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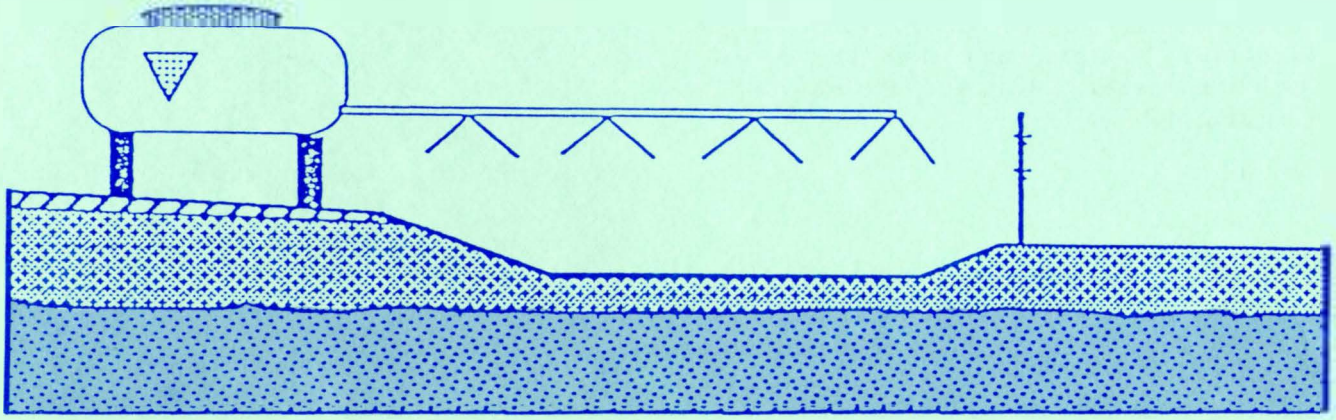
Road ditch spraying
can contaminate shallow ground water



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Herbicides are the most often detected pesticides in shallow aquifers in eastern South Dakota. Since most of the people in this part of the state obtain drinking water from these shallow aquifers, there is increasing concern for aquifer water purity.

In the Oakwood Lakes-Poinsett project area, Lasso was the herbicide most often detected in the aquifer, followed by 2,4-D. Tordon 22k (picloram) was second to Lasso in 1991 data from Turner County and Bowdle aquifer studies.

The road ditch over the aquifer is one of the most sensitive environments to ground water pollution.

This is particularly true for naturally shallow soils with only 1 to 3 feet of soil over the gravel aquifer material. In the process of building up the road, an average of 1 foot of soil is taken from the road ditch. This leaves the ditch with 0 to 2 feet of soil over the gravel. Thus, these road ditches are extremely sensitive to the leaching of herbicides into ground water.

Medium and fine textured soils overlie much of the Big Sioux aquifer in eastern South Dakota. Under natural conditions, water enters and moves through these soils at very high rates, even if the soil contains significant amounts of clay. Essentially all water in the ditch enters the soil during the growing season.

Gravel roads only absorb about a quarter inch of water during a rainfall; the balance runs off into the road ditch. Since the soil's absorption rate is in excess of the combined rate of rainfall plus road runoff, all water enters the soil in the ditch. This is illustrated in Fig 1, a cross-section of an "average" road ditch in an "average" precipitation year. The leaching depth of 22 inches of water into the

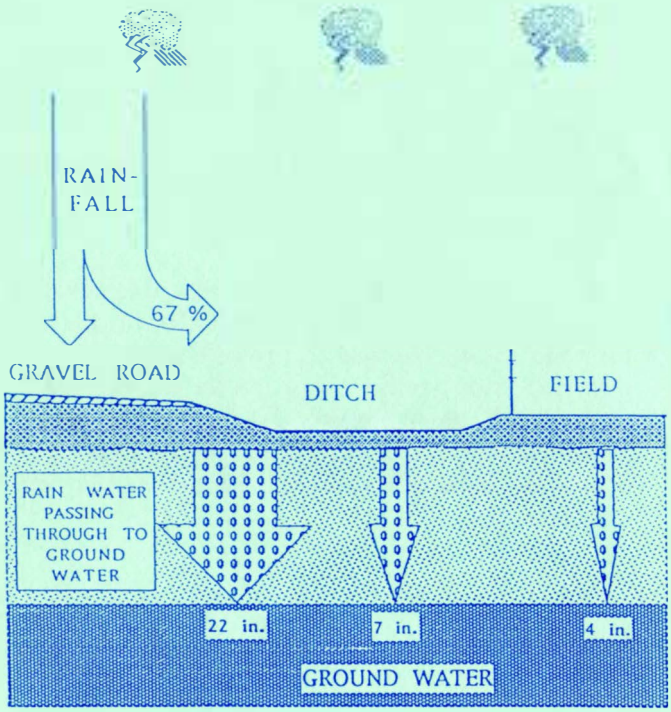

Fig 1. Gravel road rainfall runoff into the road ditch is 67% in an average rainfall year. The amount of water passing through the soil of Fordville loam and into the ground water ranges from 22 inches near the road to 4 inches in adjoining fields in average years. Renshaw and Sioux soils would exhibit larger amounts of leaching water.

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aquifer in an average year results from rainfall plus the added contribution of road runoff. The "average" ditch collects and leaches 7 inches of water, while the adjoining farm field leaches only 4 inches. This is simply a result of a shallower soil in the ditch. This again emphasizes that the road ditch is more vulnerable to herbicide leaching than agricultural fields.

Road ditch spraying for weed and tree control is done whenever weather permits because of labor and equipment limitations. This means that rain could occur at any time after spraying, from the same day to many days later. In our study we were able to control rain, applying water the same day as the herbicide application. This would likely lead to maximum herbicide leaching.

For a mobile herbicide like Tordon 22k, the amount leached by rain which fell any time after spraying would not likely taper off. However, for a somewhat volatile herbicide like 2,4-D, less would remain to be leached at any time after application because of its continued loss by evaporation.

We used standard rates of 1 1/2 pints of Tordon 22K and 1 quart of 2,4-D amine per acre. The amount of herbicide leached by a single 1-inch rainfall and by a total of six 1-inch rains occuring every 7 to 10 days without further herbicide applications is given in Table 1.

For the mobile herbicide, Tordon 22k, one third leached during the first rain, with almost one half leaching during the season through the shallow Fordville loam profile. Less, 5% for one rain and 12% total, leached through the deeper and more clayey Lamoure silty clay loam. Amounts for 2,4-D are less, being about 24 and 2% for the two soils.

Great care must be used when applying herbicides to road ditches, especially in areas containing shallow loam soils. The soils of major concern are Divide, Estelline, Fordville, Renshaw, Sioux, Arlo, Dempster, Enet, Delmont, and Talmo.

Results of our study would strongly argue against blanket spraying over these soils. If applications

Table 1. Percent of applied Tordon and 2,4-D that leached through Fordville loam and Lamoure silty clay loam and into the aquifer material from a single one-inch rainfall and the cummulative amount from six such events occurring at 7- to 10-day intervals.

	Percent of applied herbicide leached			
	Tordon		2,4-D	
Storms	Fordville	Lamoure	Fordville	Lamoure
1	33	5	22	1.6
6	49	12	24	2.1

are absolutely necessary, careful spot spraying (without excessive application) or wick applications may be considered.

Sandier soils, such as Arvilla, Egeland, Embden, Maddock, Sperdrup, Alwilda, Henkin, Blendon, and Thurman, are even more vulnerable. In fact, Tordon 22k is not labeled for these coarse soils.

Road ditches over aquifers are some of the most sensitive sites leading to ground water contamination. So how do we minimize the amount of pesticide reaching ground water through road ditches?

- Soil maps make good base maps for spraying crews. They are made from aerial photographs and contain features which help crews determine their location on the road. Copies of these maps can be marked by SCS personnel to identify fragile soils along roads. Blanket spraying should not be done over these areas.

- Spot spraying can be done over the aquifer, but weed crews would have to be carefully trained to avoid excessive applications.

- Wick application or mechanical control are also options that can be considered.

The prime consideration is to protect ground water. Weed control options that reduce the potential of herbicide contamination of ground water are the only methods that should be used.

This paper reports the results of research. The use of brand names does not constitute an endorsement by the South Dakota Agricultural Experiment Station.

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