NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SALINITY AND SODIC SOIL MANAGEMENT

(Ac.)

CODE 610

DEFINITION

Management of land, water and plants to control and minimize accumulations of salts and/or sodium on the soil surface and in the crop rooting zone.

PURPOSE

- To reduce and control harmful salt concentrations in the root zone
- To reduce problems of crusting, permeability, or soil structure on sodium affected soils
- To promote desired plant growth and to utilize excess water in the root zone in non-irrigated saline seep areas and their recharge areas.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where the concentration or toxicity of salt limits the growth of desirable plants or where excess sodium causes crusting and permeability problems. This practice also applies to non-irrigated land where a combination of factors such as topography, soils, geology, precipitation, vegetation, land use and cultural/structural practices can increase the extent and concentration of salts in saline seep areas.

CRITERIA

General Criteria Applicable to All Purposes

All work, including associated practices for management of drainage and runoff, shall comply with Federal, State, and local laws and regulations.

Type and rate of application of soil amendments shall be based on the chemistry of both the soil water and irrigation water (where applicable) regarding concentrations and types of salts and/or sodium, sodium adsorption ratio (SAR or RNa), exchangeable sodium percentage (ESP), concentration and types of salts, and pH.

Soil affected by salinity that limits the crop production by more than 10% will have a soil test taken according to NMSU guidelines listed in the Nutrient Mgt. Standard 590. This will be used to develop the Sodium Adsorption Ratio (SAR) and any needed gypsum, elemental sulfur, or sulfuric acid recommendations. ECe of the soil will be determined using the saturated paste method listed in this specification for this standard.

Table 1 shows crops of NM and their tolerance to soil ECe levels and water ECw levels. If the soil and water salt levels in the field are greater than the allowable level in the table for a give crop, a more salt tolerant crop can be selected, or leaching the salts may alleviate the problem. Without good drainage and source of clean irrigation water lower ECe soil levels may not be possible.

On irrigated fields, irrigation water management NRCS practice 449 is required to minimize non-point pollution of surface and groundwater resources.

Table 1 Crop Salt Tolerance Table for NM:

Table 1: Crop Salt Tolerance Table for NM									
Crop (name)	**Yield loss 0%**		**Yield loss 10%**		**Yield loss 25%**		**Yield loss**		**M**
	ECe[1]	**ECw**	**ECe[1]**	**ECw**	**ECe[1]**	**ECw**	**ECe[1]**	**ECw**	**E**
Barley	8.0	5.3	10.0	6.7	13.0	8.7	18.0	12.0	2
Cotton	7.7	5.1	9.6	6.4	13.0	8.4	17.0	12.0	2
Sugarbeet	7.0	4.7	8.7	5.8	11.0	7.5	15.0	10.0	2
Wheat	6.0	4.0	7.4	4.9	9.5	6.4	13.0	8.7	2
Safflower	5.3	3.5	6.2	4.1	7.6	5.0	9.9	6.6	1
Soybean	5.0	3.3	5.5	3.7	6.2	4.2	7.5	5.0	1
Corn, Grain & Silage	1.7	1.1	2.5	1.7	3.8	2.5	5.9	3.9	1
Bean, Faba	1.6	1.1	2.6	1.8	4.2	2.0	6.8	4.5	1
Cowpea	1.3	0.9	2.0	1.3	3.1	2.1	4.9	3.2	8
Beans	1.0	0.7	1.5	1.0	2.3	1.5	3.6	2.4	8
Apple	1.7	1.0	2.3	1.6	3.3	2.2	4.8	3.2	8
Pear	1.7	1.0	2.3	1.6	3.3	2.2	4.8	3.2	8
Walnut	1.7	1.0	2.3	1.6	3.3	2.2	4.8	3.2	8
Peach	1.7	1.0	2.2	1.4	2.9	1.9	4.1	2.7	6
Apricot	1.6	1.1	2.0	1.3	2.6	1.8	3.7	2.5	6
Grape	1.5	1.0	2.5	1.7	4.1	2.7	6.7	4.5	1
Almond	1.5	1.0	2.0	1.4	2.8	1.9	4.1	2.7	7
Blackberry	1.5	1.0	2.0	1.3	2.6	1.8	3.8	2.5	6
Boysenberry	1.5	1.0	2.0	1.3	2.6	1.8	3.8	2.5	6
Raspberry	1.0	0.7	1.4	1.0	2.1	1.4	3.2	2.1	5
Strawberry	1.0	0.7	1.3	0.9	1.8	1.2	2.5	1.7	4
Beets	4.0	2.7	5.1	3.4	6.8	4.5	9.6	6.4	1
Broccoli	2.8	1.9	3.9	2.6	5.5	32.7	8.2	5.5	1
Tomato	2.5	1.7	3.5	2.3	5.0	3.4	7.6	5.0	1
Cucumber	2.5	1.7	3.3	2.2	4.4	2.9	6.3	4.2	1
Cantaloupe	2.2	1.5	3.6	2.4	5.7	3.8	9.1	6.1	1
Spinach	2.0	1.3	3.3	2.2	5.3	3.5	8.6	5.7	1
Cabbage	1.8	1.2	2.8	1.9	4.4	2.9	7.0	4.6	1
Potato, Irish	1.7	1.1	2.5	1.7	3.8	2.5	5.9	3.9	1
Corn, Sweet	1.7	1.1	2.5	1.7	3.8	2.5	5.9	3.9	1
Potato, Sweet	1.5	1.0	2.4	1.6	3.8	2.5	6.0	4.0	1
Pepper	1.5	1.0	2.2	1.5	3.3	2.2	5.1	3.4	8
Lettuce	1.3	0.9	2.1	1.4	3.2	2.1	5.2	3.4	9
Radish	1.2	0.8	2.0	1.3	3.1	2.1	5.0	3.4	9
Onion	1.2	0.8	1.8	1.2	2.8	1.8	4.3	2.9	7
Carrot	1.0	0.7	1.7	1.1	2.8	1.9	4.6	3.1	8
Wheatgrass, Tall	7.5	5.0	9.9	6.6	13.3	9.0	19.4	13.0	3
Wheatgrass, Fairway	7.5	5.0	9.0	6.0	11.0	7.4	15.0	9.8	2
Bermudagrass	6.9	4.6	8.5	5.7	10.8	7.2	14.7	9.8	2
Ryegrass, Perennial	5.6	3.7	6.9	4.6	8.9	5.9	12.2	8.1	1
Trefoil, Birdsfoot	5.0	3.3	6.0	4.0	7.5	5.0	10.0	6.7	1
Fescue, Tall	3.9	2.6	5.8	3.9	8.6	5.7	13.3	8.9	2
Wheatgrass, Crested	3.5	2.3	6.0	4.0	9.8	6.5	16.0	11.0	2

Crop (name)	Yield ECe[1]	Yield ECw	Yield ECe[1]	Yield ECw	Max. ECe[1]	ECw	ECe[1]	ECw	E
Vetch	3.0	2.0	3.9	2.6	5.3	3.5	7.6	5.0	1
Sudangrass	2.8	1.9	5.1	3.4	8.6	5.7	14.4	9.6	2
Wildrye, beardless	2.7	1.8	4.4	2.9	6.9	4.6	11.0	7.4	1
Trefoil, Big	2.3	1.5	2.8	1.9	3.6	2.4	4.9	3.3	7
Alfalfa	2.0	1.3	3.4	2.2	5.4	3.6	8.8	5.9	1
Lovegrass	2.0	1.3	3.2	2.1	5.0	3.3	8.0	5.3	1
Corn, silage	1.8	1.2	3.2	2.1	5.2	3.5	8.6	5.7	1
Orchardgrass	1.5	1.0	3.1	2.1	5.5	3.7	9.6	6.4	1
Meadow Foxtail	1.5	1.0	2.5	1.7	4.1	2.7	6.7	4.6	1
Clover, All	1.5	1,0	2.3	1.6	3.6	2.4	5.7	3.8	1

[1]Ece means electrical conductivity of saturated extract of the soil, report in millimhos per centimeter at 25 degrees C.

Additional Criteria to Reduce Salt Concentrations in the Root Zone

On irrigated lands, leaching requirements shall be determined as presented in National Engineering Handbook Part 623, Chapter 2.

Subsurface drip irrigation may concentrate salt in the root zone of some crops. Seed zone ECe are required to determine if it is safe to plant sensitive crops (See table 1).

On non-irrigated land, reclamation shall utilize vegetative methods, soil amendments, and/or enhanced drainage to effect a reduction in soil salinity.

Additional Criteria to Reduce Problems of Crusting, Permeability or Soil Structure on Sodium-affected Soils.

Apply soil amendments containing soluble calcium, or that cause calcium in the soil to become available.

The NMSU Fertilizer Interpretation software has a calculation that will determine the rate of gypsum needed to amend sodium affected soils using the SAR. This requires a soil test as mentioned above.

The NMSU Fertilizer Interpretation software technical note is on the WEB at http://www.nm.nrcs.usda.gov/technical/tech-notes/agro/ag58.doc The tool is at: http://www.nm.nrcs.usda.gov/technical/fotg/section-4/jobsheets/js590.xls

Additional Criteria Specific to Saline Seeps and Their Recharge Areas

Plant and/or maintain adapted high water use vegetation in recharge areas to utilize soil water.

CONSIDERATIONS

Soil salinity levels can be monitored (with annual soil test) to minimize the effects of salinity on crops and to evaluate management practices.

Shallow valley irrigation wells can have TDS levels from 1000-3000 ppm. Blending and with lower concentration irrigation may be necessary to use this water.

Removal of salts from the root zone by leaching operations may increase salinity of water tables. Avoid excessive leaching and schedule leaching operations during seasons when potential contaminants in the soil profile, such as nitrogen, are low.

Chiseling and subsoiling can improve permeability, root penetration and aeration where water movement is restricted by layered soils. Avoid inversion tillage that can bring salinity to the surface and interrupt the leaching process.

Consider using bedding and planting methods designed to reduce salinity near plant root zone, especially for germinating seeds. When the field is furrow or subsurface drip irrigated and the seed zone has a high ECe, the tops of

the beds can be moved aside to lessen the ECe of the seedbed.

Green manure crops or applications of organic matter can improve soil structure and permeability.

Applications of gypsum, sulfur or calcium will help in displacing sodium from the root zone with adequate drainage and irrigation leaching fraction.

Water of slight to moderate salinity (less than 1000 ppm TDS) not dominated by sodium can enhance leaching of salts.

Residue management can improve the organic matter content of the soil, improve infiltration and minimize surface evaporation and capillary rise of salts to the soil surface.

Consider selecting crops with tolerance to salinity/sodium levels in the soil.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations, and Operation and Maintenance described in this standard. Specifications shall be recorded using the approved job sheet in the conservation plan.

OPERATION AND MAINTENANCE

Fields must be monitored annually with a standard soil test (SAR and ECe) to determine effectiveness of the practice and the need to change leaching needs.

Irrigation water should be monitored over the irrigation season to understand the seasonal changes as water tables and river systems concentrate salts.

REFERENCES

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