TECHNICAL NOTES

U. S. DEPARTMENT OF AGRICULTURE Portland, Oregon SOIL CONSERVATION SERVICE

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ECONOMIC LOSS FROM NITROGEN PERCOLATION IN IRRIGATED AREAS

Frequently one of the physical effects of inefficient field application of irrigation water is water loss through deep percolation. Associated with deep percolation is leaching of plant nutrients. Nitrate nitrogen is a water soluble plant nutrient included in the leaching fraction of irrigation water lost through deep percolation. Because of crop yield responses to nitrogen, either yield reduction can be expected or increased applications of replacement nitrogen are required to maintain crop yield when nitrogen is lost through deep percolation.

One measure of the economic cost of nitrogen percolation losses is the replacement cost of the nitrogen. Two estimates are needed to measure economic loss in agricultural production. First, the quantity of nitrogen lost as deep percolation of irrigation water varies, and second, the cost of replacement nitrogen. Pfeiffer and Whittlesey (1978) have modified the work of others[1/] to develop a nitrogen percolation regression equation. The equation developed is:

$$N_L = .029\ (Na)^{1.05}\ (Q_d)^{.7}$$

Where:

N_L = pounds of nitrogen leached per acre per year
Na = pounds of nitrogen applied per acre per year
Q_d = drainage volume in acre inches per acre per year (deep percolation)

So, for example, on a crop to which 200 pounds of nitrate nitrogen are applied per acre per year and for which deep percolation is 12 acre inches per acre per year, estimated available nitrogen loss is 43 pounds per acre per year. The authors caution that the equation will tend to overestimate nitrogen loss by about one-third in areas of fine-textured soil or when irrigation application is by row or furrow methods.[2/] It is important to recognize that nitrogen applied and nitrogen loss are measured in terms of nitrate (available to plants) nitrogen. Estimates of deep percolation loss in inches per acre must be made to use the equation.

1/ Pfeiffer, George H., and Norman K. Whittlesey, Economic Impacts of Controlling Nitrogen Concentration and Other Water Quality Determinants in the Yakima River Basin, Management of Nitrogen in Irrigated Agriculture, edited by P. F. Pratt, published by the Department of Soil and Environmental Sciences, University of California, Riverside, California, May 1978, pp. 415-442.

2/ Telephone conversations with Norman Whittlesey and Brian McNeil, Washington State University, November 21, 1979.

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The second estimate needed to measure economic loss in agricultural production is the replacement cost of available nitrogen. If commercial fertilizer with an available nutrient analysis of 33-0-0 cost $200 per ton applied, the cost per pound of available nitrogen applied is $0.30. In the example above, an estimate of the economic loss in production would be $12.90 per acre per year (43 pounds per acre per year x $0.30 per pound).

Personnel at Washington State University are currently expanding and refining a predictive equation of nitrogen loss which includes other variables, such as crop, soil factors, etc. The refined equation and applications will be discussed in a subsequent technical note following publication of work explaining the research for developing the equation.