Vanishing Ponds Not a Sure Sign of Spring

Now you see it, now you don't.

The disappearance of ponded meltwater in the field may not be as accurate an indicator of spring thaw as generations of farmers have believed, say ARS scientists in the Soil and Water Management Research Unit at St. Paul, Minnesota.

Using sophisticated measuring devices and microwave technology, the researchers are studying the effects of freezing and thawing on soil and how winter conditions affect chemical infiltration and water quality. Measuring the disappearance of snowmelt in Minnesota fields gives them clues about the permeability of frozen soils.

"We've been studying the hydrology of frozen soils for about 6 years," says ARS soil scientist John Baker. "We've learned some new things about soil properties in winter. For instance, we'd always assumed a frozen soil was impermeable—that very little water could penetrate it—but we find that's not always true."

Using a time domain reflectometer to measure the liquid water content of soil, the scientists can monitor the extent to which a soil is frozen.

"Soil doesn't freeze in one large block," Baker explains. "It freezes in a progressive pattern, with larger pores freezing before smaller ones.

"This means there is always some liquid water present in the soils around here. But in very coarse sandy or gravelly soils, this wouldn't be true."

The traditional spring thaw heralded by the disappearance of ponded water in fields is a bit deceiving, says Baker. "In early spring, when the snow begins to melt, the initial meltwater often refreezes where the snow and soil meet, blocking the penetration of additional water. Excess snowmelt then flows across the surface of the soil to low spots in the field, forming temporary ponds.

"At this point, the story gets more complicated," says Baker. "As thawing continues, a point is reached at which the ponds drain rapidly—often in less than a day. But this doesn't mean the soil underneath the pond is completely thawed.

"Our measurements indicate that a substantial layer of the soil beneath the pond, a zone as thick as 16 inches, can still be frozen at the time these ponds disappear. The water is apparently moving through large cracks and voids in the root zone, quickly reaching the subsoil below."

The implications of water movement in frozen soil are important, Baker says.

"Because water moves across the surface of the soil to meltwater ponds, it means farmers should avoid spreading manure during the winter. The nutrients in it are likely to drain into these ponds and subsequently be carried to the groundwater," he says.

The loss of water from spring thaw also drains the soil of important spring moisture reserves.

"This meltwater that drains to ponds and rapidly infiltrates could be used by crops if it could be kept in place in years when fall moisture recharge is minimal," says Baker.

Scientists think their finding may lead to a changeover to tillage practices that tend to avoid ponding and leave more moisture in the soil.

"Farmers may want to identify ponded areas in their fields in the early spring and make changes in fall tillage patterns to maximize moisture storage," says Baker.—By **Dawn Lyons-Johnson,** ARS.

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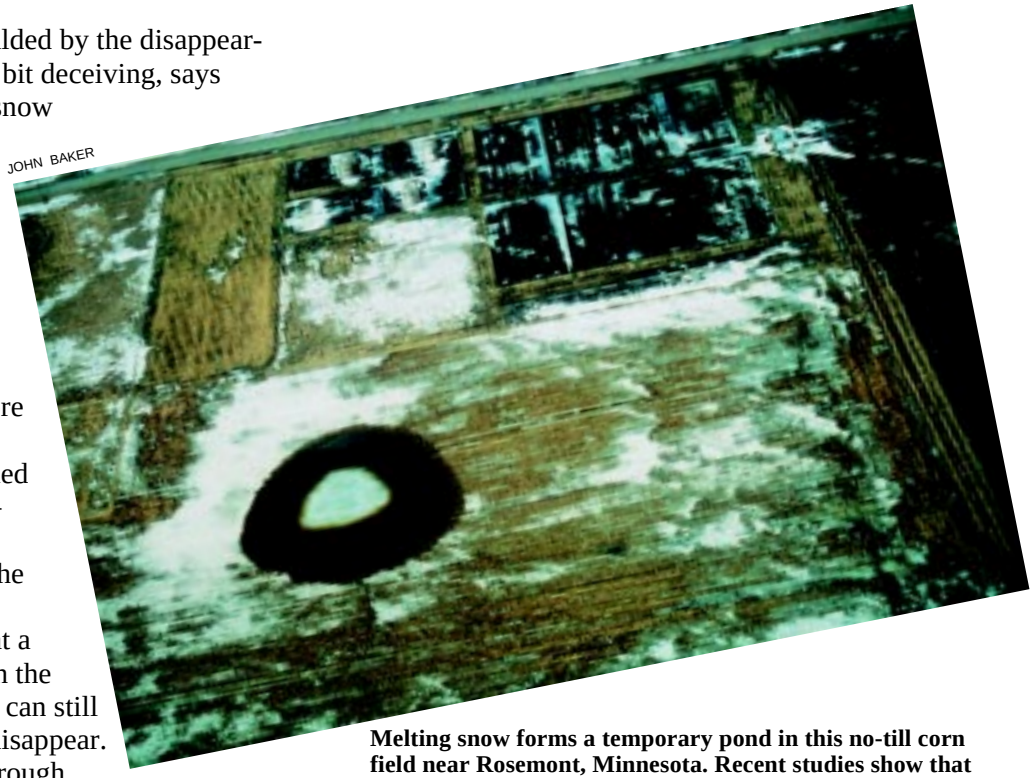

Melting snow forms a temporary pond in this no-till corn field near Rosemont, Minnesota. Recent studies show that snowmelt water often infiltrates, even while the soil beneath is still frozen.