productive pasture can use 40 to 60 acre-inches of water annually, including precipitation, to maximize production. The amount and application frequency vary with temperature, humidity, wind velocity, soil type, irrigation system and pasture species. High temperatures, low humidity and high winds increase the water requirement. Sandy soils have less water-holding capacity than heavier soils and require lighter but more frequent applications. Sprinkler systems cannot apply water at the same rate as surface irrigation (flood and furrow irrigation), so irrigation frequency usually is higher, possibly as often as weekly. Poor management of surface irrigation can lose one-third or more of the applied water to run off or percolation below the root zone. Irrigations should be applied often enough to prevent obvious moisture stress to the pasture.

Cool-season grasses use as much water as alfalfa hay to maximize production, but they are not as productive even with unlimited water. Depending on soil texture, some species need to be irrigated more frequently (1-1.5 inches per week, on the average, applied weekly or semimonthly), because of their shallow, fibrous root system. Others are more drought-tolerant or have deeper root systems and can be irrigated every 28-35 days, if 4-6 inches of water are applied. One disadvantage to using cool-season grasses is that although they may not be productive during the summer, many do not truly go dormant and still require supplemental water to survive. Additionally, recent research at Tucumcari shows that while irrigating alfalfa and other cool-season legumes during winter semidormancy increases yield in the spring, irrigating cool-season grasses during that period may decrease summer yield.

Warm-season grasses seem to conserve water, because they need to be irrigated only two to three times during their growing season, which is shorter than that of cool-season grasses. However, they also are only productive from late spring to fall and may increase forage harvesting, storage and feeding costs for use at times when they are not productive.

When pastures are furrow-irrigated, the animal trampling effect may necessitate cutting new furrows as often as every year. This should be done in winter when desirable species are dormant by using a narrow shank cultivator. In pivot-irrigated pastures, wheel tracks should be packed using the pivot and a light irrigation so that deep ruts are not formed. If ruts form, landscape fabric under a bed of gravel may prevent further damage to the pasture and other equipment as well as possible injury to animals. Horses especially are prone to broken legs as they frolic on uneven land, such as that formed for furrow irrigation or rutted by irrigation pivots.

Pest control. While a limited number of herbicides are available to help producers, good pasture management in regard to species selection, fertility, irrigation and grazing practices will produce a dense, vigorous stand of plants and provide the safest and most economical weed control.

Occasionally, insects can be a problem in irrigated pastures, particularly those containing alfalfa. Beneficial insects are valuable tools for keeping many insect pests under control. However, some insects apply peak pressure in early spring before beneficial insect populations exert adequate control. It is in those times that irrigated pasture producers should scout fields for damage and resort to labeled insecticides.

Plant diseases usually are not a problem in forage crops that have been properly managed, beginning with species and variety selection. When diseases do occur, chemical control measures are limited and not usually feasible.

If chemicals are used to control any pest, be sure to read the label and follow all instructions, especially those about safety, cleanup, target pests, application rate and timing and grazing or harvest restrictions.

Post-grazing management. Mowing (clipping) to remove grass seedheads forces the grass to become vegetative again, producing leaves instead of seed. The best time to clip is when the grass first heads. This can be accomplished in either continuous stocking or stockpiling systems. However, in a rotational stocking system, it is best to wait until after a grazing period so that more of the seed stalk can be removed. Another reason to clip pastures is weed control. Many annual weeds can be controlled effectively and seed production prevented by clipping off flowers. Care should be taken when clipping is done to avoid removing too much leaf of the desirable species, which can reduce yields under continuous stocking or stockpiling and inhibit growth under rotational stocking. Animal droppings also should be scattered evenly over the pasture after each grazing period and before irrigation. Animals tend to avoid areas where droppings are concentrated; failure to spread them can result in unused forage in those areas. Concentrated droppings also may interfere with the water distribution pattern, especially in flood- or furrow-irrigated fields. In many areas, a chain harrow is pulled behind the shredder to accomplish pasture clipping and manure scattering in one operation.

SUMMARY

In most cases, whether animals are owned to generate income or for work, pleasure or aesthetics, feeding costs can be reduced greatly with irrigated pastures in New Mexico. Having the animal harvest forage by grazing saves equipment and labor costs of harvesting, storing and feeding hay or other stored feeds. Properly managed irrigated pastures often can meet the nutritional demands of most livestock. They also lend themselves to easy supplementation for all higher levels of animal productivity, with the exception of maximum milk production and general consumer-quality beef finishing. To an extent, better pasture management reaps higher forage quality and yields. It also offers savings for some inputs and greater returns for others.

Maximum productivity begins with establishing well-adapted, highly productive pasture species. Circular 585 provides information about which pasture species are well-adapted to New Mexico conditions and how to establish uniform, productive, persistent pastures. Contact your county Cooperative Extension Service office or visit NMSU's College of Agriculture and Home Economics publications Web site at www.cahe.nmsu.edu/pubs for a copy or for other information.

To find more resources for your home, family, or business, visit the College of Agriculture and Home Economics on the World Wide Web at www.cahe.nmsu.edu.

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