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Reducing seepage from stock tanks with uncompacted, sodium-treated soils

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Quick Facts

Seepage from many stock tanks in calcium-aggregated soils can be greatly reduced by treatment with sodium carbonate without soil compaction.

Treatment with sodium carbonate should be successful if the depth of the soil overlying sand, gravel or porous rock is at least a foot (30.5 centimeters) deep, the clay content is at least 15 per cent, and the cation exchange capacity exceeds 15 milliequivalents per 100 grams of soil.

Salt should be broadcast on the surface, then worked into the soil by disking or harrowing to the predetermined treatment depth.

Two or three years after treatment, the seepage rate may start to increase as sodium is lost.

2. Measure the soil depth in the pond bottom (minimum acceptable depth is one foot or .3 meter).

3. Take at least three separate random soil samples from the bottom and three from the side of the pond at the 0- to 6-inch (0- to 15-cm) depth. Mix the three bottom samples together and mix the three side samples together. Then have these two composited samples analyzed for the following: a) clay content-per cent by weight of material less than 2 microns in diameter, b) cation exchange capacity (CEC) in milliequivalents per 100 grams of soil, c) exchangeable sodium (ES) in milliequivalents per 100 grams of soil.

4. Measure the area and depth of the pond. Don't guess! Calculate the amount of water the pond holds at different water depths.

Treatment criteria

Experience indicates that treatment with sodium carbonate should be successful if the following criteria are met:

1. The depth of the soil overlying sand, gravel or porous rock should be at least 12 inches (30.5 cm).

2. Clay content should be 15 percent or greater.

3. Cation exchange capacity (CEC) should exceed 15 milliequivalents per 100 grams of soil.

Calculating sodium carbonate*

In the following calculations, the information from the soil sample with the highest CEC should be used. The amount of sodium carbonate* required for treatment can be estimated with the following equation: $Na_2CO_3 = 0.004 DA (0.15 CEC - ES)$ where Na_2CO_3 is pounds** of sodium carbonate*, D is depth of soil to be treated (in inches**), A is area to be treated (in square feet**), CEC is cation exchange capacity (meq/100g), and ES is exchangeable sodium (meq/100g).

SUMMARY-Seepage from many stock tanks in calcium-aggregated soils can be greatly reduced by treatment with sodium carbonate without soil compaction. The proper amount of sodium carbonate, determined by soil analysis, is broadcast on the soil and mixed into the top 3 to 5 inches (7.6 to 12.7 centimeters). Seepage losses were reduced from 5 inches (12.7 cm) a day to 0.15-inch (.4 cm) a day in field tests.

Treatment Guidelines

Pretreatment survey

The following measurements and analyses should be made before attempting any treatment.

1. Measure the rate of water loss to make sure there is a seepage problem. To do this, drive a marked stick into the pond bottom and measure the drop in the water surface over a period of several days free of rainfall and runoff. Part of the water loss is due to evaporation, which can be estimated from local National Weather Service records.

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Treatment procedure

The sides and bottom of the pond must be cleared of grass, shrubs, trash and rocks prior to treatment. To insure uniform distribution of the salt, a grid system should be staked out on the treatment area, using string or twine stretched between stakes. Each grid section should cover an area that can be treated conveniently with 20-, 50- or 100-pound (9-, 23- or 45-kilogram) quantities of salt, assuming the salt is obtained in 100-pound (45-kg) bags. If this method is not feasible, the pond can be marked roughly into quarters and one-fourth of the salt broadcast uniformly into each section. If the salt is obtained in bulk, the amount applied to each grid or quarter section should be weighed. The salt should be broadcast on the surface, then worked into the soil by disking or harrowing to the predetermined treatment depth. Face masks are recommended during salt broadcasting. Soil compaction is not necessary. The pond is ready to receive water immediately after treatment.

Maintenance

Two or three years after treatment, the seepage rate may start to increase as sodium is lost. The initial treatment should reduce seepage drastically, but does not completely stop it. Calcium and magnesium in the pond water

eventually will replace the sodium applied in the treatment. This problem can be solved by adding sodium carbonate and sodium chloride to the water in the pond. The maximum amount of sodium carbonate added should not exceed 6.5 pounds per 1,000 cubic feet (one kilogram per 10 cubic meters) of water. More than this may increase pH above 9.5. Additional sodium must be added in the form of sodium chloride. A suggested guide follows:

1. $\text{Na}_2\text{CO}_3 = 6.5 V$ where Na_2CO_3 is pounds** of sodium carbonate and V is volume of pond in 1,000-cubic-foot** units.

2. $\text{NaCl} = 0.25 \text{ Na}_2\text{CO}_3$ used in original treatment minus the Na_2CO_3 added to water, where NaCl is pounds** of sodium chloride.

3. Total salt = step 1 + 2. The sodium chloride and sodium carbonate can be mixed together and broadcast evenly over the water surface. Broadcasting from a small boat usually is desirable.

**Granular soda ash, technical grade, 99- to 100-per-cent sodium carbonate (Na_2CO_3).*

***To convert to metrics, use the following equivalents: 1 inch = 2.5 centimeters; 1 square foot = .09 square meter; 1 pound = .45 kilogram; 1 cubic foot = .03 cubic meter.*