Controlling Saline Seeps

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What is a Saline Seep?

Saline seeps are an increasing problem in Kansas. Locally known as “alkali spots” or “slick spots,” they are areas of bare soil or reduced crop production, usually located on a side-hill, a toe-slope, or low-lying area. Seeps range in size from a few square yards to tens of acres. They tend to stay wet longer than surrounding areas, and may discharge water during wet periods. During dry periods, white salt crystals may be visible on the surface.

Why be concerned?

Seeps reduce land value in many ways, including loss of crop production, inconvenience, loss or inefficient use of inputs, and erosion. Seeps usually occur on what would otherwise be very productive soil. The scattered nature of seeps makes it inconvenient to “farm around them,” yet it is often impossible to cross them with field machines. If you have noticed some of the initial signs of seep development (wet areas, often having very good crop production), you may want to take steps to control the seep before it develops into a barren area.

What causes a saline seep?

If crops or range plants do not use all the water that enters the soil, the excess water moves downward. In many soils, this downward movement tends to slow as the water encounters zones of slow permeability or compacted layers. When this happens, water moves laterally until it approaches the soil surface. Once the water is within 2 to 3 feet of the soil’s surface, capillary action can lift the water to the surface, where it evaporates and leaves salts behind. Figures 1 and 2 illustrate the general process.

In a semiarid climate like central Kansas, it is difficult to believe that seeps are caused by excess water. You can verify this by digging a posthole (3 to 4

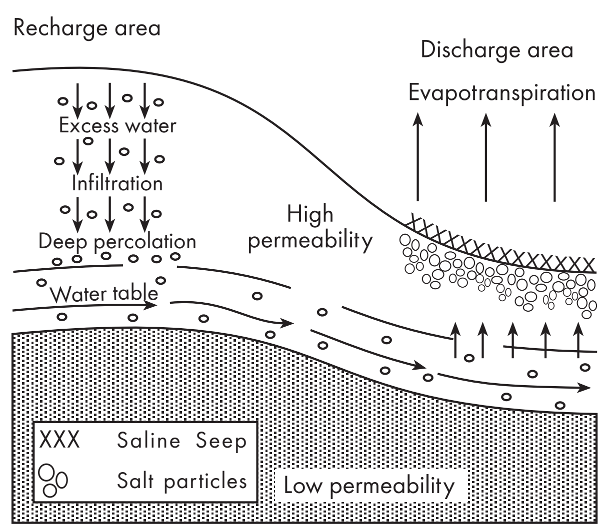

Figure 1. *Water Movement to Seep.*

feet deep) in an established seep. You will probably bring up saturated soil, and if you return after 24 hours, you are likely to find water standing in the bottom of the hole. Dryland seeps are common in areas having much less rainfall than Kansas. In fact, much of the strategy for controlling seeps originated in Montana and Alberta. The critical point is not the amount of rainfall, but the balance of rainfall and crop water use.

Where does the water come from?

The "recharge area" supplies water to the seep. Geology varies, but the recharge area is usually located upslope and within 2,000 feet of the seep (Brown, et al., 1983). Water infiltrates the soil in the recharge area and carries dissolved salts to the seep. These dissolved salts are common in soils, originating from the weathering of soil parent material. Common soil-forming minerals contain large quantities of basic cations like calcium, sodium, magnesium, and potassium, which can form water soluble salts in the soil. Cropland is believed to be the largest contributor to seeps in the region. Continuous winter wheat does not utilize as much water as the native grasses, and a portion of the unused water finds its way to the seeps.

Intermittent ponds caused by poor surface drainage are obvious sources of infiltration, but they are often overlooked. Poorly drained terraces and the "dead furrows" left by years of moldboard plowing can seriously aggravate the problem. Sediment-dammed road ditches, clogged culverts, and other interruptions of surface drainage should be corrected. Compliance to wetland regulations must be ensured.

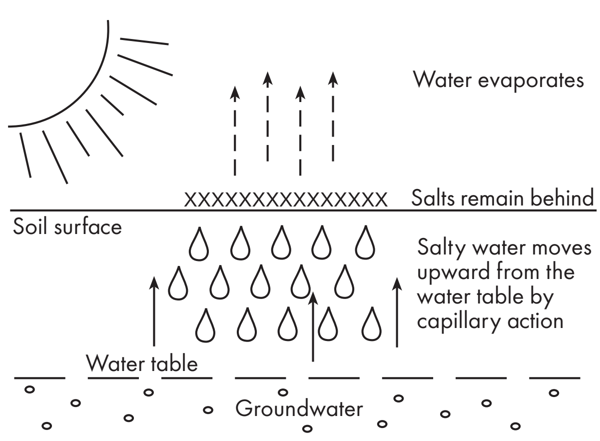

Figure 2: Evaporation and Salt Concentration.

How can I control a seep?

The two basic steps are 1) cut off the supply of water from the recharge area, and 2) reclaim the actual seep area.

It is possible to install subsurface tiles (perforated plastic pipe) to intercept the subsurface water flow on its way to the seep. The pipe is typically installed using a laser-controlled tile machine. Although costly, tiling can be an economical solution for seeps located near an acceptable water outlet.

In most cases, the best solution is to increase water use on the recharge area by changing cropping practices. Of the common field crops adapted to the region, alfalfa is the heaviest water user. Alfalfa has good profit potential on most of the soils that are subject to seep formation. As a very deep-rooted perennial, alfalfa is capable of using all natural rainfall in all but the very wettest years. Alfalfa's effectiveness in controlling seeps has been well documented in other parts of the nation. Seeps have been reclaimed within 5 years of the establishment of alfalfa on the recharge area (Halvorson, 1988). In south central Kansas, many fields have very acid topsoils, a condition that should be corrected prior to seeding alfalfa. Alfalfa also is a relatively heavy user of phosphorus, so soil testing and appropriate fertilization is a must.

But what if I don't want to grow that much alfalfa?

If for some reason alfalfa is not acceptable, intensified flexible cropping is an alternative way to control seeps. "Intensified" implies a crop sequence having more than one crop during some years of the rotation. Three crops in two years (one winter wheat and two summer crops) can be used to increase water use. "Flexible" refers to the idea that cropping decisions are driven by soil moisture. In some years, the soil is saturated after wheat harvest (who hasn't mired a wheat combine?). If this is the case, fallowing the land between wheat harvest and fall wheat seeding cannot possibly store soil moisture. Because the soil is already saturated, all summer rainfall is lost through deep percolation and evaporation. Today's planting equipment and herbicides make it possible to plant a summer crop immediately after wheat harvest. The summer crop can use the stored soil water and reduce the water supply for the seeps. As with alfalfa, intensified cropping has been an effective method of controlling seeps in other parts of the country.

Successful Double-Cropping in Central Kansas

Likely crops for no-till production after wheat are grain sorghum, forage sorghum, and soybeans. No-till planting into standing wheat stubble saves the moisture and time that would be lost with tillage. The stubble also decreases soil water evaporation by lowering the effective wind speed and by shading the soil. All of these factors are important in germinating the new crop and protecting the seedlings from harsh summer conditions.

For the sorghums, nitrogen fertilization probably will be needed prior to planting. Heavy-duty knife-type ammonia applicators (often based on a chisel plow) can function in untilled wheat stubble, particularly if the shank spacing is increased to 18 inches or more. Such an applicator can apply NH_3 directly into 60 bushels per acre wheat stubble, with minimal residue disturbance. A planter can follow immediately behind the applicator (at a different angle).

For double-crop soybeans, all necessary fertilizer can usually be applied at planting. A “2 × 2” placement (2 inches below and 2 inches to the side of the seed) is preferred as soybeans are sensitive to starter fertilizer placed in direct seed contact. Like alfalfa, soybeans are sensitive to low pH soils. Group 4 or 5 soybeans will reach acceptable height, even when planted in early July. This may not be the case for group 2 or 3 double-crop soybeans (Kilgore, 1994). Row planters are preferred to grain drills because of more accurate seed metering and better depth control. The 30 inch rows are also believed to “ration” available soil moisture more effectively under dry conditions (Fjell, 1994). Observations also indicate that the thicker plant density of the 30 inch rows tends to stimulate vegetative growth and lead to higher pod set, an important harvest consideration.

For livestock producers or others having a market, forage sorghum is a practical double crop. Adequate fertilization is important, and it is desirable to obtain soil samples before the wheat is harvested to reduce time delays.

Spring Crop after Double Crop

For the second summer crop, which is planted in the spring following the double crop, much more flexibility exists. In addition to grain sorghum and soybeans, early corn has the potential to perform in this crop segment. Successful strategies avoid placing the crop at the reproductive stage in the late July-early August time period.

Spring weed control is important. One of the key advantages of this cropping system is the opportunity to destroy the winter annual grasses during the February to April preplant period. Winter soil moisture can be consumed if the winter annual grassy weeds are allowed to grow. Under no circumstances should the winter annual grasses be allowed to head. Several burn-down herbicides are available.

Spring tillage is discouraged because heavy May through June thunderstorms produce severe erosion potential. The spring crop seedlings are not capable of protecting the soil at this time; the residue from the previous crops must be retained. This is an important difference between winter wheat and the summer crops, because winter wheat offers excellent soil protection at its peak of vegetative growth in May and June.

Winter Wheat after Spring Crop

Grain sorghum, soybeans, and corn have all been followed by successful wheat crops. In general, the wheat will be planted later than usual, but a target seeding date of October 10 through November 10 is realistic. Reduced fall tillering of late wheat implies that wheat seeding rates should be increased by 25 to 50 percent. At this point, winter annual grasses that did not germinate during the previous winter fallow will be germinating and emerging. Light tillage of the sorghum, soybean, or corn stubble can provide valuable control of seedling (or not-yet-emerged) winter annual grasses. This may be accomplished in combination with NH_3 application with a V-blade. Fertilization is important, and higher-than normal N rates are needed to compensate for the lack of time available for breakdown of the previous crop residue. This wheat crop is unlikely to produce grazing, but with proper fertility, grain yield can equal or exceed that produced by early planted grazed wheat.

What should be done to the actual seep area?

Because the seeps themselves produce little or no vegetative growth under normal cropping systems, they are subject to heavy erosion and rapid decay of soil organic matter. If at all possible, the barren soil should be planted to a salt-tolerant plant to protect it as control is gained over the recharge area. Once the supply of water is stopped, rainfall will leach the surface salts down through the soil profile in the seep area. An actively-growing perennial plant in the seep area will help remove water, increase water infiltration into the soil, and hasten the leaching of the salts.

Salt-tolerant grasses are a good choice for the actual seep area. Common choices for perennials are wheatgrass and alkali sacaton. Some annual sorghum-sudans or sudan grass varieties are also salt-tolerant. NRCS personnel can assist with recommendations for specific sites. Once established, the seep can be harvested for hay if seep size and crop growth permit. Grazing of the seep is also possible, but the resulting surface compaction may slow water infiltration and extend the time needed to leach salts down from the surface.

Where can I get more information?

Local K-State Research and Extension Offices and Natural Resource Conservation Service Offices can help plan remediation efforts. Producers with large seep areas should know that the current Conservation Reserve Program provides for the enrollment of saline areas.

Management of Saline and Sodic Soils (Lamond and Whitney, 1992) contains useful information on soil salinity tests, the interpretation of test results, and suggestions for management of these problem areas.

K-State Research and Extension publishes handbooks for alfalfa, grain sorghum, soybeans, corn, and wheat. The handbooks contain information on fertility, planting rates, planting dates and other general crop information.

There is an excellent site on the worldwide web, developed by the Alberta Department of Agriculture (Wentz, 1997). It shows examples of many different types of seeps not discussed here. It contains more than 40 pages of recommendations for plant materials and renovation techniques, including tile drainage. The address is:

http://www.agric.gov.ab.can/sustain/soil4.html

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2391 January 1999

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File code: Crops and Soils 4-6