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## **Salted Soil**

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GRAFTON, N.D.

Even the best of soils can have its drawbacks, and in the Red River Valley, that means salt. Lots of it.

“There is between 1.5 (million) and 2.5 million acres of saline soils in the valley,” says **Mike Ulmer, Natural Resources Conservation Service senior soil scientist** from Bismarck, N.D. “That’s a tremendous problem in Minnesota, North Dakota and in Manitoba.”

Ulmer and several colleagues hosted the recent **NRCS Salinity Tour** in Grafton, N.D. to help growers find ways to identify and deal with the problem.

“We want to increase awareness of salinity in the northern valley with producers and some of our agency people from” North Dakota State University and NRCS, he says. “We’ve had salinity in this area before and since cultivation.”

### **Growth inhibitor**

The salts in saline soil compete with the plant roots for moisture, so even when moisture is available, the plant may show signs of drought and stunted growth.

“It mainly affects how the plant can bring up water and nutrients,” Ulmer says. “The salt will compete with the plant for moisture. In plant physiology, there’s an ‘osmotic’ potential. The soil solution has a certain concentration and the root solution has a certain concentration. When you have too high a (salt) concentration, the nutrients won’t cross over the root membrane into the root. So even though your soil is wet, your plant suffers from drought.”

Some areas of the Red River Valley have very high levels of salinity where nothing grows.

“Only the most salt-tolerant crops or native species will grow,” he says. “There’s plenty of water, but the water is so salty, that the plant can’t uptake it.”

**Why worry now?** Growers in the Red River Valley have spoken for decades about the “alkali” or “sour” soil in certain areas. And though alkali is present in some soils, it does not represent the majority of soils that growers are becoming concerned with today.

“Alkalinity and salinity are two separate issues,” says **Ted Alme, state agronomist for NRCS in North Dakota**. “It's different chemistry. When we talk about salinity, we're talking about salts in the surface that are affecting crop production. Alkalinity is a different form and affects plants differently.”

He says that the wetter climate cycle now being experienced encourages the salts to move up with the water in the soil.

“They're very soluble, so they move very easily. As the water table rises in certain areas, that salt will manifest itself at or near the surface, where it can affect plant growth.”

“I think we're becoming more aware of it because we're growing more specialty crops that aren't adaptive to the saline soil,” Ulmer says. “Back in the '60s and '70s, a lot of this area was barley and wheat, which are fairly tolerant to salinity. But now we've moved into other crops. I think that's why we're seeing more issues with salinity.”

**Ice Age and Lake Agassiz:** It is widely known that the Ice Age and Lake Agassiz are responsible for the fertile soils of the valley. As it turns out, they also are the culprits for the salinity in those soils.

“In eastern North Dakota geology, you have to talk about the Pleistocene, the Ice Age,” Ulmer says. “And when you talk about ice ages, you have to think about maybe the winter of 1997 on steroids, and think of it lasting for thousands of years. The ice sheet was up to a mile thick around Hudson Bay. When it crossed into North Dakota, it was still 2,000 feet thick. There was tundra and frozen soil way into South Dakota and southwestern North Dakota. That mass of ice was so thick that it depressed the earth in Pembina County about 600 feet.

“You have this huge mass of ice up in the Hudson Bay area, slowly creeping down and advancing and retreating across this area. It started about 2 million years ago, and ended about 10,000 years ago. And really, what we're in now is an interglacial period - a warming period.”

When the glacier melted, it formed Lake Agassiz, which was larger than the sum of the Great Lakes.

“Here in Grafton, the lake was about 400 feet deep,” he says. “And wherever water goes, salinity goes.”

The Red River Valley is now a regional discharge area for the whole northern Great Plains, he says, “so we have artesian water moving through the valley, carrying sediments, and with it, salt.”

Streams such as the Forest, Park and Turtle rivers all pick up salinized waters as they cross these artesian-soaked plains and move it into areas such as Lake Ardoch and Salt

Lake in Walsh County and Kelly Slough's in Grand Forks County. These are all areas where salt-encrusted soils can be found.

**Where to start:** Recognition of saline soils is the first step in addressing the problem.

“There's technology to help producers recognize what level of salinity they have and where it is,” Alme says. “Producers can invest in good soil mapping and good management of their fields and yield-tracking.”

The NRCS maintains the Web Soil Survey, an electronic Internet version of its Soil Survey. The NRCS Web Soil Survey can be accessed at [websoilsurvey.nrcs.usda.gov](http://websoilsurvey.nrcs.usda.gov). Alme also recommends growers contact their local NRCS office to gain more information or assistance in finding out their soil salinity levels.

If producers do have a salinity issue, Alme recommends crop selection as one course of action.

“I think there's a number of mitigation options, depending upon the severity of the problem and the plan of what the farmer wants to do,” he says. “Crops that are deep-rooted, that use a lot of water and move water up the system, like forages, alfalfa and sweet clovers, are all good water users that will impact that water table at or near the surface, moving the salts back out of the root zone.

“If forages and hay aren't in the producer's plan, other deep-rooted annual crops like sunflowers, corn and soybeans that are good water users but maybe not as good as a perennial crop, would be the next option.”

“They are becoming more aware of the salinity issue because we're losing some highly productive land,” Walsh County extension agent Brad Brummond says. “The salts are moving into some very productive areas, decreasing and, in some areas, causing total loss of production. This is an issue that's gradually getting worse, and the sad thing about it is it doesn't necessarily have to be that way.”