Species Selection and Establishment for Irrigated Pastures in New Mexico

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Using animals to harvest forage crops, such as irrigated pastures, requires much less labor and equipment than hay and feeding operations and allows for an increase in net farm income. But there are numerous other uses for irrigated pastures that are not driven by generating income. In many areas, small tracts are used to pasture horses or hobby livestock. Ranchers use irrigated pastures as holding sites, calving pastures, horse pastures, hay sources or supplemental rangeland grazing.

To assist New Mexico's irrigated pasture producers with selecting and establishing pasture species, New Mexico State University's Agricultural Experiment Station has conducted research throughout the state and accumulated information from other states and producers. That information is presented here as a guide to developing productive, irrigated pastures in New Mexico. These recommendations might change as more data and improved species become available.

Circular 586, "Grazing Systems and Management for Irrigated Pastures in New Mexico," and other resources that provide more information about topics covered here are available from your county Cooperative Extension Service office or through NMSU's College of Agriculture and Home Economics publications Web site (www.cahe.nmsu.edu/pubs/). Several are mentioned by name in this publication.

PASTURE SPECIES SELECTION

Several factors must be considered in pasture species selection that fall into two broad categories—local adaptation and intended use. Within those two categories, there are some questions producers should answer before developing their forage program.

How long will this land be in pasture?

Pasture cropping systems generally fall into three categories: permanent, annual and rotational. Permanent pastures usually consist of perennial species that remain on the site indefinitely. Benefits of permanent pastures include establishment costs prorated over a longer period, soil and water conservation and soil improvement, particularly on marginal land. Annual pastures are planted for seasonal use. They can be used to supplement permanent pastures during times of low forage productivity, or they may constitute the entire forage program. Many producers prefer to use a combination of annual species year-round for pastures, because they provide a valuable source of high-yielding, nutritious forage. While annual species generally yield more than permanent pastures, the additional cost of land preparation, seed and planting each year could more than offset any differences in production. Irrigated pastures that will be rotated with row crops are part of a rotational cropping system. The forage species used in

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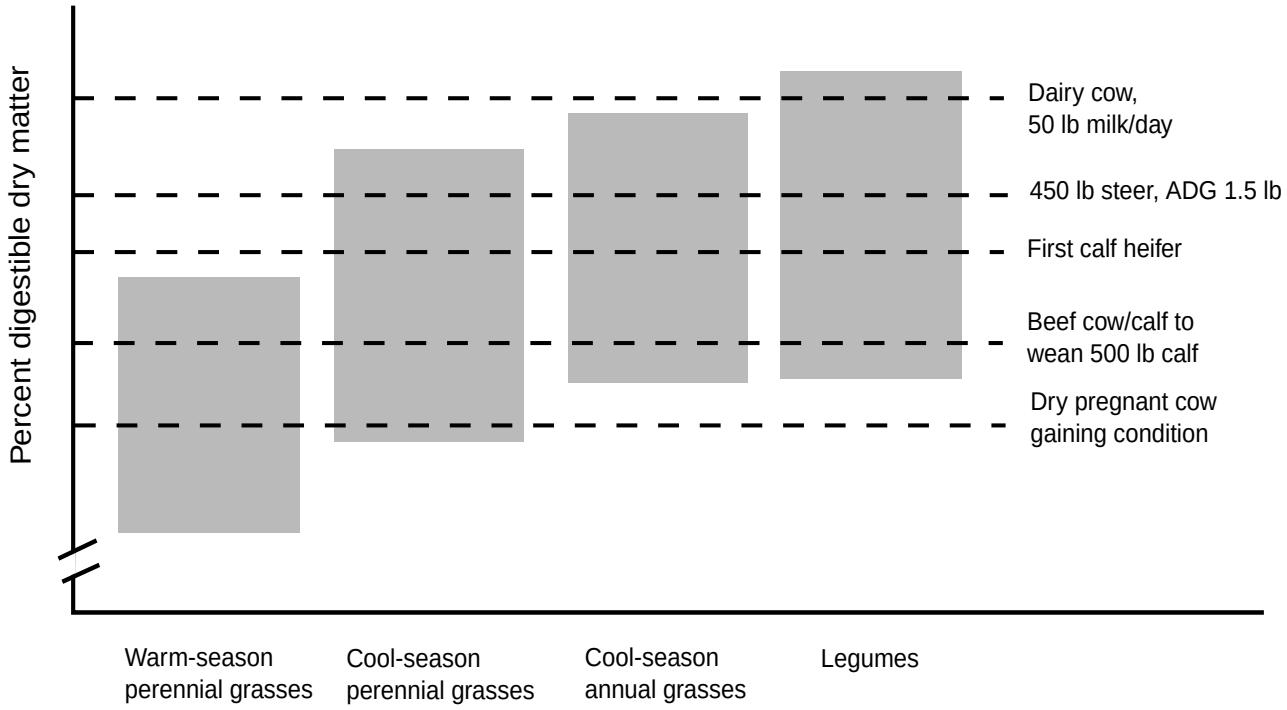

Figure 1. Relative quality of forage crop types and requirements of different cattle classes (Source: Ball, D. M., C. S. Hoveland, and G. D. Lacefield. 1991. Southern Forages).

this situation, whether annuals or perennials, cool-season or warm-season, depends on the length of the rotation, season of the year and the desired amount of forage produced.

What kind of animals will graze the pasture?

Different animal species and classes of animals within each species have different nutrient requirements (fig. 1). Animals that have high nutritional demands, such as working horses, lactating cows or growing steers, need greater amounts of higher-quality forage. But, in the case of horses, if quality is too high and fiber too low, colic can be a problem. Also, if the pasture will be managed only for aesthetics or as a low-maintenance turf, less productive pasture species might be more desirable. Additionally, different animal species apply different kinds of grazing pressure to pastures. Some, like beef cattle, graze uniformly across a pasture. Others, such as horses, spot graze, leaving some areas to become overmature and overgrazing other areas. Finally, while legumes usually are higher in yield and quality than grasses, some legumes cause bloat in ruminants, which can lead to death. Producers need not avoid legumes entirely, but they do need to manage pastures with legumes to lessen the likelihood of the occurrence of bloat. More information about bloat and protecting animals against bloat is presented in Circular 586.

What forage crop species can be grown?

New Mexico has vast differences in elevation and latitude. The wide range of climatic conditions allows for a broad range of species that may be adapted when irrigated. Pasture

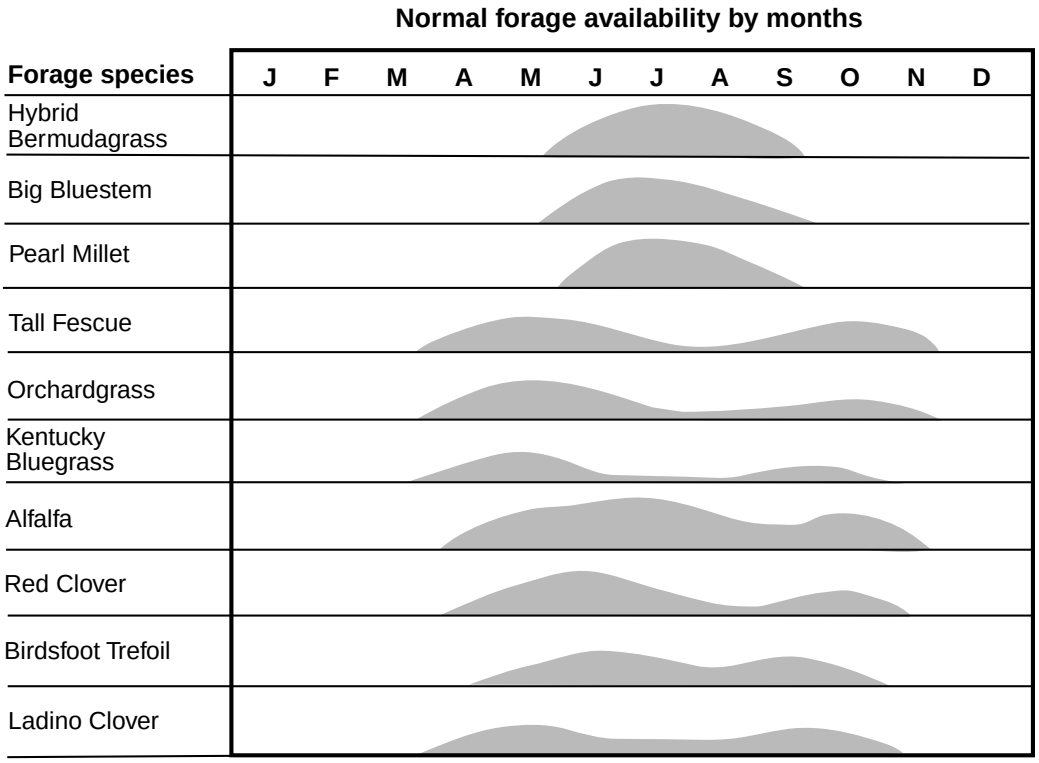

Figure 2. Seasonal yield distribution of selected forage crop species adapted to New Mexico (Source: Ball, D. M., C. S. Hoveland, and G. D. Lacefield. 1991. Southern Forages).

species discussed later in this publication are known to be well-adapted to the state and have value as livestock feed. The description of each species includes limitations on adaptation. Other considerations in determining adaptability are the types of insects and weeds found in the area to be used for pasture. Not many pesticides are labeled for pasture use. Soil type also plays a key role in selecting pasture species. Species performance can be affected greatly by poor or excessive drainage, soilborne diseases and nematodes, soil depth, soil pH and salinity. The U. S. Department of Agriculture soil survey and a soil analysis will help determine the soil constraints on your property that should be considered when selecting irrigated pasture species. Once the pasture species are selected, variety selection also can be a critical decision based on the same criteria as that used for species selection. Contact your local county Cooperative Extension Service for more information.

DESCRIPTION OF PASTURE SPECIES

Species types. Forage species usually are classified by their growth characteristics—when they grow, how long they live and how they spread. Cool-season species grow best between 60° and 80°F. Warm-season species grow best between 80° and 95°F. Most warm-season species are killed when temperatures consistently fall below 10°F. Annual species complete their life cycle in one year or less, biennials need two growing seasons or years to complete their life cycle. Species that persist for three or more years are considered perennial. Generally, cool-season species are higher in quality than warm-season species, annuals are higher in quality

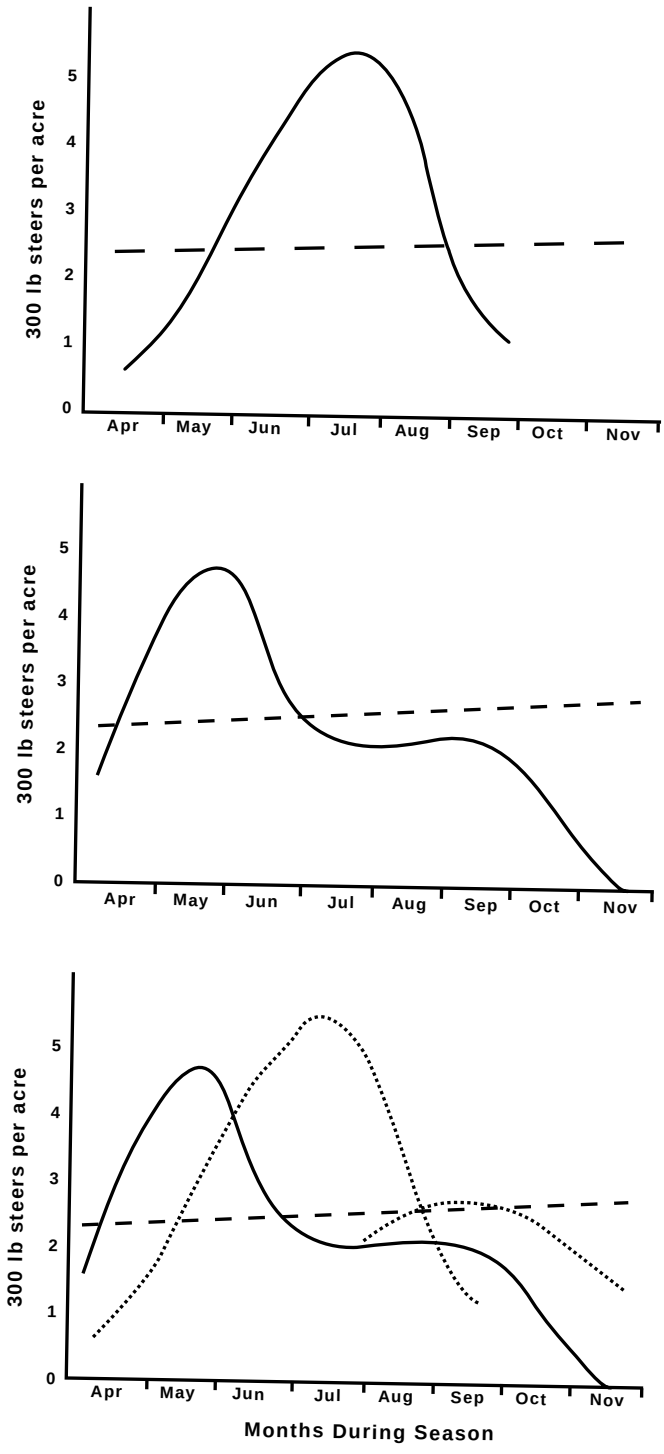

Figure 3. Seasonal yield distribution of warm- and cool-season forages and forage needed to meet animal requirements (Source: Allen, V. G. 1999. Irrigated Pasture Grazing School. New Mexico State University Agricultural Science Center at Tucumcari. Aug. 5, 1999).

than perennials, and legumes are higher in quality than grasses (fig. 1).

Seasonal yield distribution is another factor to consider when making species selections so that forage production will match animal demand (figs. 2-3). Cool-season perennial species generally have their highest production in the spring, followed by a summer slump and another growth period in the fall. If irrigation water is available only during the growing season, alfalfa yields will be lower early in the season and sustained during the summer (fig. 4). Cool-season annuals grow some in the fall, followed by a period of dormancy or minimal growth in the winter and highest production in the spring. Generally, warm-season annuals and perennials grow actively from mid-May until a hard freeze in the fall. Peak production generally is in midsummer.

Most species will spread by seed. Otherwise, some species have a bunch-type growth habit and spread by tillering or crown expansion (i.e. tall wheatgrass, tall fescue). Other species reproduce vegetatively, with lateral stems either belowground (rhizomes) or aboveground (stolons) that can form new plants by rooting at nodes. In addition to spreading by seed, Johnsongrass (normally considered a weed) spreads by rhizomes; buffalograss spreads by stolons. Bermudagrass can spread by rhizomes, stolons and seed.

Forage crops described in this publication include grasses and legumes. All forage crops need nitrogen for maximum productivity, but legumes live in cooperation (symbiosis) with certain nitrogen-fixing bacteria (rhizobia), which form nodules on the roots and convert atmospheric nitrogen into a form the plant can use. For this reason, little or no nitrogen fertilizer is necessary for legumes. Grasses do not have this capability and must have their nitrogen requirement met by other means.

Another difference between most grasses and legumes is their potential to cause frothy

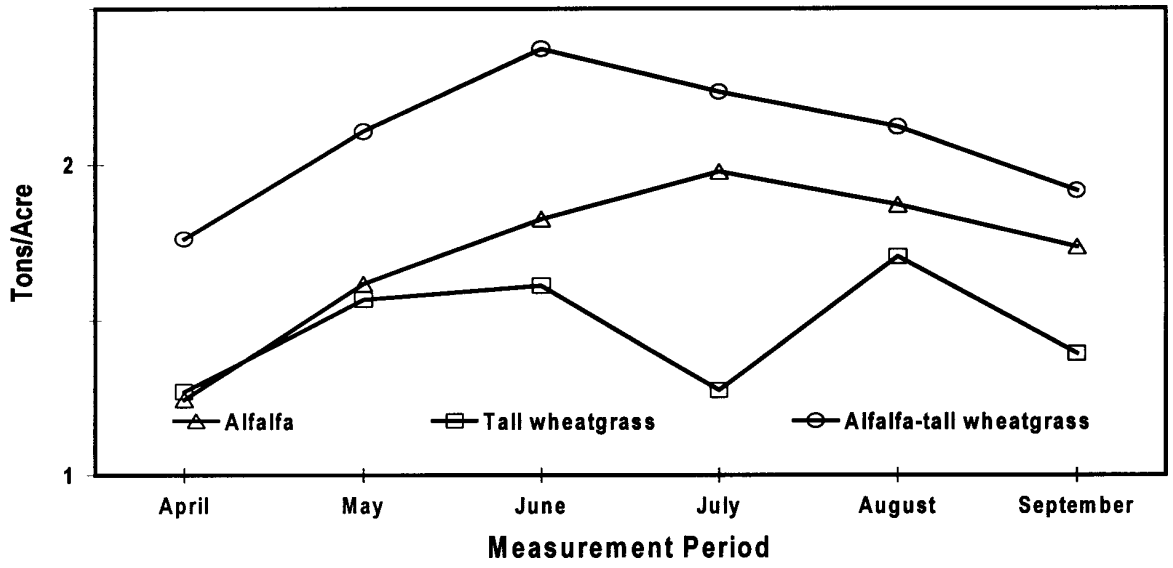

Figure 4. Seasonal yield distribution (35 days regrowth) of alfalfa and tall wheatgrass pastures at NMSU's Agricultural Science Center at Tucumcari, 1999-2001.

bloat in ruminants. Cool-season, annual grasses, such as small grains and most legumes, can cause bloat; animals grazing pastures including these species should have a bloat preventive available at all times.

Finally, grass tetany, caused by magnesium deficiency, can occur if soils are low in magnesium. This disease is most common in monoculture grass pastures during periods of rapid growth from fall through spring. Some grass species are more likely to cause grass tetany, generally because they are poor magnesium accumulators or they have a period of extremely rapid growth in the spring. More information on grass tetany is given in Circular 586.

Mixtures. Grass-legume mixtures generally are preferred over monocultures. Because forage yield and quality usually increase, seasonal distribution can become more uniform (fig. 4). And the legume supplies nitrogen to the grass, reducing fertilizer costs. Also, if the grazed material from the pasture is at least 50 percent grass, the incidence of bloat is reduced. Furthermore, using grass-legume mixtures can reduce the likelihood of grass tetany mixtures, because legume forage generally is higher in magnesium.

With few exceptions, the legumes described in this publication should be used in pastures as mixtures rather than monocultures. Simple mixtures (no more than two grasses and/or two legumes) are better than complex mixtures, because complex mixtures present several problems. Differences in requirements for cultural practices (harvest timing, fertility, irrigation); grazing management; and ability to compete for light, water, nutrients and space make it difficult to maintain all species in the stand. Additionally, animals will selectively graze more palatable species and eliminate them from the stand, leaving less palatable species to become overmature.

While mixing perennial cool- and warm-season grasses in the same pasture has not been successful in most irrigated areas, including perennial cool-season legumes in warm-season grass pastures

has been successful in the Southeast and some testng has been done in New Mexico (NMSU Research Report 167). Overseeding dormant, warm-season pastures, such as bermudagrass, with annual cool-season grasses like annual ryegrass or legumes also has been successful. However, in these mixtures, the warm-season grass needs to be going dormant prior to planting in the late summer, and the cool-season species should be grazed or killed before the warm-season grass greens up in the spring. The availability of irrigation water for establishment and early spring production might be a concern in many areas of the state.

Most of the forage crop species listed in this publication have demonstrated adaptation and are prominently used in irrigated pastures in New Mexico. A few are included that have not yet been widely used but show promise. Other species might be well-adapted, but are not included because of low productivity, insurmountable antiquality factors or they simply might not be as well-adapted as the species listed in this publication. Specific varieties are not listed because of differences in seed availability and local adaptation.

Perennial Cool-Season Legumes

Alfalfa *(Medicago sativa*) is a long-lived species that continues to be the legume of choice in most irrigated pasture situations. The plant grows erect with shoots rising from the crown. Grazing might damage the crown, providing an entry for disease organisms. However, grazing pressure has been used to develop many newer varieties. These varieties have a crown located below the soil surface where it is protected from trampling effects. They also have broader crowns and taproots that maintain a higher carbohydrate reserve and shoots that produce leaves below the grazing horizon, so that the plants can continue to photosynthesize while being grazed. Alfalfa is a high-yielding, nutritious, palatable species, but the possibility of bloat in ruminant animals exists, even in grazing-tolerant varieties.

Alfalfa is adapted to most regions of New Mexico. It grows best on loamy, fertile, well-drained soils, but it grows on most soil types. Once established, it can tolerate a considerable amount of salt and has more heat tolerance than most cool-season forage legumes. Alfalfa produces high yields as a monoculture but also performs well when mixed with many grasses. If planted as a monoculture, use 15 to 20 pounds per acre. For mixtures, use only 4 to 5 pounds per acre.

Alfalfa is allelopathic. That is, when a stand is more than a year old, a compound is released into the soil that kills or stunts newly germinated alfalfa seedlings. This toxic compound remains in the soil for approximately one year after all the alfalfa is gone. So, once alfalfa is no longer contributing enough to pasture yield and quality, renovation with another legume, such as birdsfoot trefoil or red clover, is advisable. After one year, alfalfa can be reestablished successfully. Otherwise, the entire pasture should be rotated to an annual crop for at least one complete growing season, so that tillage and irrigation practices can help dissipate the toxic compound.

Alfalfa varietal performance is tested at several locations each year in New Mexico. The results of those tests and variety selection guidelines are available in an annual report from your county Cooperative Extension Service or on the Web at www.cahe.nmsu.edu/pubs/.

Birdsfoot trefoil (*Lotus corniculatus*) is a biennial or short-lived perennial with a semierect to prostrate growth habit. It is adapted only to the state's cooler regions or higher elevations, because it lacks heat tolerance. Birdsfoot trefoil is adapted to most soil types and can be grown on heavy, poorly drained or swampy soils unsuited for most

other legumes. Birdsfoot trefoil has good tolerance to flooding and salinity. It is considered nonbloating, but bloat can occur on rare occasions. Birdsfoot trefoil does not have the yield potential of alfalfa and other legumes. While it is best-suited for mixing with grass, yield of the mixture is usually similar to that of a properly fertilized monoculture of the associated grass. Birdsfoot trefoil should be sown at 4 to 6 pounds per acre in mixtures. It should be managed to permit natural reseeding at least every other year so that new plants can replace those that die.

Cicer milkvetch (*Astragalus cicer*) has a creeping, rhizomatous growth habit. It is drought-tolerant, but must be irrigated to maintain stands in most of New Mexico. Cicer milkvetch is nonbloating, but it does cause photosensitivity (sunburn) in livestock. Seedling emergence and growth is slower than either alfalfa or sainfoin. It generally does not perform well in mixed pastures and should be used only as a monoculture in which it will produce approximately half the yield of alfalfa. Additionally, persistence of cicer milkvetch under grazing has been questioned. However, for low-maintenance situations or rotational stocking with a longer rest (45-60 days) period, cicer milkvetch might perform satisfactorily. The seeding rate for monoculture cicer milkvetch is 5 to 8 pounds per acre.

Kura clover (*Trifolium ambiguum*) is rhizomatous and long-lived. It is very similar in appearance to white clover, but plants are larger. Kura clover establishment is directly related to the number of plants that nodulate, but it does not nodulate well in the field. Therefore, when seeding kura clover, it is crucial to use properly inoculated seed (described later in this publication) or to use seed that has been factory treated within the previous year. This species is slower to establish than most other legumes. However, once established, kura clover is an aggressive spreader. It even overtook tall fescue sown at the same time in a trial in north-central New Mexico at NMSU's Sustainable Agriculture Science Center at Alcalde. In that study, it yielded as well as alfalfa after four years and was still maintaining stand and yield after eight years when the trial was concluded. In trials in eastern New Mexico, at the Agricultural Science Center at Tucumcari, kura clover did not perform as well as it had in north-central New Mexico, indicating that its adaptation area might be limited to the higher elevations of northern New Mexico. Like white clover, most of the grazed material is leaf and, therefore, higher in quality than alfalfa. But it can cause bloat.

Kura clover establishes well when sown in mixtures. It is likely that drilling the kura clover in rows (10 pounds per acre for mixtures) and broadcasting the associated grass on the soil surface would help enhance stand establishment. Data indicates that initial yields will be mostly grass that will provide grazing until the kura clover is established. Once established, kura clover will become dominant in the stand. Bloat preventives should be provided to animals grazing pastures that include kura clover, even in the early years when the stand is greater than 50 percent grass. Although high-yielding, kura clover does not tolerate frequent defoliation and should be rotationally stocked with a long rest interval (45 to 60 days).

Red clover (*Trifolium pratense*) generally is a biennial or short-lived perennial that might act as an annual in some areas. It has an erect growth habit. The leaves usually are covered with hair. Red clover does not tolerate frequent close grazing. However, in a rotational stocking system similar in frequency to that of hay management (30 to 45 days), it can perform quite well. Red clover does best on fertile, well-drained soils with a moderate pH range (6 to 8). It is adapted to the state's cooler regions (northern half or higher elevations in the south). Diseases common to red clover contribute to its short life span in other areas

but might not be prevalent in New Mexico's well-drained soils. Four-year-old stands of red clover at NMSU's Agricultural Science Center at Tucumcari still yielded comparably to two-year-old stands without reseeding. Bloat is a severe problem with red clover, but it is compatible with several cool-season grasses. Although red clover usually is a short-lived species, stands can be maintained by allowing it to reseed naturally approximately every other year. Use 8 to 12 pounds per acre when seeding monoculture red clover or 4 to 6 pounds for mixtures.

Sainfoin (*Onobrychis viciaefobia*) has a growth habit similar to that of alfalfa, but production has been limited to early to midspring. Sainfoin's stand persistence has been questionable in many situations, especially when grown under intense irrigation. Sainfoin's crown is weak and will not tolerate trampling by grazing animals, so it should be planted in rows to reduce trampling, if used in pastures. Sainfoin requires a well-drained soil and is adapted to calcareous and sandy or cobbly soils that might be unsuitable for other forage legumes. It is resistant to the alfalfa weevil. But is susceptible to many other alfalfa pests as well as Lygus bugs. Sainfoin also is susceptible to root and crown diseases. It is nutritious, highly palatable and nonbloating. These qualities make sainfoin susceptible to overgrazing if not managed properly. It is compatible with many cool-season grasses but also makes an excellent pasture as a pure stand. Sainfoin is not an efficient nitrogen fixer and might suffer a midseason slump in production due to nitrogen deficiency. Seeding rates for sainfoin are 35 to 40 pounds per acre as a monoculture and 20 pounds per acre in mixtures.

Strawberry clover (*Trifolium fragiferum*) is a long-lived, stoloniferous perennial. Because it is a very low-growing species, it is well-suited for grazing, but not for hay production. While strawberry clover is adapted best to the state's cooler regions, it has fair heat tolerance. It also has good salt tolerance and prefers wet soils with high pH. Strawberry clover is not used widely for irrigated pastures in New Mexico, but it has potential for low-maintenance areas and is compatible with many cool-season grasses. Use 2 to 3 pounds per acre when seeding strawberry clover as a monoculture or in mixtures.

Sweetclover (*Melilotus officinalis* and *M. alba*) includes species that are cool-season biennials or annuals with a very erect growth habit. Plants in these species usually grow to heights of more than 2 feet with stems that are coarse and become woody toward maturity. Sweetclover not only causes bloat, but also contains a chemical called coumarin, which has an undesirable taste, affecting palatability. Coumarin can be converted to a toxic substance that reduces the blood's clotting ability, causing animals to bleed to death from slight wounds or internal hemorrhaging. Sweetclover also has a very low leaf-to-stem ratio, which affects both quality and yield. Although it is adapted to most soil and climatic conditions in the state and is an excellent green manure crop, sweetclover generally is not recommended as a pasture species because of its antiquality factors.

White clover (*Trifolium repens var. giganteum*), a biennial or short-lived perennial has a creeping, stoloniferous growth habit. White clover tolerates frequent close grazing and trampling by livestock. It is adapted to a wide variety of soil types and will grow on poorly drained soils, but it does not tolerate salinity. Stolon and root rot diseases can deplete white clover stands. It also is susceptible to leaf diseases and root knot nematodes, although some varieties have tolerance to nematodes. Like alfalfa, white clover can cause bloat. It can be grown in most areas of New Mexico, but it is best-adapted to the northern half of the state and higher elevations in the southern half. The various white clover

types are well-adapted to grazing. But because of their prostrate growth habit, they are not well-suited for hay. White clover is compatible with most cool-season bunch grasses and should be sown at 2 to 3 pounds per acre in mixtures.

Perennial Cool-Season Grasses

All perennial cool-season grasses described in this publication are compatible with legumes. Unless otherwise specified, seeding should be 15-20 pounds per acre rates for monocultures and 12-14 pounds per acre for mixtures.

Altai wildrye (*Elymus angustus*) is a rhizomatous species that looks like a bunchgrass. Tests at Tucumcari, have shown it to be widely adapted to well-drained and poorly drained, high saline soils. It was among the highest-producing, cool-season grass species, giving greater summer and late-season yields than tall wheatgrass and tall fescue. Leaf blades are wide, similar to tall fescue, and coarse like tall wheatgrass with a sharp point. However, cattle grazing plots that included several cool-season grasses appeared to have a similar preference for altai wildrye as for tall wheatgrass. Because this species holds promise for increasing late-season, cool-season grass pasture productivity, more research is needed to determine how broadly adapted it is to New Mexico and the best management practices for its use here.

Orchardgrass (*Dactylis glomerata*) has a bunch-type growth habit. It is adapted to New Mexico's cooler regions and tolerates a wide range of soil conditions, but prefers fertile, well-drained soils. Orchardgrass is palatable when fertilized well and grazed frequently. It is one of the more widely used pasture grasses at the higher elevations in northern New Mexico, but it is not as hardy or long-lived as tall fescue or tall wheatgrass and is not very salt-tolerant. Orchardgrass also is a poor accumulator of magnesium, and grass tetany can be a problem (see Circular 586).

Perennial ryegrass (*Lolium perenne*) is a short-lived perennial with a bunch-type growth habit that can reseed when managed properly. However, ergot can reduce seed yield and quality and limit reseeding. Of all the cool-season grasses used in New Mexico, perennial ryegrass appears to be the most sensitive to cold, heat and drought. Best adapted to New Mexico's cooler regions, it prefers fertile, well-drained, medium-textured soils with nearly neutral pH. Perennial ryegrass generally is not recommended for New Mexico pastures.

Russian wildrye (*Elymus junceus*) is a long-lived, bunchgrass. In tests at Tucumcari, it was the most drought-tolerant of the cool-season grasses and responded quickly to precipitation. Russian wildrye is a low-growing species that produces seedheads early and remains vegetative for the rest of the year, maintaining fine leaves that are palatable and high in quality. Because it is low-growing, it is not well-suited for hay production. This species might have value in low-input, low-stocking density systems in the northern half of New Mexico, but production can be increased with irrigation and fertilization.

Smooth bromegrass (*Bromus inermis*) is a rhizomatous perennial with an erect growth habit. It has an adaptation area similar to that of orchardgrass and is used mainly in the higher elevations of northern New Mexico. Smooth bromegrass might tolerate periods of drought, temperature extremes and salt better than orchardgrass. But it tends to become sod-bound because of heavy rhizomes, which can reduce productivity. To overcome this, stands may need to be renovated by disking or chiseling every three to five years to improve air, water and fertilizer infiltration.

Tall fescue (*Festuca arundinacea*) is a long-lived species with a bunch-type growth habit, although it is weakly rhizomatous and

can form a dense sod over time. Tall fescue can be grown throughout New Mexico, but it performs best in the northern half of the state, particularly along the Rio Grande and Pecos corridors. It is adapted to a wide variety of soil types and pH, tolerating wet, poorly drained soils as well as moderate drought, heat and shade. Tall fescue is quite tolerant to grazing and management stresses. Although it might be less palatable than some cool-season grasses, livestock will graze it and perform well, when it is fertilized properly and grazed frequently. Tall fescue is compatible with most cool-season legumes in mixtures.

Tall fescue endophyte. Poor animal performance on tall fescue pasture has been linked to a fungus, *Acremonium coenophialum*, found within the plants (endophytic) that is only transmitted through the seed. This endophyte causes tall fescue plants to make alkaloids that are associated with their ability to withstand mismanagement and other stress factors. But the alkaloids also have been linked to poor animal performance. Producers who want to know the endophyte status of their tall fescue pastures can submit a plant sample for analysis. Contact your county Cooperative Extension Service office about the sampling technique and laboratories that conduct analysis. Because the endophyte is more active in reproductive tillers, declines in animal performance can be reduced or avoided by maintaining the tall fescue in a vegetative state. This can be accomplished by grazing until approximately early May, when seedstalk elongation begins, and clipping after grazing to remove the seedstalks. Additionally, anytime the tall fescue is stressed from heat or drought, the endophyte's negative effects will be magnified.

Endophyte-free varieties that perform as well as the older, endophyte-infected varieties are available. These cultivars might not stand up as well under mismanagement, such as overgrazing or drought. One variety that has a beneficial endophyte has not been shown to cause poor animal performance.

Tall wheatgrass (*Agropyron elongatum*) is a long-lived bunchgrass that, like tall fescue, can form a dense sod. While most perennial cool-season grasses decline in quality and palatability when mature, tall wheatgrass does more so than other species. It is adapted to a wide range of soil types and has the best salt tolerance of most perennial cool-season grasses described in this publication. Tall wheatgrass can withstand frequent grazing but not overgrazing. Although it is adapted to most of New Mexico, its primary use will be in the lower elevations of the state's northern two-thirds.

Timothy (*Phleum pratense*) is a biennial bunchgrass adapted to the higher elevations of northern New Mexico. It exhibits perennial characteristics by vegetative reproduction. Timothy provides high-quality forage for hay or pasture but will not persist under close, continuous grazing; is not heat- or drought-tolerant; and recovers slowly under limited moisture.

Because it is a biennial, managing timothy is critical to stand maintenance. To allow sufficient storage of carbohydrates important to vegetative reproduction, the first harvest each year should occur between flowering and the soft-dough stage. This is in contrast to most other cool-season grasses, which should be harvested at the early head stage to maximize yield and quality. Additionally, even more crucial than for all other cool-season grasses, nitrogen should be applied to timothy more frequently, but in lesser amounts. This species produces two generations of tillers each year, the second of which overwinters and becomes the primary growth for the following year. To encourage second generation growth in both years, nitrogen needs to be available in the fall and early spring. Without split applications, poor

fall growth will occur and even poorer regrowth the next spring. Management similar to that which maximizes yield and quality of other cool-season forage grasses, namely higher applications of nitrogen and early harvest, will consistently reduce timothy stands. The seeding rate is 8 to 14 pounds per acre for monoculture timothy and 4 to 6 pounds per acre for mixtures.

Perennial Warm-Season Legumes

There are no perennial, warm-season legumes known to be suitable for use in New Mexico's irrigated pastures. Sericea lespedeza (Lespedeza cuneata) and perennial peanut (Arachis glabrata) are examples of perennial warm-season legumes used elsewhere. However, sericea lespedeza performs poorly in calcareous soils, such as those prevalent in New Mexico. Additionally, production potential by perennial peanut is reduced after long, cool spells and it winterkills at 15°F.

Perennial, Warm-Season Grasses

Bermudagrass (*Cynodon dactylon*) establishes rapidly compared with most perennial warm-season grasses and forms a dense sod, spreading by both rhizomes and stolons. It favors medium- to light-textured soils and is very salt- and drought-tolerant. Bermudagrass responds well to fertilizer and can stand heavy applications of animal waste. It has poor shade tolerance and is not compatible with many other grasses or legumes, but might mix well with alfalfa. Bermudagrass is sensitive to cold; growth slows or ceases when night temperatures fall below 60°F. Therefore, bermudagrass grows best at the lower elevations found in the southern two-thirds of New Mexico. While winterkill has been a problem for bermudagrass in New Mexico, newer varieties are available that are more cold-tolerant. Bermudagrass can be established either vegetatively (with sprigs) or by seed. Sprigging is more expensive than seeding but might give quicker fill, even when sprigs are placed on 3-foot centers.

Some bermudagrass varieties are available only as sprigs, because they do not produce large quantities of seed or the seed is not true to the variety. Most of these are ecotypes that might be well-adapted and productive near their area of origin. However, the farther away from their point of origin they are grown, the less productive they tend to be with the same level of fertilizer and water inputs. The Natural Resources Conservation Service has plant materials centers located around the country. These centers, including one located at NMSU's Agricultural Science Center at Los Lunas and another in Woodward, Okla., have tested many bermudagrass ecotypes and can provide information about the adaptation area of many varieties, as well as many other forage crop species. As is the case with all forage crops, some companies have not had their bermudagrass varieties independently tested by universities over a broad range of environments. Before buying planting material (sprigs) of any bermudagrass variety, always ask if university data is available for that variety. Sprigged bermudagrass varieties should be planted at 15 to 20 bushels per acre. If a seeded type is selected, plant 5 to 10 lb per acre.

Harvest frequency and fertility management, particularly of taller-growing cultivars, can influence forage bermudagrass yield and quality.

Blue grama (*Bouteloua gracilis*) is a native range bunchgrass that has been improved for use in irrigated pastures. Because of its rangeland background, improved blue grama is probably better suited for limited irrigation and limited nitrogen situations than the other perennial warm-season grasses, which are all introduced species, listed in this publication. Although some seedstalks can be 1 to 3 feet

tall, blue grama leaves remain closer to the ground, so it is not well-suited for hay production. Additionally, blue grama quality will likely be better maintained in low-input systems and after the growing season. Productivity also will be lower. Blue grama can grow throughout New Mexico. It should be sown at 1 to 1.5 pounds pure live seed (PLS) per acre, using a drill with a fluffy seed box.

Kleingrass (*Panicum coloratum*) is a bunchgrass introduced to the United States from Africa. It is fine-stemmed and leafy and grows to a height of 3-4 feet. Kleingrass spreads by tillering and short rhizomes. It also can establish roots at nodes on the stems that come in contact with the soil, an effect called layerage. Kleingrass is adapted to a fairly wide range of soil and climatic conditions. However, there are some concerns about its cold tolerance. Although it has been grown successfully during a period of mild winters at Tucumcari, it currently is recommended for use only in the southern half of the state. Kleingrass can cause photosensitization (swellhead) in white-faced sheep. The seeding rate for kleingrass is 1.5 to 2 pounds PLS per acre.

Old world bluestem (*Bothriochloa ischaemum*) is a bunchgrass that was introduced from eastern Europe and Asia. This species is not as salt-tolerant as bermudagrass and prefers well-drained soils. Growth is initiated later in the spring than bermudagrass and is sustained later in the summer, when other species are not as productive or are dormant. Establishment can be slow, but good stands can be achieved in one season under good management and optimum conditions. Initially, old world bluestem does not compete well with weeds or other species when sown in mixtures. Once established, it is very competitive, spreading by crown expansion and seed. During peak production periods, livestock might not be able to prevent old world bluestem from forming seedheads. Concentrating animals in a smaller part of the pasture and harvesting excess forage as hay might help resolve this problem. When seeding old world bluestem, plant 2 to 3 pounds PLS per acre using a drill with a fluffy seed box.

Cool-Season Annual Legumes

Berseem clover (*Trifolium alexandrinum*) has been grown at Tucumcari, even though it was originally not known to be a winter-hardy species and has not been previously used in New Mexico. It has an erect growth pattern and is very tolerant of alkalinity, salinity and poor drainage. Berseem clover produces high-quality forage that is nonbloating. It can be grazed when it reaches 10 inches and will continue producing new growth if a 3- to 4-inch stubble is maintained. Although berseem clover did not produce viable seed in the planting at Tucumcari, newer varieties have been managed for natural reseeding in other areas by removing animals during the bud stage. Once seed is produced, grazing can resume to remove all standing residue and to form good seed-to-soil contact for late-summer germination. The seeding rate for berseem clover is 20 pounds per acre.

Hairy vetch (*Vicia villosa*) is widely adapted to New Mexico's climate. It has a vinelike growth habit and can be grown as a monoculture or overseeded into dormant, perennial, warm-season grasses. Hairy vetch does not yield well in the fall, but it can provide four to six weeks of grazing in the early spring before the warm-season grasses break dormancy. Hairy vetch will reseed naturally if cattle are removed prior to the bud stage. As with berseem clover, once the seed is produced, grazing can begin on new growth of the warm-season companion grass or residue from the hairy vetch. Initial seeding rate for hairy vetch is 20 to 40 pounds per acre.

Cool-Season Annual Grasses

Annual (Italian) ryegrass (*Lolium multiflorum*) is similar to perennial ryegrass, except it completes its life cycle in one season. Annual ryegrass has been used successfully as a winter annual pasture in southern New Mexico. This species performs well in the southeastern United States, when sown into dormant, warm-season grass pastures. Use a no-tillage drill when overseeding dormant, warm-season grass pastures to achieve good seed-to-soil contact, which promotes germination and establishment. Seeding rates of 20 to 30 pounds per acre should be used for monocultures or overseeding operations.

Small grains include barley (*Hordeum vulgare*), oats (*Avena sativa*), rye (*Secale cereale*), wheat (*Triticum aestivum*) and triticale (*Triticum secale*). Barley and oats are somewhat more susceptible to cold temperatures and historically have been recommended only for southern New Mexico. But newer varieties of both have been grown successfully for pasture and hay in recent years at Tucumcari. Rye, wheat and triticale are more cold-tolerant and have been used more in the cooler regions. Barley and rye generally produce more forage than wheat or oats in the fall. Barley appears to be the most salt-tolerant of these crops, while rye generally performs better than the others on sandy or poor land. Mixtures of small-grained species are not desirable, because selective or spot grazing is likely to occur. In grazing preference trials at Tucumcari, oats were selected over other small-grained species (barley, rye, triticale and wheat). Performance by animals grazing monocultures will likely be similar across small-grained species.

Some newer varieties of spring oats also have survived winters at Tucumcari and are very productive in the fall. A mixture of those varieties and winter oats might increase fall productivity without the selective grazing problem. A better option is to plant a pasture with spring oats for fall grazing, a second pasture with winter oats for spring grazing and a third pasture with rye as a rescue pasture for winter and early spring grazing.

Small grains should not be grazed until they are 5 to 6 inches tall, allowing the plants to establish a good root system. Grazing too soon or too close to the ground slows root development and decreases the plant's ability to survive the winter and be productive in the spring. Animals should be removed when the forage has been grazed to a height of 2 inches. Small grains can provide grazing in both the fall and the spring and still produce a grain crop if grazing is halted in mid-March or at the first sign of stooling. If the crop is not to be harvested for grain, grazing can continue until forage becomes limiting, which can be well into May. Rotational stocking or deferred (strip) grazing might be valuable for providing higher levels of high-quality feed during periods of low productivity (December to February) and to extend grazing beyond mid-May. Two pastures with two-month rest periods might be satisfactory for stand recovery and productivity. Seeding rates for small-grained species in irrigated pastures should be 60 to 100 pounds per acre. Nitrate toxicity, which will be discussed in more detail later, can be a problem when using small grains pastures. Bloat is another concern, especially after a freeze or during rapid growth in the spring. Grass tetany also can be a problem during rapid spring growth (see Circular 586).

Warm-Season Annual Legumes

Warm-season annual legumes have not been tested broadly in New Mexico for use in irrigated pastures. But a few, such as cowpea (*Vigna unguiculata*), lablab (*Lablab purpureus*) and tepary bean (*Phaseolus acutifolius*), might have value when mixed with a warm-season annual grass and intensively, rotationally stocked to maximize productivity. Seeding rates for warm-season annual legumes are 60 to 100 pounds per acre as monocultures or mixtures.

Warm-Season Annual Grasses

Sorghums and sorghum x sudangrass hybrids (both *Sorghum bicolor*) provide valuable temporary pasture in lower elevations throughout New Mexico (below 6500 feet). These forages respond well to nitrogen fertilization and irrigation, producing high yields of palatable forage. Sorghum forage quality has been improved by including the brown midrib and photoperiod sensitivity traits. Brown midrib (BMR) varieties have a lower lignin concentration that increases available energy and digestibility. Heading in photoperiod sensitive varieties is not initiated until approximately mid-September when day length decreases. This broadens the harvest window, allowing for higher yields of high-quality vegetative forage. Seeding rate also can affect quality. Plants from higher seeding rates have finer stems than those seeded at lower rates. Lower seeding rates are recommended for BMR varieties, because finer stems coupled with lower lignin concentrations increase the likelihood of lodging (laying down). Sorghums should not be sown until the soil temperature reaches 60°F, which normally occurs by mid-May in most of New Mexico. Recommended seeding rates for pastures are 20 to 40 pounds per acre.

Antiquality factors associated with sorghums. Prussic acid poisoning is caused when animal are fed immature sorghum forage (including Johnsongrass, which is a perennial weed); by regrowth after harvest or grazing; or when plants are stressed by cool weather, herbicide injury, drought stress and frost. Death can occur within 15 minutes. Avoid grazing sorghums until plants are 24 to 30 inches tall. After plants recover from stress, check their base to see if new growth, less than 24 inches tall, is present. Rapid, immature growth is more palatable to grazing livestock, but it also is highly toxic. It is best not to graze sorghums in the fall until at least three days after the plants are completely frozen down to protect livestock from new growth. Prussic acid is short-lived in stored sorghum forage, dissipating from hay or silage within a month after harvesting. NMSU has more information on prussic acid in Guide B-808, "Livestock Poisoning from Prussic Acid."

Nitrate toxicity is another concern for sorghum pasture and hay but not as much for silage. Actually, any plant can accumulate toxic nitrate levels, although it is most common with annual grasses (warm- or cool-season). Sorghums are prone to accumulate nitrates, because they grow rapidly and typically receive high rates of nitrogen fertilizer. Drought stress also is commonly associated with toxic forage nitrate levels. When moisture is limiting, plants continue to take nitrogen up from the soil, but they are not able to convert it from nitrate to protein. Thus, nitrate accumulates in older and less photosynthetically active plant parts, which usually are lower to the ground (e.g., the lower one-third of stems). Additionally, plants that grow rapidly due to recent irrigation or precipitation might take up nitrogen faster than they can assimilate it, particularly during cool, overcast weather.

In grazing situations, livestock prefer the newer growth near the top of the plant. However, hungry animals are not as discriminating and might consume older plant parts that are toxic. While the ensiling process can reduce nitrate levels by as much as 60 percent, nitrates do not dissipate from forage stored as hay. Feeding greenchop is most dangerous because animals cannot avoid less palatable parts (stems and older leaves are most toxic) like they can when grazing or feeding on hay. Suspect forage should be tested and, if toxic levels are found, diluted with hay having low protein content and/or fed with a concentrated energy supplement, such as grain. High nitrates in forage harvested for hay or

greenchop can be avoided somewhat by raising the cutting height to leave lower stem portions in the field. Nitrate toxicity generally is not a problem for monogastric animals (horses, pigs). But levels greater than about 3,000 parts per million (ppm) on a dry matter basis can be toxic for ruminants (cattle, sheep, goats), particularly if they are under stress from illness, hunger, pregnancy or lactation. Healthy animals can be slowly acclimated to higher forage nitrate levels. Concentrations above 6,000 ppm are potentially toxic and should never be the only feed source. Concentrations of 9,000 ppm and above often will lead to death (see Guide B-807, "Nitrate Poisoning of Livestock").

Finally, sorghums also cause sorghum cystitis-ataxia syndrome in horses. The same compounds that are precursors to prussic acid are thought to cause cystitis-ataxia. Affected horses might exhibit urinary incontinence due to nerve damage in the urinary tract. Prolonged exposure leads to posterior ataxia or incoordination and numbness in the hindquarters. Further, urinary stasis (the inability to void urine) can result in urinary tract infections that may lead to kidney infection. Horses exhibiting symptoms can be treated with antibiotics for urinary tract infections, but if ataxia is present, recovery is very unlikely. Guide B-704, "Sudangrass and Sorghum Sudan Hybrid Poisoning of Horses" provides more information.

Pearl millet (*Pennisetum typhoides*) is another choice for lower elevations, but it does not perform well on soils high in calcium. This species will not yield as much as the sorghums, but it is safe for horses and does not cause prussic acid poisoning.

Foxtail, German or Italian millet (*Setaria italica*) might provide temporary summer pasture in New Mexico's higher elevations. Foxtail millet is less productive than pearl millet and its shallow root system makes it easy for grazing animals to uproot. As plants mature, they can accumulate setarian, a compound that acts as a diuretic in horses, causing excessive urination. This compound can lead to kidney problems and also has been implicated in liver, bone and joint damage, especially if the foxtail is the only hay source for the horses. If symptoms are observed early, removing millet hay from the diet might correct the problem. More information on all species of millet can be found in Guide A-414, "Millet Production."

Crop residues. Other forage sources for grazing include plant residues after grain harvest or cotton harvest that can be used to defer grazing on small grains or stockpiled pastures. Except for the seed found in cotton remnants, these materials generally are lower in quality, because they are no longer actively growing. They also are overmature and weathered. In the case of grain crops, the energy was removed by previous harvest. Thus, some supplementation might be necessary, particularly for actively growing or producing livestock.

Establishing Irrigated Pastures

Seed and plant stock selection. When establishing an irrigated pasture, use the best quality seed or planting stock available to improve your chances of obtaining a uniform, productive and persistent stand. Once a species or combination of species is chosen, variety selection is critical to get the best genetics for your irrigated pasture system. Use certified or plant variety protected seed stocks to ensure the genetics in the bag are true to the variety name (see Guide A-131, "Certified Seed"). Read the seed label (Guide A-216, "Know What is in a Bag of Seed"), because several factors listed involve seed quality and directly affect the pasture species performance. The test date on the label must be within the previous nine

months for the seed to be sold legally in New Mexico. Seed purity affects seeding rate and stand uniformity as well as establishment of weeds and undesirable crop species. High inert matter, which includes stems, chaff, dirt and rocks, usually is due to inefficient or poorly developed seed-cleaning techniques. Higher seeding rates must be used, increasing seed costs. Excessive inert matter also interferes with seed distribution, because it can plug planting equipment or restrict seed flow. Weeds and other crop species compete for water, space and nutrients and reduce forage production and quality. A relatively weed-free field can be contaminated with weeds, if seed containing weed seeds is sown. Be sure that no noxious weeds are listed on the label. Germination also is important for determining the seeding rate and obtaining a uniform stand. Seeding rate of many species is given as pure live seed (PLS, calculated as purity X germination). Seeding rates for many warm-season grasses are given as PLS values because they generally are very chaffy (high inert matter) and have low germination rates. Germination is affected by crop species and seed dormancy, age, damage, weathering and storage conditions. However, even seeds that will germinate might not have enough energy to produce viable plants. Seedling vigor might be affected by the same factors as germination. Seed treatments are beneficial to seed delivery, legume inoculation and protection from seedling diseases and insects.

Preplant fertility and legume inoculation. Before ground is broken for a new pasture, a soil sample should be taken and submitted for analysis. Guide A-114, "Test Your Soil" gives information about soil sampling and testing. If sowing a monoculture grass pasture, apply 20 to 25 pounds per acre of starter nitrogen to help the grass get established. If planting a grass-legume mixture, pay attention to the phosphorus and potassium recommendations. Legumes have the ability to fix nitrogen from the atmosphere. If inoculated with the proper bacteria, they can meet their own nitrogen requirement and provide nitrogen to the companion grass (Guide A-129, "Nitrogen Fixation by Legumes"). Adding excessive nitrogen at establishment will inhibit nitrogen-fixing nodule formation. Without good nodulation, legumes will produce stunted, yellow plants typical of nitrogen deficiency, necessitating the addition of supplemental nitrogen. Natural inoculation can occur if the legume has been grown in the field within the previous five years. However, if there is any doubt, it is best to inoculate and not use any preplant nitrogen.

Different legume species need different bacteria, and the cost of inoculum is relatively low compared to the cost of nitrogen fertilizer. Commercially available seed of many legumes will be pretreated. The treatment date should be within the previous year. If untreated seed is purchased, inoculate the seed just before planting. Be sure to use the inoculant strain labeled specifically for the legume to be planted. Apply the inoculum evenly to the seed. Be sure to follow the instructions on the inoculum package, including those related to using a sticker to ensure uniform contact between the seed and the inoculant. Beware of using carbonated soft drinks, 10 percent syrup mixtures or other homemade stickers, because they might be too acidic or alkaline and kill the bacteria. When adding a liquid sticker, don't get the seed too wet or it will become clumpy. Alfalfa seed should just feel sticky, and it must be uniformly moist. Mixing by hand in a large bucket, using a hoe in a larger pan or using a cement mixer are equally effective for a uniform treatment. More information about legume inoculation can be found in Guide A-130, "Inoculation of Legumes."

Land preparation. Proper land preparation is important for establishing and maintaining an irrigated pasture. The field

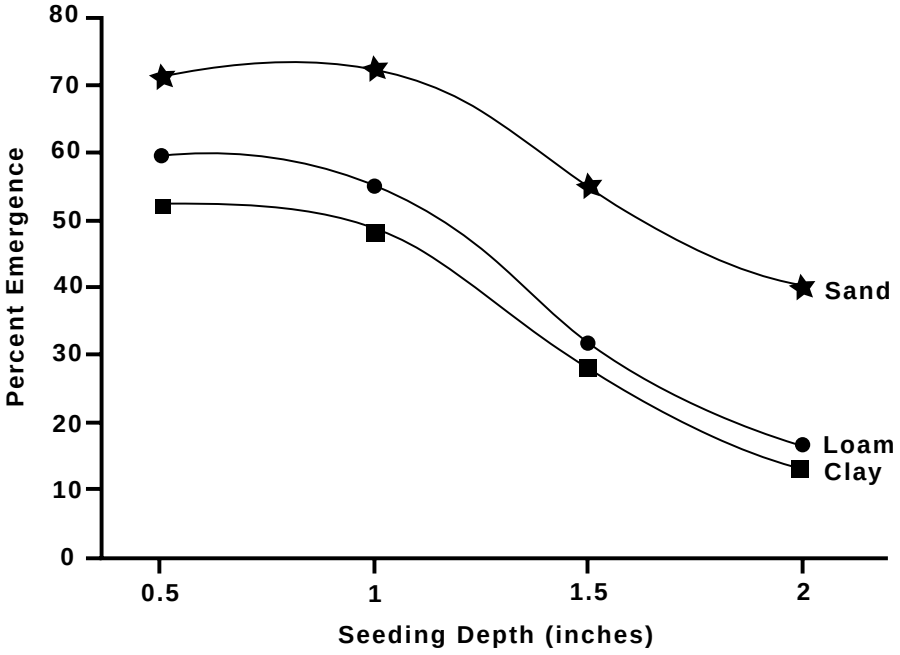

Figure 5. Effect of seeding depth on alfalfa emergence (Source: Sund, et al., University of Wisconsin, 1966).

should be prepared so it provides for the best use and uniform distribution of water. The type of irrigation system and soil condition determines how much land preparation is necessary. With sprinkler systems, the land need only be level enough to allow easy operation of the sprinklers and other equipment. Flood and furrow irrigation, on the other hand, require the land to be level across the flow pattern, with the proper slope for water to flow freely, while allowing sufficient time for infiltration.

Another aspect of land preparation involves developing a firm, smooth seedbed so that planting depth can be regulated and good seed-to-soil contact can be achieved. Most perennial forage crops have small seeds and should be planted no deeper than one-half inch in heavy soil or up to an inch in sandier soils (fig. 5). Uneven ground will cause some seeds to be planted too deep, and the new seedlings will not have enough energy to emerge and begin photosynthesis. It also is difficult to regulate planting depth in loose or cloddy seedbeds. Seed sown at the surface of loose seed beds can be displaced by irrigation water, leaving unsown areas for weed infestation. Additionally, seed might be at the correct depth, but poor contact with soil particles limits access to water and nutrients and decreases root-anchoring strength when seedbeds are loose.

Planting time. Time of seeding is determined largely by soil temperature and species to be sown. Warm-season plants germinate and emerge most rapidly when soil temperature is above 55°F; cool-season plants germinate and emerge when the soil temperature reaches 45°F. Warm-season species should be planted from spring to midsummer (mid-May through July). This allows sufficient time for the crop to establish a good root system before freezing temperatures occur. While cool-season perennial species can be sown in the spring, several factors make late summer planting (mid-August to late September, depending on location) more desirable. Late summer seedings give the plants time to establish fully and be ready to graze the following

spring. Also, there usually is less weed competition in fall than in spring; more time is available to control weeds that germinate during summer. And, while some summer weeds might germinate after planting, not many will have time to produce seed before frost. Finally, evapotranspiration and wind generally are less in the fall, allowing for lower water requirements. Late summer seedings need to be early enough to allow plants to establish before freezing. Generally, six to eight weeks are needed for fall establishment.

Planting methods. Most pasture species are established by seeding. But certain crops like some of the improved bermudagrasses must be established vegetatively. Vegetative planting requires special operations and equipment. The sprigs (vegetative planting material) must be vigorous and healthy. Plant them as soon as possible after harvesting, because they do not store well. Sprigs may be scattered and covered by light disking or rototilling, or they can be planted with a sprigging machine. Sprigging machines provide more uniform sprig distribution and covering, but they might not always be readily available. Sprigging and then irrigating are a common practice to improve sprig-to-soil contact.

When possible, seeding is more desirable than vegetative planting because of availability and equipment and planting material costs. With conventional tillage, many pasture species can be sown either by drilling or broadcasting. Both methods provide uniform seed distribution, but properly set drills and air-seeders with packer wheels provide better seed coverage in the same operation. Seed left on the surface can be displaced by wind and water, removed by birds or rodents, or die due to lack of seed-to-soil contact. Broadcast plantings must be covered with a harrow or roller but neither provides covering as well as packer wheels on a drill or air-seeder (fig. 6). Generally, harrowing or rolling is done in a second operation, but equipment is available that will broadcast and harrow or roll in one operation. Broadcast seeding is easier and takes less time than drilling, but this advantage can be more than offset through seed loss by displacement and the need for secondary operations. Hydroseeding also might be an option for establishing smaller pastures. Hydroseeders are available at many larger landscaping companies.

If land reconstruction is not needed to improve conditions for irrigation, no-tillage or minimum-tillage planting can save time and money as compared with conventional tillage operations. These practices also improve moisture conservation, because the soil is mulched with plant residue. No-till planting does require a seed drill especially designed for penetrating untilled ground, so be sure the equipment is heavy enough to place the seed at the proper depth. Existing vegetation must be controlled to prevent competition and allow new seedlings to establish. Initial chemical applications should be made two weeks before planting to remove the established insects' food sources and to encourage them to migrate to another area so that they won't feed on the seed. Insecticide seed treatments help overcome this problem. Also, if the same forage species is reseeded, disease pressure on seedlings might escalate, especially for legumes. Metalaxyl seed treatment is relatively effective for protecting seedlings from many diseases. For no-till planting, use the highest recommended seeding rate.

Established grass pastures can be renovated with legumes by either of two methods, no-till in late summer or frost-seeding in late winter (early February to mid-March, depending on location). In either situation, apply a chemical to burn down the grass or remove as much top growth as possible by grazing. Grazing probably is the best option, and animals can remain in the pasture until they begin biting or uprooting the new seedlings. Once that happens, remove

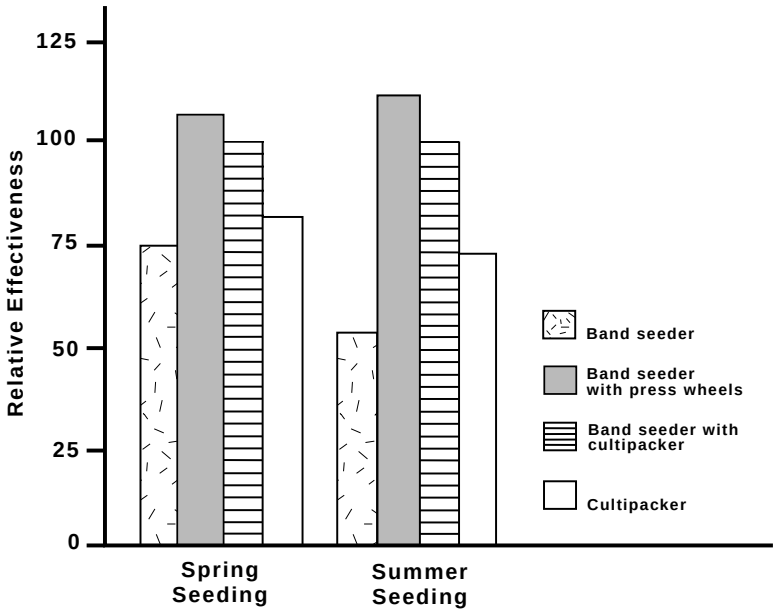

Figure 6. Relative effectiveness of using different seeding equipment and methods to achieve a forage crop stand (Source: Tesar, University of Michigan, 1984).

the animals and allow the new seedlings to establish by reaching 25 percent bloom.

Irrigation. Preplant irrigation can help overcome some problems with land preparation and seed movement caused by post-planting irrigation. Wetting the soil breaks down clods and firms the seedbed, improving seed-to-soil contact at planting time. Soil crusting, which inhibits new seedlings from emerging, also can be prevented with pre-irrigation. But this method also has disadvantages. Planting must be done before the soil has dried too much for satisfactory germination. If the soil is too wet, there can be excessive soil compaction and crusting. Knowing when the soil is moist enough to plant, yet dry enough to drive equipment over the field, is largely a matter of experience. Also, because most perennial forage crop seeds are small and must be planted shallowly, desiccation of new seedlings must be prevented by keeping the top inch or so moist until emergence. Crusting also must be prevented, possibly requiring more frequent irrigation just for establishment. This should not be much of a problem when using sprinkler irrigation, which can apply lesser amounts of water more frequently. But flood and furrow irrigation systems are not as efficient and small amounts of water cannot be applied. Pre-irrigating might cause water to be in short supply at another time during the growing season.

Companion crops. Sometimes an annual crop, usually a small-grained species, is planted with a perennial pasture species as a companion (also known as a nurse crop) to protect it until it becomes established. This practice is discouraged except under special circumstances, such as when seedlings need protection from wind or the soil is highly erodible. The companion crop might protect the pasture species from the wind and provide an early hay or grain crop, but it competes directly with the pasture species for

water, nutrients, light and space, delaying stand establishment drastically and possibly resulting in a less uniform stand. Seeding early enough in the late summer for plants to establish a good root system and some top growth is the best management option. Producers also can consider no-till seeding into residue from the previous crop to protect the new seedlings.

Completing establishment. Once seedlings have emerged from the soil, they need special care to become established as a productive, persistent pasture. Management during the first growing season determines the perennial pasture stand's uniformity and longevity. Adequate nutrients are essential. Follow preplant soil test recommendations for the species. Irrigation management also is critical. There must be a compromise between providing enough moisture for the plant to rapidly grow and forcing the plant to develop a good root system as it searches for water. Too little irrigation causes the plant to use too much energy for root system development rather than top growth. Desiccation also can lead to plant death. Too much irrigation also is detrimental, because some nutrients can be leached, root system development is inhibited, and seedling diseases are encouraged.

Weed control still will be a concern because weeds compete for nutrients, water, light and space. The best weed control begins with a weed-free seedbed, assisted by a uniform stand of the pasture plants that can quickly establish ground cover. It still might be necessary, however, to mow weeds or control them with a herbicide labeled for the weed and the forage crop(s). Be sure to mow high enough to avoid clipping the desirable species.

Grazing pastures too soon also can cause problems. New pasture plants should be allowed to become reproductive before being harvested or grazed the first time. Allow grasses to reach the early heading stage and legumes to reach approximately 25 percent bloom. Manage grass-legume mixtures for the legume. If a companion crop is sown to protect the new seedlings, use grazing as with a frost-seeding. Otherwise, harvest the companion crop as hay to reduce shading and competition. In either case, manage the pasture to protect the new seedlings by not grazing or clipping them until they are mature enough.

SUMMARY

Irrigated pastures can serve many valuable purposes, such as generating income or maintaining animals for work, pleasure or aesthetics. Whatever the purpose, success begins with good species selection and establishment. Pasture species should be well-adapted to the site where they will be grown and suitable for their intended purpose. The information provided in this publication should be useful in the planning and decision-making process. Other resources also are available from your county Cooperative Extension Service office or through New Mexico State University's College of Agriculture and Home Economics publications Web site (www.cahe.nmsu.edu/pubs). Circular 586, "Grazing Systems and Management of Irrigated Pastures in New Mexico" provides information about designing pasture systems, grazing techniques and managing pastures for productivity, persistence and animal health.

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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