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Item Type	text; Pamphlet
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Publisher	College of Agriculture and Life Sciences, University of Arizona (Tucson, AZ)
Download date	08/05/2018 16:04:50
Link to Item	http://hdl.handle.net/10150/144724

Establishing irrigated pasture at 4,000- to 6,000-foot elevations in Arizona

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This information has been reviewed by university faculty

<http://ag.arizona.edu/pubs/194028.pdf>

Publication number 194028
Published and reviewed
September 1994

Irrigated pasture can provide forage for livestock, be useful during breeding and calving time, serve as an exercise area for horses, and conserve and improve soil and provide an alternative to rangeland. Before establishing a pasture, some planning must be done. Consider the feasibility of pasture in view of stocking needs, land availability, and look at the cost and availability of equipment and materials to establish and maintain the pasture. All alternatives should be examined before entering into development of irrigated pasture.

Establishment

The primary characteristics of a suitable site for establishing irrigated pasture are: (1) convenient location; (2) suitable soil; and (3) sufficient water is readily available for both irrigation and livestock.

Once the irrigation and drainage system is completed and tested (*see Irrigation*), prepare the seedbed. First, plow the soil, then follow with a disk, harrow, or other implement. Incorporate fertilizer near the end of seedbed preparation, just before planting. Application of 50 lbs. P205 (22 lbs. of phosphorus) per acre is beneficial in most cases. Grasses respond well to small applications of nitrogen (20 to 40 lbs. per acre) at planting time to speed early growth and development.

Best results are obtained when seeds are planted in pre-irrigated soil. Seeds can be planted with a cultipacker seeder, by broadcasting, or with a grain or rangeland drill. Use the correct amount of seed and cover the seed lightly with soil. If seed is broadcast, be sure to follow with cultipacker. For most small-seeded grass and legume species, plant 1/4 to 1/2 inch deep.

After the pasture has been seeded, take care to prevent soil crusting, especially for legumes. Frequent, light irrigations after planting prevent crusting. Frequency of irrigations will be determined by soil type, temperature, and other factors. Three or more irrigations may be required to keep the top one to two inches of soil moist during germination.

Selecting the right seedling mix depends on how the pasture is to be used. The person who owns horses for show, racing, or breeding may want the pasture used as a place for exercise and exhibition. An exercise pasture does not require a large area since it supplies only a small portion of the animals' feed. The working rancher, on the other hand, may depend on the irrigated pasture to furnish most of the feed. Forage pastures must be much larger than exercise pastures if they are to furnish most of the energy requirements of livestock.

If the main use of the pasture is to provide an exercise area, then grass sod pasture is best. Bermuda grass is commonly used for horse pasture below 4,000 ft elevation. At higher elevations, tall fescue produces the best sod pasture.

Pastures can be seeded with a mixture of grasses. However, some grasses are more aggressive and will choke out the less aggressive species. For example, orchardgrass does not last more than 2 or 3 years when planted with fescue. The growth habit of individual grasses should be considered. An individual grass plant spreads by a number of different methods: tillers, rhizomes, stolons, and seed. Brome grass spreads into surrounding areas more efficiently than wheatgrass because it reseeds and spreads by tillers. Wheatgrass spreads mainly by rhizomes.

A mixture of grasses and legumes, such as tall fescue with either clover or alfalfa, can make a productive pasture. If sheep or cattle, as well as horses, are going to use the pasture, then care should be taken so it is not dominated by bloat-causing legumes such as Ladino clover (legumes such as strawberry clover and the trefoils are less likely to cause bloat). Many horse owners exclude clover from their horse pastures because horses tend to prefer grass and make little or no use of clover. Legumes should comprise no more than one-third of the seeding mixture by weight. Alfalfa planted on irrigation borders can improve the quality and carrying capacity of grass pastures.

Choice of species

COOL SEASON GRASSES will have peak yields in April, May or June. They are planted in September for best germination. Make late summer or early fall seedings soon enough to permit good top and root growth before the onset of cold weather. Some Arizona ranchers report good stands by planting in November; the winter rains provide sufficient moisture for germination; additional irrigation is needed for pasture establishment in the spring. Recommended species include brome grass, orchardgrass, tall fescue, and wheatgrass. New varieties are developed on a regular basis. Check for the latest recommended varieties.

The optimum temperature for growth of the cool season grasses is 65 to 75 degrees F. These grasses have a high demand for nitrogen in the spring and are dormant during the hot summer. Close grazing of cool season grasses through the fall will result in poor stands in the spring.

When planting fescue, be sure to use certified seed that is endophyte-free. Tall fescue may contain an internal fungus (endophyte). This fungus causes

intercellular, systemic infections without symptoms in the grass. The fungus overwinters in the plant crown, parallels tiller growth in the spring, infects the flower panicle and seed. The primary method of transmitting the fungus is through infected seed.

Cool season grasses have been traditionally used at intermediate and high elevations in Arizona. However, warm season grasses have the potential to increase irrigated pasture yields later in summer than the cool season grasses.

WARM SEASON GRASSES are planted in June after the soil is 60 degrees F or above at planting depth. They produce highest yields in June, July, or August, have a higher optimum temperature for growth (90 to 95 degrees F) than do cool season grasses, and therefore remain productive during hot summers. They become dormant in early fall. These grasses do well at intermediate elevations, but are not recommended above 5000 feet. Close grazing of these grasses during late summer and early fall causes poor stands the following year. Warm season grasses adapted to mid-elevations in Arizona include weeping lovegrass, Cochise lovegrass, plains lovegrass, sideoats grama, yellow plains blue-stem, blue panic and bermuda varieties (warmest locations). Bermudagrass and giant types and propagated by seed. Coastal bermudagrass and other non-seed producing varieties must be established by planting rhizomes or stolons. For exercise pasture, a combination of 30 percent common bermuda and 70 percent giant bermuda is recommended. Bermudagrass pastures can be overseeded with annual ryegrass, barley or oats to make spring forage or hay. This should not be done on more than 1/3 of the total acreage, however, as this practice sets back the growth and production of bermudagrass by at least one month in late spring/early summer.

LEGUMES are planted in September. Recommendations include alfalfa, Ladino clover, black medic clover, birdsfoot trefoil and narrowleaf trefoil. An important consideration in the selection of an alfalfa variety is its relative dormancy. At 5,000 feet elevation, varieties with intermediate dormancy yield and persist well. Dormant alfalfa varieties, such as Ranger and Vernal, are suggested for the highest irrigated valleys. All legume seed should be inoculated with the correct strain of fresh nitrogen-fixing bacteria (*Rhizobium*) to achieve adequate nodulation. These bacteria, an association with the legume plant, will fix atmospheric nitrogen into a form that can be utilized by plants. Keep inoculated seed in a cool place out of direct sunlight and plant it within 24 hours after treatment.

	SEEDING RATE (LBS. PER ACRE)			
SPECIES	SINGLE SPECIES		MIXTURE	
	DRILL	BROADCAST	DRILL	BROADCAST
LEGUMES				
alfalfa	10	20	4	8
sweet clover	5 to 10	15 to 20	2	3
birdsfoot trefoil	5	10	3	7
black medic	-	10 to 15	2	4
WARM SEASON GRASSES				
lovegrass	1/2 to 1	2 to 3	-	-
bluestem	-	12	-	-
bermudagrass (hulled, common and giant)	2 to 3	7 to 12	-	-
COOL SEASON GRASSES				
orchardgrass	6	5 to 12	5	10
smooth bromegrass	10	15 to 20	8	12
tall fescuegrass	10	10 to 14	8	10
tall wheatgrass	12	18 to 30	10	14

Note: seeding rates represent lbs. of live seed (100 percent germination).

Irrigation

Water may be applied by surface methods or by sprinkler. For surface irrigation, level the soil before planting. A sprinkler irrigation system requires little or no leveling but is more expensive initially than surface methods. Sprinkler irrigation has an advantage where the water supply is limited or expensive, the soil shallow or sandy, or the terrain rough or steep. A sprinkler system is more convenient because it requires less operator time and labor. However, sprinklers are difficult to manage in areas of strong wind. They may require protective barriers to prevent damage by livestock or to prevent injury.

Irrigation amount and frequency will vary depending on weather, soil type, rooting depth and presence of subsoil impervious layers. Most pastures require between 4 and 6 acre-feet per acre of water per growing season. The seasonal water requirement for bermuda grass above 4,000 ft. is 3 to 4 acre-feet of water per growing season. Two or more irrigations should be applied each month during the period of active growth. Less frequent irrigations are required during the late fall, winter, and early spring. The irrigation interval for sands or sandy loam is much shorter than for fine textured (clay) soils.

Soil moisture can be determined by using a soil tube, soil auger, or shovel. Soil moisture should be checked throughout the rooting zone of the species in the pasture. Clover can use moisture down to a depth of about 2 feet, while grasses extract water down to 3 to 4 feet, and alfalfa may extract water down to 6 feet if soil conditions do not impede root growth. Adequate soil moisture should be maintained throughout the entire rooting zone of all plants in the pasture. This requires irrigation often enough to keep the shallow-rooted clovers growing vigorously and deep enough for the grass roots.

Schedule irrigations so that the soil will be firm enough to support livestock, without injury to plants, when the grazing cycle begins. This is especially important to avoid soil compaction. Compacted soils take water slowly, are poorly aerated, and produce less forage. Some compaction will occur on irrigated pastures, particularly when rain occurs during the grazing period. The depth of compaction ranges from 2 to 10 inches depending on the soil type and soil wetness. A good practice is to rip the pasture to a depth of 12 inches every third year.

Certain species of pasture plants can survive with limited water, and plants differ in their water requirement. Warm season grasses utilize water more

efficiently during summer months. Cool season grasses such as tall fescue and tall wheatgrass require frequent irrigations during the hot summer months.

Fertilization

Fertilization will vastly improve pasture production. The first post-seeding fertilization should be delayed until the seeded pasture species are growing vigorously and can compete with the weeds. Then, take care to graze off all the forage produced, or mow the pasture periodically so that coarse material of low nutritive value does not accumulate.

Applications of nitrogen to legumes do not produce economic returns. Applications of nitrogen will reduce the activity of the *Rhizobium* associated with legumes reducing the amount of free nitrogen that is fixed. Grasses, however, respond well to applications of nitrogen when adequate irrigation water is supplied. Make several applications of nitrogen during the year. Divide the annual application of nitrogen for grass pastures (up to 300 lbs. per year) into at least three applications per year (40 or 50 lb. increments). Irrigate as soon as possible after fertilization to reduce nitrogen loss. The largest portion of the total annual nitrogen applications should be made during the time when the most vigorous growth occurs, usually spring and summer. Cool season grasses have a high demand for nitrogen in the spring; apply nitrogen again in the early fall.

Vigorous, dark green plants associated with livestock urine spots indicate the soil is deficient in nitrogen. However, excessive rates of nitrogen fertilization may result in pasture forage containing toxic amounts of nitrate nitrogen. Do not use the pasture during the 2 or 3 week period after heavy fertilization with nitrogen because of risks associated with nitrate poisoning.

Yield of legumes grown on many Arizona soils is increased by phosphate application. The phosphate requirement for several years may be applied at the time of seeding. When this is done, phosphate is worked into the soil during seedbed preparation. Phosphate may also be applied after stand establishment by broadcasting on the surface of the soil when this operation will not interfere with the pasture management program. Phosphate does not move readily from the point of contact with soil in calcareous soils, so it must be incorporated into the soil to be most effective.

Fertilizer application can influence the make-up of the stand when mixtures of grasses and legumes have

been planted. Phosphate favors legumes; nitrogen favors grasses. Fertilizer applications can be made to keep the ratio of legume to grass plants desired.

Generally, potassium applications have failed to increase the yield of crops in Arizona. However, there may be specific locations where applications of potassium may increase dry matter yield and the percent of potassium in forage.

Weed control

Weed control is best accomplished by maintaining a healthy pasture, mowing, proper drainage, and avoiding soil compaction. Periodic grazing or clipping of the pasture prevents weeds from producing seed. Herbicides can also be very effective in controlling weeds, but their costs must be weighed against benefits gained. Chemicals are best used to spot-treat concentrations of weeds rather than for spraying the entire grazing area.

Woody plants, such as mesquite, desert broom and burrobrush, can be serious weeds in some pastures. These will need to be plowed out periodically.

Cultural practices

Cattle often leave mature, unpalatable clumps of grass. These clumps, and weedy growth, may be removed by clipping or with a flail type chopper. Clippings may be raked and placed along fences or on the tops of borders. Do not cut sweet clover below a six-inch height. Cutting below the area of the stem where buds form will kill sweet clover plants since there are no crown buds.

Plants near manure spots frequently are not eaten by livestock. As these plants become mature, they may still be avoided. Droppings can be spread with a harrow or other suitable tool once or twice each year after animals are removed from the pasture and before irrigating. This will reduce this problem as well as supply a low fertilizer rate to the pasture. Spreading of droppings, mowing, fertilizing, and irrigating follow in this order.

Management overview

During a 6- to 8-month growing season, one acre of established, well-managed irrigated pasture should supply enough feed for one to two 1,000 pound

animals (1 to 2 animal units per acre). Irrigated pastures managed with minimal fertilizer and water applied only to supplement rainfall will average much less. Carrying capacity will vary depending on time of use as plant productivity changes due to weather.

Growth of pasture plants begins slowly in the spring. Rate of growth is dependent on species and increases as temperatures become more favorable. Delaying the time of first harvest until most grass seed heads have emerged or until most legume stems have flowers permits storage of food in the roots and strengthens the plants. For established stands, delaying the first pasturing in the spring until early bloom, near the end of the first period of active growth will be beneficial to the plants. Studies in other states show that forage quality remains high if high leaf-to-stem ratios can be maintained. Stop grazing in the fall soon enough to permit plants to grow to full bloom, just before their period of inactive growth or dormancy. Forage may be removed after the plants have become dormant by pasturing or by cutting for hay.

Rotating livestock between several pastures reduces overall grazing pressure, improves pasture productivity, allows for irrigation and fertilization when the stock are not in the pasture, and helps control internal parasites. Many Arizona growers have obtained good results by subdividing the entire pasture area into five or six fields, using temporary or permanent fence. Each field should have a source of water for the livestock. Rotation schemes should be set so that each field has about four weeks to recover after use.

The frequency of rotation depends on the species of plants used and their vigor. Low growing plants such as clover and bluegrass can be grazed often down to 2 to 4 inches in height. In contrast, tall-growing pasture species such as tall fescue, alfalfa, and orchardgrass can be grazed closely but not often. Animal rate of gain on bermuda grass has been shown to be best when the grass is kept at a 6 inch or lower height. Best results are obtained when the number of animals placed on each area is sufficient to remove the forage in 2 to 3 days, however, this requires rotational grazing. Alfalfa and alfalfa-grass mixtures should be permitted to attain 8 to 18 inches height before grazing.

Because horses can physically damage pasture plants, the stand should be well-sodded before they are introduced, which means it will be years before a new pasture can tolerate maximum stocking. Horses can damage pastures rapidly because of their active behavior and their ability to graze pasture plants more closely than other classes of livestock.

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, James A. Christenson, Director, Cooperative Extension, College of Agriculture, The University of Arizona.

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