Irrigated Forages for Southern Nevada-Type Climate

Joint Recommendations by Nevada Cooperative Extension University of Nevada, Reno and the Soil Conservation Service

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Summary

A series of publications regarding plant materials adapted for various uses and soils in the different climatic regions of Nevada has been developed by Nevada Cooperative Extension, University of Nevada, Reno and the Soil Conservation Service, United States Department of Agriculture. This series includes four publications: Irrigated Forages for Northern Nevada-Type Climate; Irrigated Forages for Western Nevada-Type Climate; Irrigated Forages for Southern Nevada-Type Climate; and, Conservation Plantings for: Rangeland, Windbreaks, Wildlife and Soil Conservation Cover.

The recommendations were developed to serve as a common source of information and recommendations regarding plant materials. Their use is encouraged by agricultural workers in the state to aid individuals/agencies in arriving at proper decisions regarding use of plant materials for agricultural and nonagricultural use such as mining reclamation, highway beautification and recreation.

Acknowledgments

The joint recommendations have been developed with the assistance of many workers. Special recognition is accorded to E. A. Naphan (Retired), N. R. Ritter (Retired), J. E. Garrison (Retired) of the SCS; and to F. F. Peterson (Retired), D. E. Gilbert (Retired), G. D. Robison (Retired), and R. O. Gifford (Deceased) of the University of Nevada, Reno, for their contributions.

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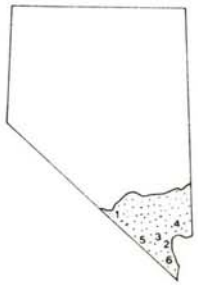
Irrigated Forages for Southern Nevada-Type Climate

This publication is intended to provide information regarding irrigated forages adapted to southern Nevada. Recommendations have been developed jointly by Nevada Cooperative Extension and the Soil Conservation Service. Climate and soil conditions and availability of plant materials have been considered. It is recognized, however, that these recommendations may require adjustments on any individual farm or ranch as dictated by particular needs or conditions within a small area.

Resource Area

The area in Nevada for which these recommendations are intended is shown in the shaded area of the map. Resource area 30 as defined in Agricultural Handbook 296, USDA, SCS, 1981, "Land Resource Regions and Major Land Resource Areas of the United States" is included. This area includes all of Clark County and portions of Lincoln and Nye counties



1. Beatty
2. Boulder City
3. Las Vegas
4. Overton
5. Pahrump
6. Searchlight

The area contains several relatively low-elevation basins and valleys with smooth, gentle alluvial slopes that are bound by high, steep, north-south oriented mountain ranges. The Spring Mountains, Muddy Creek Mountains, Sheep Mountains and Virgin Mountains are outstanding landmarks in the area.

The mountains consist, for the most part, of well-consolidated sedimentary rock in the north portion, and igneous and metamorphic rock in the south. The soils of the valley or basin floors have formed from eolian sands, fine lacustrine sediments or gravelly fan alluvium.

Elevations in the area range from about 500 feet at Fort Mohave on the Colorado River to over 11,000 feet on Charleston Peak in the Spring Mountains.

As in most of Nevada, topography has a pronounced effect on the climate. In the southern area, two mountain ranges -- the Sierra Nevada of California and the Spring Mountains west of Las Vegas -- act as barriers to moisture moving from the Pacific and create rain shadows. There are two peak periods for precipitation: one in the winter, associated with storms out of the Pacific, and one in the summer, associated with tropical moisture from the California Gulf. Minimum precipitation occurs May through June and in September. Summer precipitation occurs as frequent, severe thunderstorms. Mean annual precipitation is 4 to 6 inches on the lowlands and greater at higher elevations. This area has the lowest humidity in the state. This fact, combined with high temperatures and abundant sunshine, causes rapid evaporation. Pan evaporation is exceedingly high, ranging from 90 to 130 inches annually. The number of hot days (temperatures over 90 degrees Farenheit) varies from approximately 110 days in the western section at Beatty and Pahrump to about 155 days in the Overton area.

Table 1
Climatic data for selected southern Nevada locations

Location	Elevation (feet)	Annual Precipitation (inches)	Mean Temperature		Mean Freeze-Free Period	
			Annual °F	July °F	32°F days	24°F days
Beatty	3300	4	59	80	198	254
Boulder City	2500	6	67	89	286	365
Las Vegas	2200	4	66	90	248	302
Overton	1200	4	68	91	231	291
Pahrump	2650	5	61	84	201	257
Searchlight	3500	8	64	84	257	334

Key
Soils for Irrigated Forages

This key identifies the major differences in soil properties that affect the varieties of irrigated forages grown in Nevada. To use the key, start at the top, work down stepwise, and put your soil in the **first** group it fits.

Other problems such as climate, slope, fertility, stoniness, and water management will have to be considered separately. Soils should have at least 20 inches of usable depth for best production of improved irrigated forages. Soils less than 10 inches deep usually require irrigation too frequently to be suitable for improved irrigated forages. Salt-affected or sodium-affected (alkali) soils should be reclaimed by proper use of drainage, leaching, and soil amendments.

A more complete listing of the properties of these soil groups is given in the Appendix with a detailed list of properties to use in the field for determining soil drainage and water holding capacity.

Table 2

Irrigated Forage Plant Characteristics

Grass or legume	Recomm. Varieties	Seedling vigor	Yield Potential	Longevity	Growth habit	Compata-bility	Palatabil-ity	Recovery Rate	Use	Stubble Height (inches)	Season of Growth	Drought tolerance	Wetness and flood tolerance	Salt and alkali tolerance
Tall wheatgrass (1)	Alkar	Excellent	Medium	Medium	Bunch	Poor	Poor	Slow	Multiple	Eight	Cool	Excellent	Good	Excellent
Tall Fescue (2)	Alta Fawn	Excellent	Medium	Medium	Bunch	Poor	Fair	Rapid	Multiple	Three	Cool	Fair	Good	Good
Ryegrass (3)		Excellent	Low	Annual	Bunch	Good	Excellent	Rapid	Pasture	Two	Cool	Poor	Fair	Fair
Bermudagrass (4)	Giant	Good	High	Long	Sod	Poor	Good	Rapid	Multiple	Two	Warm	Excellent	Good	Excellent
Blue Panic (5)		Good	High	Medium	Bunch	Poor	Poor	Rapid	Multiple	Eight	Warm	Fair	Poor	Good
Sudangrass & Sorghum-Sudangrass Hybrids (6, 7)	Piper Sweet Sudan Trudan 8 Sordan 79	Excellent	High	Annual	Bunch	Poor	Good	Rapid	Multiple	Six	Warm	Fair	Poor	Good
Barley (8)		Excellent	Medium	Annual	Bunch	Poor	Excellent	Medium	Pasture or green chop	Four	Cool	Poor	Poor	Good
Oats (9)	Monida	Excellent	Medium	Annual	Bunch	Poor	Excellent	Medium	Multiple	Four	Cool	Poor	Poor	Fair
Alfalfa (10)		Excellent	High	Medium	Tap Root	Good	Excellent	Rapid	Multiple	Three	Cool & warm	Good	Poor	Good
Narrowleaf birdsfoot trefoil (11)		Poor	Low	Medium	Fibrous Root	Good	Excellent	Medium	Pasture	Three	Cool	Fair	Good	Good
Sweet clover (12)		Excellent	High	Biennial	Tap Root	Fair	Poor	Medium	Pasture or green chop	Six	Cool & warm	Good	Fair	Excellent
Bur clover (13)		Good	Low	Annual	Fibrous Root	Good	Excellent	Medium	Pasture	Two	Cool	Fair	Fair	Good

(1) Well adapted to saline-sodic soils.
(2) Use in simple mixture.
(3) Use either annual or perennial ryegrass alone or in over-planting of Bermudagrass.
(4) Use in reclamation of saline-sodic soil. Several seeded varieties are available.
(5) Cut in boot stage for hay.
(6) Danger of HCN poisoning after frost or when growth is retarded.
(7) Other commercial Sudan-Sorghum hybrids are also adapted.
(8) Provides early fall and winter forage. Oats, rye or wheat may be substituted for barley for production on non-saline sodic soils.
(9) Provides winter and spring forage.
(10) There are several non-dormant and semi-dormant varieties adapted to the area. See your Cooperative Extension agent or SCS district conservationist for current recommendations.
(11) Plant in alternate rows to aid in establishment. Non-bloat. Molybdenum accumulator.
(12) Use primarily in reclamation of saline-sodic soils.
(13) Use in overplanting of Bermudagrass.

Table 3
Mixtures and Seeding Rates for Soil Groups A, B, C and D

Soil Groups	Hay	lb/A	Pasture	lb/A
A, B, C, D No problems other than some slight to moderate wetness or some only moderate salinity hazard or claypans at less than 20 inch depth that restrict roots and water penetration or clayeyness throughout the soil profile.	Alfalfa (1) or Sudangrass (3)	15 25	Bermudagrass - Warm Season (2) or Sudangrass (3) Alfalfa - Cool Season with Tall Fescue or Barley, Oats, Wheat or Rye	3 25 6 8 100

lb/A = pounds per acre

(1) Plant semi-dormant variety at higher elevations. See your Cooperative Extension agent or SCS district conservationist for current recommendations.
(2) Overplant Bermudagrass pastures with bur clover (15 lb/A), ryegrass (25 lb/A) or winter cereals (100 lb/A). Do not plant oats in Soil Group B.
(3) Use Sudangrass or Sudangrass-sorghum hybrids for mid-summer forage following winter annual crops.

Table 4
Mixtures and Seeding Rates for Soil Groups E and F

Soil Groups	Hay	lb/A	Pasture	lb/A
E and F Droughtiness due to gravel at less than 20 inch depth, or sandiness throughout the profile (3).	Alfalfa (1) or Bermudagrass or Sudangrass (4)	15 3 25	Sudangrass - Warm Season (4) or Bermudagrass (2) Alfalfa - Cool Season (1) with Tall Fescue or Barley, Oats, Wheat or Rye or Ryegrass	25 3 6 8 100 25

lb/A = pounds per acre

(1) Plant semi-dormant variety at higher elevations. See your Cooperative Extension agent or SCS district conservationist for current recommendations and variety characteristics.
(2) Overplant Bermudagrass pastures with bur clover (15 lb/A), ryegrass (25 lb/A) or winter cereals (100 lb/A) in fall for forage when Bermudagrass is dormant.
(3) Frequent irrigations are required to obtain satisfactory yields.
(4) Use Sudangrass or Sudangrass-sorghum hybrids for mid-summer forage following winter annual crops.

Table 5
Mixtures and Seeding Rates for Soil Group G

Soil Group	Hay	lb/A	Pasture	lb/A
G Droughtiness due to hardpan or bedrock at less than 20 inch depth (3).	Bermudagrass (1)	3	Bermudagrass - Warm Season (1) or Tall Fescue - Cool Season with Narrowleaf Birdsfoot Trefoil (2) or Barley, Oats, Wheat or Rye or Ryegrass	3 8 5 100 25

lb/A = pounds per acre

(1) Overplant Bermudagrass with bur clover (15 lb/A), ryegrass (25 lb/A) or winter cereals (100 lb/A) in fall for forage when Bermudagrass is dormant.
(2) Seed birdsfoot trefoil in alternate rows with grass.
(3) Care must be taken in irrigation to prevent perched water table.

Table 6
Mixtures and Seeding Rates for Soil Groups H, I and J

Soil Groups	Hay	lb/A	Pasture	lb/A
H Poorly drained but without salinity hazard.	Does not occur in large enough areas to be of agronomic significance in southern Nevada.			
I Poorly drained with salinity hazard.	Bermudagrass - Warm Season or Tall Wheatgrass - Cool Season with Sweet Clover	3 10 5	Bermudagrass - Warm Season (1) or Tall Fescue - Cool Season with Sweet Clover or Narrowleaf Birdsfoot Trefoil (2) or Barley (3) or Tall Fescue (4) with Narrowleaf Birdsfoot Trefoil (2)	3 10 5 5
J Excessive wetness. (Very poorly drained)	Does not occur in large enough areas to be of agronomic significance in southern Nevada.			

lb/A = pounds per acre

(1) Overplant Bermudagrass with barley (100 lb/A) for winter forage.
(2) Plant birdsfoot trefoil in alternate rows with grass.
(3) Barley stands may not be uniform.
(4) Plant on less severe sites.

Appendix 1
A grouping of soils for irrigated forages

Soil Group	Major Soil Limitations (1)	Usable Depth in. (2)	Surface Texture (3)	Subsoil Texture (3)	Drainage Class (4)	Salinity Hazard Ec, mmhos/cm (5)	Sodium Hazard (SAR) (6)	Available Water Holding Capacity in Surface Foot in. (7)
A	Soils with no problems other than some slight to moderate wetness	>20	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	well, mod. well, somewhat poorly drained	<4	<10	>1.25
B	Only some moderate salinity-sodium hazard	>20	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	well, mod. well, somewhat poorly drained	4-10	10-30	>1.25
C	Claypan at less than 20 inch depth that restricts root and water penetration	<20 to claypan	sl,fsl,vfsl, l,sil,si,cl scl,sicl	sc,sic,c	well, mod. well, somewhat poorly drained	<4	<10	>1.25
D	Clayeyness throughout the soil profile	>20	sc,sic,c	sc,sic,c	mod. well, somewhat poorly drained	<4	<10	>1.5
E	Droughtiness due to gravel at less than 20 inch depth	<20 to gravel	sl,fsl,vfsl, l,sil,si	s,ls,gravel, cobbles	well, mod. well drained	<4	<10	>1
F	Droughtiness due to sandiness throughout the soil profile	>20	s,ls	s,ls	excessively well, mod. well, somewhat poorly drained	<4	<10	<1
G	Droughtiness due to hardpan or bedrock at less than 20 inch depth	<20 to hard-pan, bedrock	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	sl,fsl,vfsl, l,sil,si,cl, scl,sicl	well, mod. well drained	<4	<10	>1.25
H	Poorly drained but without salinity-sodium hazard	<20	all textures	all textures	poorly drained	<4	<10	>1
I	Poorly drained with salinity-sodium hazard	<20	all textures	all tex-	poorly drained	4-20	10-50	>1
J	Excessive wetness (very poorly drained)	<10	all textures peats		very poorly drained	<4	<10	- -

< = less than > = more than

Appendix 1
A grouping of soils for irrigated forages (continued)

1. Only serious soil problems are considered. Gravel content <35 percent by volume is assumed. Climatic, irrigation, and fertility factors are assumed suitable. The drainage and salinity hazards are for the soil at the present time. In defining these soil groups, some major later crop management requirements have been considered in addition to mere species adaption.

2. Usable depth refers to that depth exploited by large numbers of roots.

3. The surface soil is the 0 to 10 inch depth layer, or the plowed layers. The subsoil is the B horizon of soil survey reports if one is present, or else the 10 to 40 inch depth layer, or from 10 inches depth to bedrock or hardpan in shallow soils.

The following list of abbreviations for soil texture names are given by the generalized groups which are used to report soil texture on the soil test data sheets from the Nevada Soil and Water Testing Laboratory, University of Nevada, Reno:

1. Coarse Textures
   - s = sands
   - ls = loamy sand

2. Moderately Coarse Texture
   - sl = sandy loam
   - fsl = fine sandy loam

3. Medium Textured
   - vfsl = very fine sandy loam
   - l = loam
   - sil = silt loam
   - si = silt

4. Moderately Fine Textured
   - cl = clay loam
   - scl = sandy clay loam
   - sicl = silty clay loam

5. Fine Textured
   - sc = sandy clay
   - sic = silty clay
   - c = clay

4. The properties by which drainage classes can be identified in the field are given in Appendix 2.

5. Salinity hazard is defined in terms of electrical conductivity of a saturated paste extract (mmhos/cm) and for the plow layer. If the subsoil is more salt or sodium affected than the plow layer, it should be considered an additional hazard. Both layers should be tested. The upper salinity limit for some of the soil groups is higher than plants will actually grow at, and reflects the assumption that soil tests will be for conditions before the crop is planted, and that salinity will be reduced by irrigation. Soils with yet higher salinity need to be reclaimed before cropping.

6. Sodium hazard (i.e., alkali-affected) is estimated by the SAR value (Sodium Absorption Ratio) of a saturated paste extract. The SAR value is an estimate, and for all practical purposes is the same as the ESP (Exchangeable Sodium Percentage) value, which is also used as a measure of sodium hazard. A safe SAR upper limit for clayey soils is 10; loamy sands and sandy loams may be used with few problems up to values of about 15. Soils with yet higher SAR values should be reclaimed before or during cropping.

7. Values for estimating available water holding capacity (AWC) from textures and thickness of soil horizons are given in Appendix 3.

Appendix 2
Field evidence for identifying soil drainage classes

Class	Field Criteria
Very poorly drained	Water table remains at the surface or within 20 inches most of the year; the surface horizons are commonly dark colored and peaty or mucky; subsurface horizon colors are neutral greys, olive or bluish grey with or without dull mottling; grazing possible at least seasonally, hay can be harvested in drier years.
Poorly drained	Soil very wet much of time; water table seasonally at or near surface for several weeks; water table between 20 and 40 inches most of the year; surface horizon commonly dark colored; prominent soluble salt accumulation may occur at or near surface; subsurface horizon dull grey or olive, with or without mottling; grazing possible most of time, hay usually can be harvested.
Somewhat poorly drained	Soil seasonally very wet for several weeks because of an impermeable layer, or a water table at 40 to 60 inches; surface horizon commonly thick and dark colored; subsurface horizon dull grey and commonly mottled; prominent soluble salt accumulation may occur in upper 40 inches; drainage necessary for deep rooted crops.
Moderately well drained	Soil seasonally very wet for a week or so because of an impermeable layer or an intermittently high water table which is below 60 inches most of the year; or because of surface flooding from adjacent areas; surface horizon usually thicker and darker than adjacent well drained soils; indistinct mottling usually present in lower subsurface horizon.
Well drained	Soil is not very wet for more than a few days after protracted and heavy storms; no water table within 60 inches at any time; surface and subsurface horizons not greyed or mottled, but yellowish, brownish, or reddish colored.
Excessively drained	Soil moist for only few days after storms; soil porous throughout with no fine textured or impermeable layers; water does not run off surface except under most intense storms; no water table within 60 inches.
Altered drainage	Soils which have been artificially drained but retain the dark colored surface horizons, peaty or mucky surface horizon, or dull or mottled subsurface colors from former drainage status.

Appendix 3

Estimates of available water holding capacity based on soil texture

(After: Tech. Note-Soils-15, 1968, SCS, USDA, Berkeley, California)

Available water is that which plants can extract from the soil, and is roughly equivalent to that which is held between 1/10 and 15 bars suction in laboratory measurements, or between "field capacity" and the "permanent wilting" moisture contents. The 15 bar moisture content is quite closely related to the clayeyness of the soil, whereas the moisture content at field capacity is a more variable property affected by soil structure and very fine sand-silt content in addition to clay content. But since soil texture is so important in determining both, it can be used to estimate available water holding capacity (AWC). Volume content of available water is a more useful measure of AWC than weight percentage since we calculate irrigation water in inches, and since the actual amount of water in a soil for a given weight percentage varies with the available water ratio, that is, the decimal fraction of volume of water per unit volume of soil. This is the same as the decimal ratio of inches of water per inch of soil, or feet of water per foot of soil:

$$\text{Available water holding capacity ratio} = \frac{\text{Volume soil, cubic centimeter}}{\text{Volume water, cubic centimeter}} = \frac{\text{inches water}}{\text{inches soil depth}}$$

In the following table, the available water ratios for different textural groups are given.

Total AWC can be calculated by multiplying the depth of a given soil by the water ratio for its particular texture. For soils with different textured layers, the AWC for each layer is calculated from its thickness and water ratio, and the values for the layers totaled.

Available Water Holding Capacity Ratio

Textural Classes	Low	Average	High
Gravelly sand	0.033	0.048	0.063
Course sand			
Sand	0.063	0.073	0.084
Fine sand			
Loamy coarse sand	0.084	0.10	0.13
Loamy fine sand			
Sandy loam			
Fine sandy loam			
Very fine sandy loam	0.13	0.15	0.17
Loam			
Silt loam			
Sandy clay			
Silty clay			
Clay			
Sandy clay loam	0.17	0.18	0.19
Clay loam			
Silty clay loam			

Appendix 4

Common name	Scientific name
Alfalfa	*Medicago sativa L.*
Barley	*Hordeum vulgare L.*
Bermudagrass	*Cynodon dactylon (L.) Pers.*
Blue panicgrass	*Panicum antidotale Retz.*
Bur clover	*Medicago hispida Gaertn.*
Narrowleaf birdsfoot trefoil	*Lotus tenuis Waldst. Kit. Ex Willd.*
Oats	*Avena sativa L.*
Rye	*Secale cereale L.*
Ryegrass - annual	*Lolium multiflorum Lam.*
Ryegrass - perennial	*Lolium perenne L.*
Sudangrass	*Sorghum bicolor (Piper) Stapf.*
Sweet clover - yellow	*Melilotus officinalis (L.) Lam.*
Tall fescue	*Festuca arundinacea Schreb.*
Tall wheatgrass	*Agropyron elongatum (Host) Beauv.*
Wheat	*Triticum aestivum L.*

Suggested seeding rates are given as pure live seed (PLS). Legume seed should be inoculated with the proper inoculant. See Appendix 5 for PLS conversion chart.

Appendix 5
Pure Live Seed Conversion Chart

To use chart:
Locate the percent purity and percent germination of the seed on lines A and B. Lay a straight edge between these two points. The point of the intersection with line C is the conversion factor for that seed.

Example:
Purity 95 - line A
Germination 35 - line B
Conversion Factor 3.00 - line C

It will take 3 pounds of this seed to equal 1 pound of pure live seed. Multiply this factor by the PLS seeding rate to obtain the seeding rate for this lot of seed.